THE INDIAN JOURNAL OF TECHNICAL EDUCATION

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Editorial

Focus on Quality Research Work: Quality research involves selecting a well-defined research topic and preparing a clear hypothesis. It is necessary to verify that the results obtained are relevant and meaningful. Quality work is always recognized. The qualities required for a researcher include good theoretical and practical knowledge in the chosen area, critical thinking skills, writing skills, and presentation skills. Students must be trained to improve their thinking skills during their college education. Many thousands of people nationwide are currently engaged in research projects to earn their doctorates, in contrast to the 1980s and 1990s. Every year, Indian universities award thousands of doctoral degrees to candidates.

To fulfill the qualification requirements of various regulatory bodies like the UGC, AICTE, etc., for faculty positions or career advancement in academic institutions, candidates must possess a doctoral degree. To meet this requirement, many researchers rush to complete their doctoral degrees as quickly as possible. In such cases, the quality of the research work often suffers. To fulfill the requirement of paper publication for the submission of the research thesis, candidates sometimes resort to shortcut methods to get their papers published in journals.

Selecting an interesting research topic is the first challenge for a researcher. Important considerations include the topic's breadth, learning more about its history, and—above all—selecting a research mentor or supervisor who can be reached whenever a discussion is needed. Updated information from books and other sources should also be available.

Publishing the methodology followed in the research work, analysis of data, and results obtained in reputed and indexed journals will not only help in getting comments and suggestions from various readers to improve the quality of the research work but also in gaining recognition for the research work across the world. Additionally, the innovation and novelty of the work can be filed for patents. It is also important to choose a research area that is useful to society.

The best practices to improve the quality of research work include making sure background information is gathered from a variety of trustworthy sources, attending conferences, seminars, and workshops, reviewing and refining the research work regularly, developing writing and presentation skills, writing papers in plain language so that even non-expert readers can understand them, making sure the research work's findings are significant, and using the most widely used tools to check for plagiarism.

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Natural Language Processing and Its Challenges

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ABSTRACT

Natural language processing (NLP) takes just expanded much kindness aimed at expressive as well as analysing human linguistic computationally. That one takes binge its applications in numerous pitches For Example machine transformation, email unsolicited mail exposure, information mining, summarization, health sector, and question answering. In this paper, we List out the Application of NLP then deliberate in feature the state of the art giving the numerous claims of NLP, existing drifts, as well as tasks.

INTRODUCTION

Natural language processing (NLP) is a machine learning skill that provides supercomputers the capability to construe, operate, and understand humanoid language. Administrations nowadays have big capacities of speech and script records since numerous announcement networks similar emails typescript letters societal media newsfeeds, video, audio, and more. They use NLP software to spontaneously process these records, analyse the determined or sentiment in the record, as well as retort in actual time to human announcement. Behind the NLP Machine Learning and Deep Learning works.

CHALLENGES OF NLP

Misspellings

Natural languages stand complete of errors, mistakes, as well as contradictions in panache. Aimed at instance, the term "procedure" can be predicted as both "process" or "processing." The difficult compounded while you comprise modulations or other types that are not in your dictionary. In Deep Learning All the Language Dictionaries Are Present but When Similar Words coming with their suffixes / affixes it can`t Predict.

Language Differences

An English lecturer might say, "I Love Sweets," while a Hindi speaker would say, "Mithaiya Muze Pasand he." Even though these two rulings mean the same item, NLP doesn`t recognize the latter except you interpret it into English first.

Characteristic Preferences

Natural processing languages are established scheduled human logic as well as records collections. In particular circumstances, NLP systems may carry out the biases of their computer operator or the data sets they use. It can also from time to time understand the framework inversely due to innate biases, leading to inaccurate results.

Words with Multiple Meanings

NLP is based on the statement that language is specific as well as definite. In realism, linguistic is neither accurate nor unmistakable. Various disputes have numerous significances as well as can be rummage-sale in dissimilar traditions. For instance, once we approximately "bark," it can either be dog woof or tree woof.

Uncertainty and False Positives

Incorrect positives happen while the NLP notices a period that should be logical but can't be responded to correctly. The area is to generate an NLP scheme that can recognize its borders and perfect up misunderstanding by using queries or clues.

Training Data

Unique of the main tasks by natural dispensation linguistic is inexact exercise records. The additional

exercise records you must better your grades. If you stretch the scheme incorrect or biased data, it will either learn the incorrect belongings or study incompetently.

CONCLUSION

NLP is an arena of AI that procedures traditional ML methods; NLP marks people's lives at ease as well as rises job efficiency and accurateness. In recent years, it has exploded in popularity amongst investigators. Procedures in addition rare datasets are continuously educating as well as breach original crushed. As a result, calculating ideas in addition to placing organized systems for clarification in the commercial area has become a lot of attention. Sectors and organizations have developed new platforms such as data analysis stages, commercial intellect stages, as well as rational applications to contribution them to adapt procedures, improvement efficiency, as well as raise quickness.

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Game Theory and Artificial Intelligence

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ABSTRACT

Game Theory and Artificial Intelligence are two mature areas of research, originating from similar roots, which have taken different research directions in the last 50 years. However, recent studies demonstrate the close ties between these fields, indicating that it was time to close the divide between these research specialties. In this paper, we focus on fundamental problems in representation, reasoning, and learning, and we address research on these topics that straddle the boundaries of game theory and artificial intelligence.

INTRODUCTION

There was a golden age of success in the early 1950s at Princeton University. There have been some bold proposals to incorporate these new forms of reasoning into "computing machines" and to expand classical mathematical and economic thinking, among other things. A great deal of new ideas have also been proposed. There, as students or faculty, were several of the pioneers in game theory and artificial intelligence who would go on to start their respective fields. Even though these disciplines have developed in separate ways, we can see the profound and foundational links between them now, fifty years later. Investigating and deepening these links might lead to noteworthy advancements in both domains. The essay takes a prejudiced stance while discussing the links between Al and game theory. Representation, reasoning, and learning are the three cornerstones of game theory and computer science that I shall focus on. Starting with some of the most fundamental issues in the field, I'll go over how these issues are handled in my own work.

REPRESENTATION, REASONING, AND LEARNING

"Intelligent" agents embedded in a complicated environment are at the heart of both game theory and Al. Using a variety of reasoning and learning strategies, these agents may engage in interactions with one another and strive for optimal behaviour. The fields of economics, game theory, and computer science and artificial intelligence are deeply intertwined:

RESEARCH ABOUT DISTRIBUTED SYSTEMS

Research in computer science focuses on distributed system characteristics, like network architecture, and computational limitations, like communication complexity, when discussing prototypes for such environments. Research in game theory focuses on interactions between agents in a rationally constrained setting, where agents act in their own self-interest. It goes without saying that both fields rely heavily on reasoning about distributed systems that takes communication and rationality restrictions into account. An example of a distributed system that does not rely on cooperation is the Internet architecture. As they engage in computational activities, users in this environment may have varying goals.

LEARNING

Fundamental to both computer science/artificial intelligence and game theory/economics is the concept of learning, and more specifically, reinforcement learning. The development of Nash equilibrium and

the prediction of agent behaviors are both addressed by game theorists' work that places an emphasis on learning as a descriptive tool [8]. Research in artificial intelligence that focuses on reinforcement learning (18) takes a normative stance and addresses algorithms that, via observed feedback, can achieve high payoffs in unpredictable contexts. Both fields rely on efficient reinforcement learning systems to adapt to dangerous situations. To implement a normative strategy for reinforcement learning in non-cooperative settings, efficient algorithms are needed to handle the optimal behaviors of agents in hostile surroundings.

REASONING

Think of a distributed system where a group of agents needs to divide up some resources. Each participant assigns a unique (personal) value to a portion of the resources. A possible definition of an agent's valuation is the maximum amount the agent would be willing to pay for a given collection of resources. An auction is a practical method for handling resource allocation in a generic non- cooperative multi-agent setting.

Economists attempt to achieve economic efficiency through the use of auctions. For an allocation to be considered economically effective, the centre must select an allocation that maximises the sum of the agents' valuations. But there are two big hurdles to jump in order to put this desired behaviour into action.

EmpowerU: A Women's Safety and Empowerment App

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ABSTRACT

Crime against women has been on the rise, especially in developing countries such as India. The changing social constructs of our society mean that women are now integral to the workforce, just as men are. The increase in female education has directly contributed to the rise in women's employment. Despite these positive trends, there are still many individuals across India who lack access to education or employment opportunities due to a combination of insufficient facilities and conservative family values. Additionally, concerns about the wellbeing and safety of women when they venture outside their homes persist. These factors highlight the urgent need for a tool to ensure the safety and empowerment of women. Smartphone ownership is fairly widespread, even in rural areas, making a mobile application for women's safety and empowerment an ideal solution that would be accessible to the majority across the country. The proposed app will feature essential tools such as SOS, location sharing, emergency contacts, and easy access to NGOs and helpline numbers. Furthermore, it will provide discussion forums, tutorials, and articles on women-related issues, along with easy access to medical and legal support.

KEYWORDS : *Women empowerment, Women's rights, Social impact technology, Mobile application.*

INTRODUCTION

Gender inequality, a pervasive issue throughout history across diverse civilizations and societies, has undergone changes in recent times. The advocacy for equal rights for both men and women by an increasing number of countries and societies has contributed to a gradual reduction in the gap of gender inequality. Women have become an integral part of a nation's workforce, and the increase in female education has positively impacted employment rates.

However, the lack of opportunities and rights for women and their safety and security is still a paramount issue worldwide and especially so in developing countries. A significant portion of women in India continue to face barriers to education and employment due to a combination of inadequate facilities and conservative family norms. The concern for the well-being and safety of women outside their homes, particularly when pursuing education or employment opportunities is another glaring issue.

More than 4 lakh crimes occurred against woman in 2019 in India alone. Domestic violence and dowry related cases were also plenty in North India. Crimes such as eve teasing and groping were also prevalent. In the decade of 2011-2020, more than 2 lakh rape cases have been reported in India [1].

Women's Employment

Gender Pay Gap: Despite progress, a gender pay gap persists in India, with women often earning less than their male counterparts for similar work.

Workplace Discrimination: Women may face

discrimination in the workplace, limiting their opportunities for career advancement. Efforts have been made to promote gender diversity and inclusivity, but challenges persist.

Crime Against Women

Violence: India has faced challenges related to violence against women, including domestic violence, sexual harassment, assault, and rape. High-profile cases have been brought to attention.

In light of these facts and the widespread distribution of smartphones in today's world, to ensure the mental and physical well-being of women, a mobile application catering to the safety as well as their specific needs would be of great use to women from all walks of life. After a thorough study, the multifaceted nature of the challenges that women face throughout their life has been identified.

Keeping this in consideration, the EmpowerU app has been carefully crafted in brief, the app should have features about two main things:

1) Safety of Women

2) Empowerment of Women

LITERATURE SURVEY

Mr. Dhruvchand et al., in their research paper introduces a mobile application called WoSApp that provides women with a reliable way to place an emergency call to the police [2].

Mr. Ravi Sekhar Yarrabothu et al., in their research paper, have described Abhaya, an Android Application for the safety of women. This application helps in live tracking of the location of the victim through GPS along with one of the registered contacts receives a call from the root device[3].

R. Pavitra et al., in their research paper have utilized to send a present area through Short Message Service [4].

Dantu Sai Prashanth et al., in their research paper presents the development of a mobile women safety app with real-time features like location tracking, SOS, and a spy camera. It integrates Pub Nub's data-stream network and Firebase for analytics. The system allows users to monitor each other's locations and sends distress alerts with GPS coordinates to emergency contacts. A comparison with existing apps is provided. The app's requirements include sufficient battery, fast internet, enabled GPS, and limited background apps. Future improvements could involve platform independence and additional functionalities. The paper emphasizes the app's role in addressing increasing crimes against women [5].

Sindhu.K et al., in their research paper proposed that their device integrates an RF signal detector and jammer to identify and counteract camera transmissions in the 0.05 to 3 GHz range. External amplifiers and antennas enhance sensitivity. Additionally, it includes glasses to detect hidden cameras using pulsating laser frequencies. This comprehensive system addresses various spying methods [6].

A.Z.M. Tahmidul et al., in their research paper proposed that their smart band system integrates an emergency switch, GPS, and GSM modules for women's safety. When the switch is pressed twice, it triggers an immediate SMS alert to police and volunteers, updating the victim's location. The accompanying app enhances awareness and provides safety features [7].

Zully Amairany Montiel Fernandez et al., in their research paper proposed that various safety apps like Circle of 6, Toranj, bSafe, and Crime Radar address personal security, each with distinct features. The Circle Armored App introduces innovative elements, utilizing AI and speech recognition to enhance user safety, particularly for women in Mexico. This app aims to collaborate with organizations and universities, offering versions tailored to specific needs and languages, with a focus on marginalized communities to create a safer environment [8].

METHODOLOGY
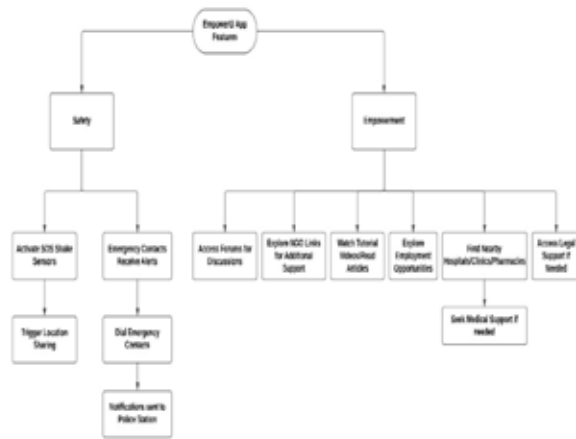
Fig. 1. Flowchart of features of EmpowerU App

Security

SOS Feature (Safe Shake Sensors)

An SOS is a one-touch emergency alert which sends location to emergency contacts and authorities and notifies pre-set contacts, ensuring swift response for women's safety in distress.

The app includes a panic button which is situated in an easily accessible location. It is ensured that the button is accessible even if the screen is locked or even if the app is running in the background. It has been ensured that the users don't accidentally press the button by pre defining the number of presses or a long press. The SOS command can also be triggered by a voice command by saying a pre-defined keyword.

To prevent unauthorized access of the SOS button we have implemented a secure authentication mechanism. It continuously monitors location in the background, which ensures ongoing safety without active user involvement.

The SOS alerts will be sent through multiple channels, such as SMS, push notifications, and email, to maximize the chances of emergency contacts receiving the message promptly. SMS alerts are also chosen because SMS is easily available across all locations.

Location Sharing

Implementing a location sharing feature is crucial for a safety app. This feature provides the live location of the user and is continuously updated with the help of GPS (Global Positioning System).

It utilizes map services to present shared locations in a user-friendly interface.

User can also choose to record location timeline of their device. The location timeline of the last 24 hours will be sent to their emergency contacts if the SOS feature is triggered.

Users can enable their location sharing preferences and can also choose certain other people to share their location with.

The distressed user might not be at the same place when the location was sent to the local authorities. In the app we continuously share the location every five minutes to ensure that authorities have access to the live location at every time interval.

Emergency Contacts

User can set a list of emergency contacts preferably their closed ones. These set of contacts will be on speed dial in the app. Also, whenever SOS is triggered, all the emergency contacts will be notified and the live location will be sent.

Helpline

It ensures continuous accessibility 24/7 day and night, for emergencies and support. Users can access different numbers for various regions or countries, ensuring the localized assistance. It allows users to send text messages for assistance, catering to different communication preferences. It also facilitates anonymous reporting for sensitive situations, which encourages the user participation. It efficiently handles call volume which minimizes the waiting time during emergencies.

Multilingual

The app has multilingual support to ensure that even in areas where English is not spoken, women receive the adequate resources and a sense of security that they need from the app.

Empowerment

Employment

It can easily integrate a job portal featuring gender-inclusive job opportunities with a focus on safety-

conscious workplaces. Users will be provided safety ratings and reviews for potential employers, promoting transparency. Users can easily share and access reviews about their workplace safety to make informed job decisions.

The women's safety app features a comprehensive employment module, ensuring both workplace safety and career development. It includes an Emergency Job Leave option for swift notification and time-off requests in safety concerns. A Workplace Panic Button integrates a quick-response mechanism at the workplace. Safe Commute Routes recommends secure paths based on real-time safety data.

A Virtual Companion enhances late-night commute security. Anonymous Reporting enables discreet reporting of harassment or safety issues.

For job seekers, the app integrates a job portal with gender-inclusive opportunities and Safety Ratings for Employers. An Emergency Interview Protocol discreetly alerts contacts during job interviews.

Workplace Reviews and Resume Privacy Settings aid informed job decisions. Networking Events with safety measures, Skills Enhancement Resources, and Safe Transport Recommendations support career development. Emergency Job Change Assistance provides swift support, and Legal Aid Information empowers users with workplace rights knowledge.

Medical Support

The app's healthcare module ensures rapid assistance with Emergency Medical Aid, alerting nearby facilities with GPS Location Sharing. Users can request ambulances, manage medications with reminders, and access virtual consultations through Telemedicine. Emergency Contacts and Health Records Storage offer quick access to vital information, while the Pharmacy Locator and Language Preferences support diverse needs. An Emergency Allergies/Conditions Alert enhances user safety during emergencies.

The medical support module in the app offers a 24/7 Medical Helpline for round-the-clock assistance. Virtual Consultations connect users with healthcare professionals for non-emergency advice. Appointment Booking facilitates scheduling for in-person consultations, and Prescription Renewal allows users to request ongoing medication refills.

The app integrates Mental Health Support resources and provides Health and Wellness Tips, promoting preventive care through regular updates, fostering holistic well-being.

Online Forums

The Online Forums feature will enable women to discuss specific issues or their own personal problems. This feature will give a safe space to women to express their mental state in a free manner. The online community will act as a support network encouraging women to solve their issues and change their life for the better. The forum will have different rooms for different topics such as self-defense, physical health, mental health, employment, education, resources, legal support and so on.

NGO Access

The app will give easy access to NGOs to help women with their specific problems by connecting them to NGOs very quickly and easily. The app will curate a list of NGOs for a variety of issues including domestic violence, safety, education, employment, mental health, etc.

Tutorials

EmpowerU, a women-centric app, walks users through key elements that ensure safety and empowerment. The Emergency Features Tutorial covers Job Leave, Panic Button, and Safe Commute Routes, with a focus on easy navigation and updating emergency contacts. The Virtual Companion Guide shows how to activate a safety layer for late-night commutes via video and article. An Anonymous Reporting Tutorial provides step-by-step instructions for reporting workplace issues anonymously, which is critical for maintaining a secure work environment. Safety Training Resources The walkthrough stresses empowerment through accessible workplace safety education. The Job Search and Safety Integration Video emphasizes the importance

of applying safety ratings and guidelines when conducting job searches. The Medical Support Module Overview emphasizes elements such as emergency medical assistance and medication reminders for women's health. Finally, the Health and Wellness Tips Exploration, available in both video and article format, promotes preventive treatment and regular updates to improve overall well-being.

Legal Support

The legal support module of the app provides extensive assistance. Users have access to a Legal Helpline that is available 24/7 for rapid assistance, as well as Emergency Legal Contacts for critical cases. Anonymously reporting legal problems is made easier, promoting a safe environment. The module features Document Storage for important legal documents, a Legal Aid Directory that connects users to available services, and virtual Legal Consultations for non-emergency guidance. Case Tracking allows users to track legal developments, while Know Your Rights Guides provide instructional information. The unique Emergency Location Trigger immediately notifies legal contacts in designated places, ensuring timely aid in emergency situations. This module is an invaluable resource, offering rapid legal aid, information, and support.

The main USP of the app is, with vast modules of different kinds of features, the app can make the experience of each user personalized according to her age, profession, relationship status, lifestyle by deploying personalized algorithms and personalized insights of various users. This level of customization ensures that users receive recommendations, content, and interventions that resonate with their unique circumstances and goals. Additionally, the app can leverage machine learning techniques to continuously refine its understanding of each user, adapting to changes in their life circumstances and preferences over time. By leveraging insights from user data, the app delivers age-appropriate safety tips, profession-specific resources, support for different relationship statuses, and recommendations aligned with individual lifestyles. The app can aid each user in a different way according to her current needs and current scenarios.

APP INTERFACE

Fig.2. Home Screen of The App

Fig 2 displays the home screen of the app. Helpline numbers for all kinds of emergencies are easily accessible. The carousel features featured articles and tutorials. A special button named stop has been added for SOS.

Fig.3.Articles about Women-centric topics

Fig 3 displays a sample article of the application. The articles are written on women centric topics such as self-

defense, physical health, mental health, employment, education and resources.

Fig. 4. List of Police Stations Nearby for Emergencies

Fig 4 displays a map with visual representation of the list of police stations present nearby the user's location for quick access to police help.
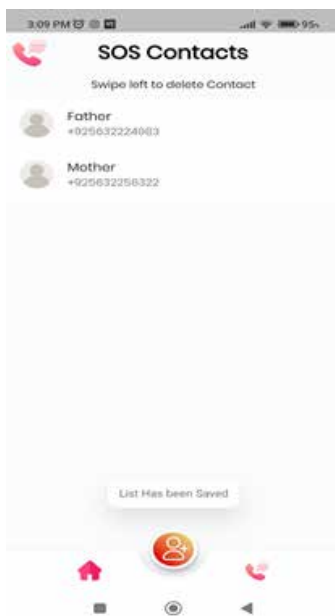
Fig. 5 SOS Contacts Set saved for Emergencies

Fig 5 displays the SOS contacts which will be notified via SMS, push notifications and email during emergencies. User can set one or multiple emergency contacts.

Fig.6 Settings

Fig 6 displays the settings page. EmpowerU introduces the unique "Safe Shake" feature, ensuring an added layer of security through a PIN system to prevent accidental activation. This innovative addition enhances user control, guaranteeing the deliberate use of this safety feature for women's well-being.
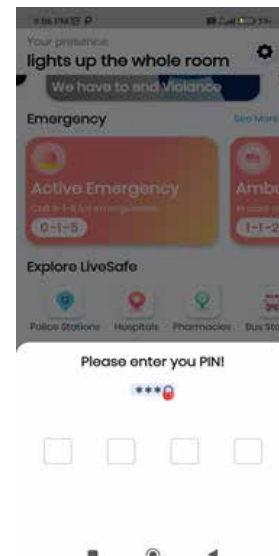
Fig.7 App PIN for authorization

Fig 7 displays the authorization layer of the app. The app will be accessible only after the correct PIN is given to prevent misuse or invasion of privacy.

FUTURE WORK

In our future endeavors, EmpowerU envisions the implementation of personalized algorithms and a virtual bot to elevate user experiences. The personalized algorithm will tailor safety recommendations and empowerment resources based on individual preferences and needs, providing a more customized and effective user journey. Additionally, the integration of a virtual bot aims to offer real-time assistance, answering queries, and providing support on safety protocols and empowerment initiatives. These advancements signify our commitment to leveraging cutting-edge technology to continuously enhance the app's impact on the safety and empowerment of women.

CONCLUSION

EmpowerU: A Women's Safety and Empowerment App is a beacon of empowerment that ensures women's well-being and security. The app targets several areas of women's safety by including features such as emergency aid, occupational safety tools, and legal support. The training and resources supplied are valuable aids, instilling confidence in using the app's functions efficiently. With a focus on preventive care, job safety, and legal aid, the app aims to create a comprehensive ecosystem for women's empowerment. Finally, through technological solutions, this app emerges as a powerful instrument that not only improves personal safety but also promotes the larger purpose of empowering women in different parts of their lives.

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Futuristic Approach Towards Internet Beyond 5G Era

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ABSTRACT

The goal of the 5G internet is to enable real- time transmission of haptic information like touch, actuation, motion, vibration, and surface texture over the Internet along with the usual data and audiovisual traffics. This is intended to cause a paradigm shift from content-oriented communications to steer/control-based communications. In order to address the complex issues facing human society, such emerging technology—is considered as the next evolution of the Internet of Things ,is predicted to open up a wide range of opportunities for the technology markets in from tele- operation systems and e-Healthcare. Virtual Reality (AR/VR) and automotive safety. However, the implementation of TI over wireless media in the future Fifth Generation (5G) networks and beyond poses a number of unconventional communication issues and strict demands for ultra-high throughput and ultra- low latency.

INTRODUCTION

Latest Fifth Generation (5G) and beyond systems are going to achieve numerous performance criteria's , such as

- 25 Gbps data rate,
- 100 Mbps data rates for the cellular,
- 106 devices per square kilometers,
- 10 Mbps per square kilometer areal capacity,
- 1 ms round-trip latency, in order to support various emerging applications/platforms [1].

COMPARISON WITH 4G

The Comparing these specifications to those of the 4G systems in use today,10 times improvements in throughput, 10 times reductions in latency, 100 times increases in traffic capacity, and 100 times increases in network efficiency are required of 5G systems [2]. Among these anticipated results, the two most difficult goals for the future 5G and beyond systems are [3]:(i) Achieving ultra-high reliability, or "five-nines" dependability—that is, a one-in-a-million risk of failure—and (ii) ultra-low latency, or around or less than 1 ms. The objective of this study is enabling TI situations in wireless systems, which will present special research problems because these two needs are crucial for the majority of TI applications..

THE TI VISION AND RECENT ADVANCES

The TI is envisioned as the next generation of IoT, enabling real-time communication and H2M interactions in Beyond 5G (B5G) networks, revolutionizing various sociological, economical, and cultural aspects of our daily lives. Future 5G and IoT networks will benefit from the TI's several new features, like carrier-grade reliability, easy availability, fast reaction times, very high security, and remote control of tactile devices [4]. 5G will also propose a means for the transmission of touch and actuation in real time with the audiovisual details, in comparison to the traditional Internet and wireless networks, which typically work as a medium for audio and visual details.

In addition to the TI's extremely high reliability design requirements and very low end-to-end latency, data security, availability, and system dependability must be guaranteed without going against the low latency requirements while also accounting for encryption delays. However, in order to achieve these requirements, the centralized network architectures that are currently in place are insufficient, and new distributed network

architectures based on cloudlets and mobile-edge computing must be investigated in order to bring TI applications closer to end users [5]. In order to meet the strict reliability and latency requirements of TI applications, it is also imperative that coming wireless access networks will be restructured by looking into new resource allocation, feedback mechanisms, interference management, and medium-access control techniques [4].

Table1: Classification of areas of IoT / mMTC and Tactile Internet

Main Domain	Sub- topics
IoT/mMTC/M2M/URLLC	1) Enabling technologies/ protocols, applications and challenges 2) IoT big data analytics 3) Short packet transmission 4) Traffic characterization and issues
Tactile Internet	1) Vision, applications and challenges 2) Haptic communications 3) Wireless virtuality/ augmented reality

OVERVIEW OF SURVEY ARTICLES

In the field of IoT, massive Machine Type Communications (mMTC), M2M communications, Ultra Reliable and Low Latency Communications (URLLC), and survey papers, there are several publications available; nevertheless, there are relatively few in the field of TI. Table 1 enumerates the relevant subjects falling under these categories as well as the current overview and survey publications.

MAIN TECHNICAL REQUIREMENTS

1) Ultra-responsive Connectivity: The majority of TI applications demand round-trip latency and end-to-end latency to be within a few milliseconds. The term "end-to-end latency" describes the total of the transmission times needed to send data from a sensor or device (or human in the case of haptic communication) to a control server via the communication infrastructure, the time it takes for the server to process the data, the processing that occurs at various communication hops (such as switches and routers), and the retransmission time through the communication infrastructure till return the data to the user (or human).

2) Highly-reliable Connectivity: This is one of the crucial requirement for the TI. Reliability in this context refers to the likelihood of achieving the desired performance over a certain period of time given the system's limits and circumstances. For instance, a smart factory's factory automation scenario requires a reliability of roughly 99.999% for latency of roughly 1 ms [6]. Using concurrent connections with numerous links and various channels for graph connectivity to prevent a single point of failure are two possible ways to improve the resilience of TI applications [6]. This approach is dependent on the availability of Channel State Information (CSI) information and the dynamics of the channel.

3) Distributed Edge Intelligence: Artificial Intelligence (AI)/ML techniques must be investigated and implemented at the edge-side of wire-less TI networks. Additionally, research must be done on AI/ML-based predictive actuation techniques to expand the scope of tactile services and applications.

4) Transmission and Processing of Tactile Data: Tactile encoding mechanisms must be created in order to make it easier to transmit tactile data across packet-switched networks. Furthermore, research is required to determine an efficient audio/visual sensory feedback system in order to address the extremely multidimensional nature of human touch perception.
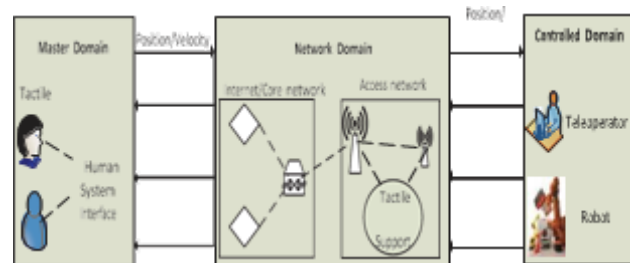
Fig. 1: A generalised view of 5G internet

APPLICATION AREAS

1. Tele operation or remote operation systems: By allowing people to interact with actual or virtual objects, these systems may carry out work in

dangerous, remote, and difficult-to- reach locations. Haptic information can be used to convey a variety of elements, including force, motion, vibration, and texture, to provide the impression that the user is physically present at the distant location. In comparison to the usual cable solutions for small distance wireless tele-operation systems confront hurdles for achieving tight standards of latency & dependability for fast and dependable remote engagement. In order to achieve , 5G finds a significant need for facilitating remote interactions over large distances through wireless connectivity.

2. Immersive Entertainment and Education Systems: The entertainment sector is another significant area in which technology is being applied. Through the real-time transmission of multi-sensory information, such as audio, video, and haptic, technology can enable a variety of new immersive entertainment services. Emerging VR and AR devices will also help new gaming applications. Moreover, end users may experience the sensation of a live event through live haptic broadcasting over TI [7]. Moreover, TI can offer an entirely new approach to teaching, opening up new edutainment applications, by facilitating haptic contact between instructors and students. But this raises the difficulty of developing a multimodal H2M interface (visual, haptic, and aural) that can function with extremely low end-to-end latency.

3. Networked Control Systems (NCS) that are Wireless: Wire- less NCSs are distributed systems made up of sensors, actuators, and controllers. A global control loop with stringent latency limits facilitates the interchange of control and feedback signals across a shared communication network. Because of the time delays and packet losses involved, NCSs must contend with the instability of wireless channels. TI offers incredibly dependable and ultra-low latency connectivity solutions, which may make wire-less NCSs possible.

MAIN DIFFICULTIES

1) Ultra-High Reliability: Lack of resources, uncontrollable interference, diminished signal strength, and equipment failure are just a few of the variables that can affect ultra-high reliability, which is most important requirements of 5G applications over traditional wireless networks [89].

2) Ultra-Responsive Connectivity: Achieving the roughly 1 ms end-to-end latency needed for many TI applications presents a number of difficulties. To achieve this goal, every element that affects end-to-end latency across several protocols—such as hardware, backhaul, air interface, layers, and the core Internet—should be optimized. For instance, in order to reduce over-the-air latency at the physical layer, shorter Transmission Time Intervals (TTI) are highly desired; yet, this will necessitate higher available bandwidth.

3) Effective Resource Allocation: When haptic communications are added to wireless/cellular networks, the radio allocation becomes more difficult because haptic communications and machine-type or human-to-human (H2H) communications must share resources, which have different and competing service requirements. Given its strict QoS requirements, haptic communications should be given precedence when it comes to resource allocation among these systems.

4) Haptic Sensors and Actuators: Important parts of haptic communications systems are haptic devices like haptic sensors and actuators. Haptic sensors are typically installed at the tele- operator end of these devices and are used to sense tactile information by interacting with the surrounding environment. The haptic actuators, also known as haptic feedback devices, subsequently communicate and relay this sensed data back to the end user in the form of haptic feedback.

6) Area-Based Sensing and Actuation: Haptic communications must address touch-based sensations across surfaces, such as the palm of the hand or other body parts. This is in comparison to the majority of current heptic devices, which use single-point contact for tactile. Haptic devices must incorporate area-based or distributed sensing and actuation for this purpose [9].

7) Specifying New Performance Measures: Since there is currently no standard method for assessing

and contrasting the performance of various haptic communications systems, it is crucial to look into appropriate performance metrics for comparing and analyzing the performance of different haptic systems over the TI [10]. To develop novel combined optimization approaches for communications, compression, and control, a sufficient relation between the QoS metrics provided from the associated networks and required heptic data processing algorithms .

CONCLUSION

Future 5G wireless networks should be able to accommodate a wide range of newly developed TI applications with various QoS needs. Because haptic information must be communicated in addition to the usual audio and visual traffics across wireless media, this has resulted in a number of non-conventional challenges that need to be handled. In this context, ultra-low latency, ultra-high dependability, very high data-rate, energy efficiency, spectrum efficiency, and network throughput are the primary technical requirements. In order to achieve this, this paper showed us a generalized framework for wireless 5G/TI that includes the basic technical requirements, important applications , 5G architecture, and the primary technologies. It also provides a thorough insight on a variety of wireless technologies, beginning with the vision of TI and recent advancements.

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React Crypto Website

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ABSTRACT

Explore the dynamic world of cryptocurrencies with our React-based website, offering a comprehensive platform for in-depth analysis of cryptocurrency charts. Empower your decision-making process by gaining insights into market trends and price movements. Seamlessly integrate MetaMask to facilitate secure and efficient Ether transfers between accounts, providing users with a powerful and user-friendly experience in managing their digital assets.

INTRODUCTION

In Cryptocurrency Research, our research endeavors to develop an advanced React-based website. This platform is a dynamic hub for cryptocurrency enthusiasts that offers in-depth graphic analysis tools. Users can see complex market trends and price changes to make strategic decisions. The main feature of this website is the seamless integration with the leading Ethereum wallet MetaMask. This integration not only improves the user experience, but also facilitates the safe and efficient transfer of ether between accounts. The synthesis of React's flexibility and MetaMask's powerful functionality creates a powerful synergy, providing users with an intuitive and secure environment to manage their digital assets. Our paper explores the complexity of this combination, revealing the technical aspects and user-centered design principles that distinguish this platform in the cryptocurrency landscape.

RELATED WORK

In the landscape of cryptocurrency platforms, various endeavors have sought to enhance user experience and analytical capabilities. Notable among these is the utilization of React, a versatile JavaScript library, to create dynamic and responsive user interfaces. React has been widely embraced for its efficiency in handling complex interfaces and real-time data, providing a solid foundation for cryptocurrency-related applications. Furthermore, the integration of MetaMask, an Ethereum wallet, has become increasingly prevalent in enhancing the security and usability of cryptocurrency platforms. Prior research has explored the seamless integration of MetaMask to enable secure transactions and interactions with smart contracts, laying the groundwork for our present endeavor. However, the intersection of React and MetaMask in the context of a comprehensive cryptocurrency website, as outlined in our introduction, represents a novel approach. This research paper aims to contribute to the existing body of knowledge by providing an in-depth analysis of the technical intricacies and user-centric design principles employed in this fusion. Through the synthesis of React's dynamic capabilities and MetaMask's secure transaction framework, our work endeavors to push the boundaries of user-friendly and secure digital asset management in the cryptocurrency domain

PROPOSED SYSTEM

The proposed system assumes the creation of a sophisticated cryptocurrency platform based on React, which prioritizes a dynamic and responsive user interface. By leveraging the versatility of React, the platform aims to provide users with advanced in-depth chart analysis tools that enable them to navigate

complex market trends and real-time data. Crucially, the system will integrate MetaMask to ensure secure and streamlined transactions, allowing users to transfer Ether between accounts with confidence. User experience will be the focus, with an intuitive interface designed for easy navigation and customization. The MetaMask integration will be seamlessly incorporated into the authentication process and contribute to a positive and engaging user journey. Security will be paramount, with strict measures in place to protect user data and transactions in line with industry standards and best practices. The platform will be accompanied by comprehensive documentation that will serve as a guide for users to explore its features and functions. User support channels will be created to address questions and offer assistance in using MetaMask effectively. The system will be designed with scalability in mind, providing flexibility for future enhancements and updates, such as additional cryptocurrency support or integration with emerging technologies. This holistic approach aims to create a leading cryptocurrency platform that not only provides users with valuable insights for decision-making, but also ensures a secure, user-friendly and customizable environment for evolving market needs.

BLOCK DIAGRAM
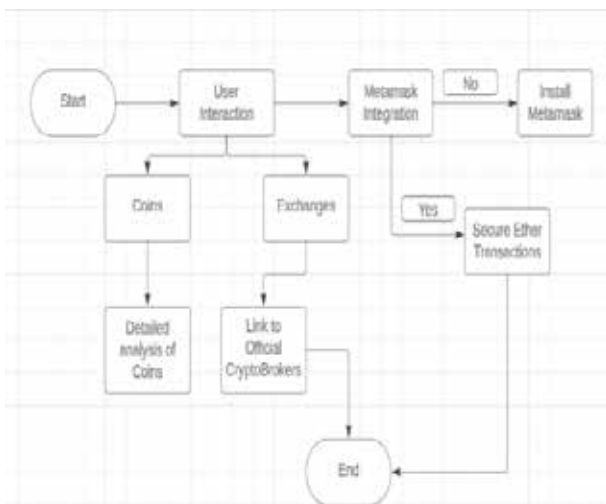
Figure 1: Block Diagram

ADVANTAGES

User-Friendly Interface: The React-based front-end ensures a dynamic and responsive user interface,

contributing to an enhanced user experience with intuitive navigation and customization options.

Advanced Chart Analysis: The incorporation of advanced chart analysis tools empowers users with valuable insights into market trends, facilitating well-informed decision-making in the volatile cryptocurrency landscape.

MetaMask Integration: Leveraging MetaMask enhances security by providing a trusted framework for secure Ether.transactions, ensuring the integrity of financial interactions and boosting user confidence.

Security Measures: Rigorous security measures aligned with industry standards and best practices instill trust by safeguarding user data and protecting against potential vulnerabilities in cryptocurrency transactions

RESULT

Figure 2: Wallet Section
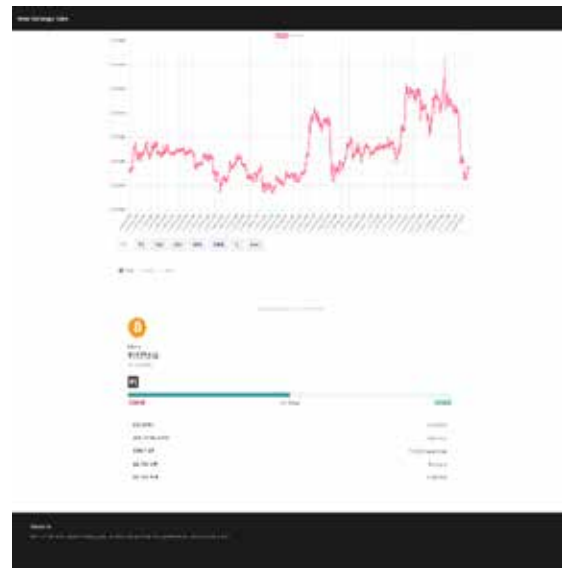
Figure 3: Chart Analysis

CONCLUSION

In conclusion, the proposed React-based cryptocurrency platform, enriched by MetaMask integration, represents a comprehensive solution poised to elevate the user experience and functionality within the dynamic realm of digital assets. By harnessing React's capabilities, the system ensures a dynamic and responsive interface, enabling users to delve into nuanced chart analyses and real-time market data. The seamless integration of MetaMask not only enhances security measures but also facilitates trustworthy and efficient Ether transactions between accounts.

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HazeErase: Enhancement of Satellite Imagery

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ABSTRACT

Haze and fog are common atmospheric phenomena that can degrade the visibility and quality of satellite captured images. Hence, image dehazing plays a pivotal role in enhancing the clarity and quality of satellite imagery obtained under cloudy situations. In this research work, we explore a comprehensive approach to dehazing multispectral satellite images by employing CycleGAN (Cycle-Consistent Generative Adversarial Networks), Convolutional Neural Network (CNN), and Depth-wise Separable Convolutional Neural Network (DSCNN) architectures. Additionally, we conduct an in-depth analysis of different loss functions to assess their impact on dehazing performance. Our proposed method involves a two-step process. Firstly, a CycleGAN is employed to understand the translation between hazy and haze-free (Dehazed) images in an unsupervised manner. This process facilitates the removal of haze and the enhancement of visual clarity. Subsequently, a Convolutional Neural Network is fine-tuned to further refine the Dehazed images, leveraging its capability to capture intricate spatial features. We embark on this study by training a CycleGAN model on unpaired multispectral hazy and haze-free satellite image data. The versatility of CycleGAN allows us to establish a translation between hazy and haze-free domains, generating imagery that reflects the underlying scene without the detrimental effects of haze. We assess the fidelity of generated multispectral images through specialized loss functions, contributing to a sustainable solution for reliable image synthesis.

KEYWORDS : *Image-dehazing, CycleGAN, CNN architectures, Loss functions, DSCNN, Satellite imagery.*

INTRODUCTION

When it comes to remote sensing, optical multispectral satellite image data are essential for various applications, but they often suffer from atmospheric haze, which reduces image quality and hampers data interpretation.

Haze, a phenomenon caused by the scattering and absorption of light in the atmosphere, leads to decreased contrast, color distortion, and reduced object visibility. Addressing haze challenges is crucial for accurate information extraction. Dehazing techniques aim to improve image visibility by mitigating the effects of haze.

Haze detection and removal are complex due to both homogeneous (uniform) and non-homogeneous (varying) haze.

In this paper, we offer a comprehensive solution for dehazing multispectral satellite images, combining image processing, statistical modelling, and machine learning. It aims to restore image clarity, contrast, and color fidelity. The proposed dehazing solution promises to enhance the quality and interpretability of multispectral satellite images, benefiting fields like agriculture, urban planning, and environmental monitoring. Overall, this solution aims to advance remote sensing technology and make satellite imagery more useful for diverse applications.

LITERATURE SURVEY

The research paper focuses on the preservation of image details in deep learning. Current networks generate confrontation loss and cyclic consistency loss, ensuring the similarity to the original image but cannot retain details. A detail-enhanced image CycleGAN is proposed to preserve details during defogging. The algorithm uses the CycleGAN structure and combines U-Net network ideas to extract visual data features in multiple parallel branches. To acquire more in-depth feature information, dep residual blocks are introduced. To improve feature expressiveness and balance deviance, a multi-head attention system is implemented. This network layout enhances the signal-to-noise ratio (SSIM) and PSNR of the picture dehazing effect by 12.2% and 8.1%, respectively, while maintaining image dehazing details, according to experiments conducted on the public dataset D-Hazy. [1].

The research mentions Image de-hazing that is a considerable difficulty in computer vision because of airborne particles that produce haze and fog in unfavourable weather. This affects computer vision issues that depend on image visibility and makes object detection more difficult. In order to dehaze images, this research suggests a deep Generative Adversarial Network that uses a perceptual loss function in place of per-pixel loss. By employing pre-trained models on ImageNet, this function extracts high-level features from photos, doing away with the issues associated with per-pixel loss functions. The goal of this strategy is to enhance computer vision capabilities in inclement weather. [2].

A 2022 research paper discusses the development of an Image Dehazing Algorithm based on Deep Learning Coupled Local and Global Features. The paper highlights that the combination of a vision transformer (ViT) and a convolutional neural network (CNN) in an end-to-end architecture can increase the algorithm's computational complexity, making it less suitable for real-time or resource-constrained applications. The study also warns of issues like overfitting. This, especially if the training sample is limited or not sufficiently diversified, might result in poor generalization to unseen data. [3].

The paper mentions using around 1500 outdoor images for validation. While this is a reasonable dataset, the diversity of hazy conditions, scenes, and geographical locations might not be sufficient to generalize the algorithm's performance to a wider range of real-world scenarios. Using a more diverse and extensive dataset could help address this limitation. The paper mentions applying filters to find haze in the image. However, it's important to provide more details about the specific filters used and their effectiveness. Different environmental conditions and types of haze may require different filter parameters or techniques[4].

The research paper by Yang et al. explores improved single image dehazing methods for resource-constrained platforms. A novel Dark Channel Prior-based technique with low-complexity morphological reconstruction and enhanced atmospheric light estimation is presented in the paper. In order to prevent computational strain and information loss, they also suggest a lightweight end-to-end network. The suggested algorithms can be used on platforms with limited resources because they are either as good as or better than cutting-edge methods with far less complexity. The purpose of the paper is to enhance single picture dehazing techniques and address the intricacy of prior-based approaches. [5].

The research paper by Yuda et al. focuses on image dehazing, a low-level vision problem that is typically handled by CNN-based techniques. The study analyzes the Swin Transformer and its limitations for dehazing, leading to the development of DehazeFormer, which presents improvements to the spatial information aggregation approach, activation function, and normalizing layer. On the SOTS indoor set, the DehazeFormer model performs better than FFA-Net with 25% less parameters and 5% computational cost, while the big model reaches a PSNR of above 40 dB. Additionally, a large-scale realistic remote sensing dehazing dataset is used in the research to assess the efficacy of the method in eliminating very non-homogeneous haze. [6].

The paper proposes a novel end-to-end architecture for image dehazing, which directly estimates Dehazed images in the Krawtchouk transform domain. The architecture includes a customized Krawtchouk Convolution Layer (KCL) and an Inverse Krawtchouk Convolution Layer (IKCL). The Krawtchouk transform helps analyze high and low frequencies of hazy images

separately. The architecture is divided into two branches, with the lower branch deeper to address haze in lower frequencies. The proposed Orthogonal Transform-based Generative Adversarial Network (OTGAN) architecture achieves competitive results[7].

The paper presents a two-stage dehazing neural network called FCTF-Net to address the issue of haze in remote sensing (RS) applications. The first stage extracts multiscale features through an encoder-decoder architecture, allowing for better refinement of the results. The network also combines channel attention and basic convolution blocks to deal with irregular haze distribution in RS images. Due to the scarcity of quality hazy RS data sets, the authors use two synthesis methods to generate large-scale image pairs for uniform and nonuniform hazy images. The network performs well on synthetic and real-world images[8].

Research paper by Guo et al. addresses the critical difficulty of haze in remote sensing image data, which can compromise data quality and hinder accurate interpretation. They provide an innovative method to haze creation that models wavelength-dependent and spatially-varying haze properties to produce realistically hazy images. The end-to-end RSDehazeNet integrates channel attention modules for robust channel correlation and employs both local and global residual learning algorithms for effective haze removal. The results of experiments demonstrate the network's advantage over contemporary methods. [9].

Researchers Faramarz et al. have developed a method for cloud removal using generative adversarial networks and sar-to-optical image translation, removing cloudsfrom remote sensing images. The technique converts synthetic aperture radar (SAR) data into optical images using two generative adversarial networks (GANs), then uses the translated images to eliminate clouds. To enhance picture quality, the method uses the structural similarity index measure (SSIM) and dilated residual inception blocks (DRIBs). Training and testing are conducted on the SEN1-2 dataset, and the results show that the method beats the latest deep learning models in terms of cloud removal and SAR-to-optical image translation metrics. [10].

PROPOSED SYSTEM

The proposed system for satellite image dehazing combines CycleGAN, Depth-wise Separable Convolutional Neural Network (DSCNN), and Loss functions to effectively remove atmospheric haze from satellite images. It starts with data collection and preprocessing, followed by training the CycleGAN to perform hazy-to-clear and clear-to-hazy image translation. The DSCNN then further refines the Dehazed results, capturing both spatial and channel-wise information. The Huber loss function is employed during training to balance L1 and L2 loss, enhancing robustness. Post-processing techniques and thorough evaluation ensure high-quality results.

Fig.1 elucidates the system architecture of our proposed research, presenting a well-defined system design that incorporates key concepts.
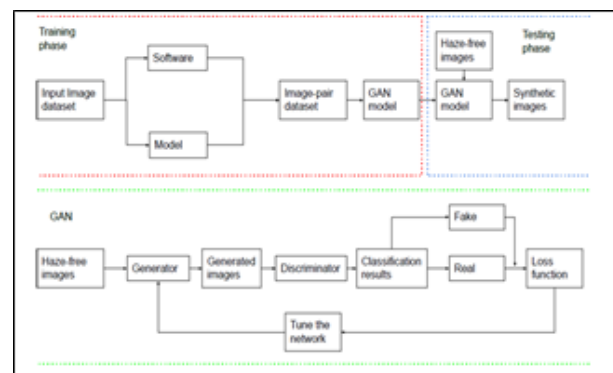
Fig. 1. System Architecture

The CycleGAN Framework

CycleGAN is a versatile framework created for image-to-image translation tasks. In the context of image dehazing, it serves as an effective tool for converting hazy images into clear ones. The fundamental components of CycleGAN include: Generators and Discriminators

Components Of Generative Adversarial Network (GAN)

A generative adversarial network (GAN) is a machine learning (ML) model in which two neural networks compete to become more accurate in their predictions. The main application of GANs is to create fresh synthetic data that mimics a certain training dataset. The

Generator and the Discriminator are the two primary parts of Generative Adversarial Networks (GANs).

1) Generator: The Generator is of the utmost significance in GANs as it is responsible for generating new synthetic data samples that resemble the training data. The objective is to use the training data to understand the underlying distribution of data and generate samples that the Discriminator cannot tell apart from genuine data. It accomplishes this by transforming random noise or latent vectors into realistic-looking data samples. The Generator typically takes in a low-dimensional noise vector as its input and transforms it into a high-dimensional output that resembles the training data.

2) Discriminator: The Discriminator is an essential component in a Generative Adversarial Network (GAN) , that works in accordance with the Generator. The Generator creates artificial data samples, and the Discriminator's job is to discern between the produced and actual data. A GAN's discriminator is trained to become skilled at differentiating between generated and actual data during the training process. It does this by minimizing a given loss function, which is usually binary cross-entropy, and it learns to distinguish between the two.

The training of a Discriminator and Generator in a GAN is an adversarial process, with the Discriminator aiming to maximize accuracy in distinguishing real and generated samples, and the Generator aiming to minimize it. This interplay drives refinement until a balance is reached, where the Discriminator is regularly tricked by realistic samples produced by the Generator. A loss function measures the difference between the generated samples and the actual data in order to assess the Generator's performance.

Loss Functions

Losses for the Generator

1) Adversarial Loss (Generator's Loss): This loss motivates the generator to generate realistic images in the target domain. For the generator G, this loss is calculated using the discriminator *DB*. It measures how well the generator can fool the discriminator. The adversarial loss for G is defined as the negative log-likelihood of *DB* classifying the generated images G(A) as real:

$$LossGAN(G) = -\log(DB\, G(A)) \qquad (1)$$

2) Cycle Consistency Loss: This loss ensures that the original image remains unchanged when translated from domain A to domain B and back again. The L1 or L2 distance between the original picture A and the reconstructed image A is used to compute the cycle consistency loss for the generator G:

$$Losscycle(G) = \|A - G(F(A))\| \qquad (2)$$

3) Identity Loss: This loss retains the identity (true nature) of an image when it is translated and subsequently translated back to its original domain. The identity loss for the generator G is computed as the L1 or L2 distance between the original image A and the image translated and back to domain A:

$$Lossidentity(G) = \|A - F(G(A))\| \qquad (3)$$

The total loss for the generator G is a weighted sum of these losses:

$$LossGAN(G) + (\lambda cycle \times Losscycle(G)) + (\lambda identity \times Lossidentity(G)) \qquad (4)$$

The λ*cycle* and λ*identity* are hyper parameters that regulate the significance of identity losses and cycle consistency, respectively.

Losses for the Discriminator

1) Adversarial Loss (Discriminator's Loss): Based on the discriminator *DB*'s capacity to discern between generated images G(A) from domain A and genuine images from domain B, the adversarial loss is computed. The total of the negative log-likelihoods of correctly classifying the generated photos and the genuine images is the adversarial loss for *DB*.

2) For Discriminator *DB*: Real Image Loss: The discriminator *DB* seeks to correctly categorize real images from domain B. It computes the loss as the negative log-likelihood of *DB* classifying real images B as real:

$$LossReal(D) = -\log(DB(B)) \qquad (5)$$

Fake Image Loss: The discriminator *DB* also needs to correctly classify generated images G(A) from domain A as fake. The loss is calculated as the negative log-likelihood of *DB* classifying the generated images as fake:

LossFace(D) = log(1 – DBG(A))   (6)

The total loss for the discriminator D_Y is the sum of the real and fake image losses

LossGAN(D) = LossReal(D) + LossFace(D)   (7)

LossGAN(D) = – log(DB (B)) – log (1 –DBG(A)) (8)

During training, the generators and discriminators are alternately optimized by minimizing their respective losses using gradient descent or other various optimization approaches. The objective is to find a balance between the generator's capacity to generate realistic images and the discriminator's accuracy to correctly categorize and classify real and generated images.

Depth wise Separable Convolutional Neural Network (DSCNN)

The Depth-wise Separable Convolutional (Depth-wise Separable Conv) operation is the method used in convolutional neural networks to lower the computational complexity of standard convolutions. It splits the conventional convolution process into two distinct phases: pointwise and depth-wise convolution.

RESULTS

Training Parameters

Dataset: 1200 images categorized into thinly, moderately, and heavily hazed (400 each).

Epochs and Batches: Trained for 200 epochs with 160 images batches per epoch.

Image Dimensions: Resized to 256x256 pixels with RGB color channels.

Optimizer: Adam optimizer with learning rate (lr = 0.0002), exponential decay (b1=0.5, and b2=0.999) for effective weight updates.

Decay Epoch: Learning rate decay implemented at 100th epoch for fine-tuning convergence and performance.

The results of our work are displayed in the figure alongside (Fig.2), which demonstrates how well fuzzy image data can be transformed into distinct and Dehazed representations and vice-versa. The graphs depicted in Figures 3 and 4 illustrate diverse loss trends across epochs, showcasing variations in decay rates.

Fig. 2. Generated images from one domain to another

Decay of first order momentum of gradient = 0.02
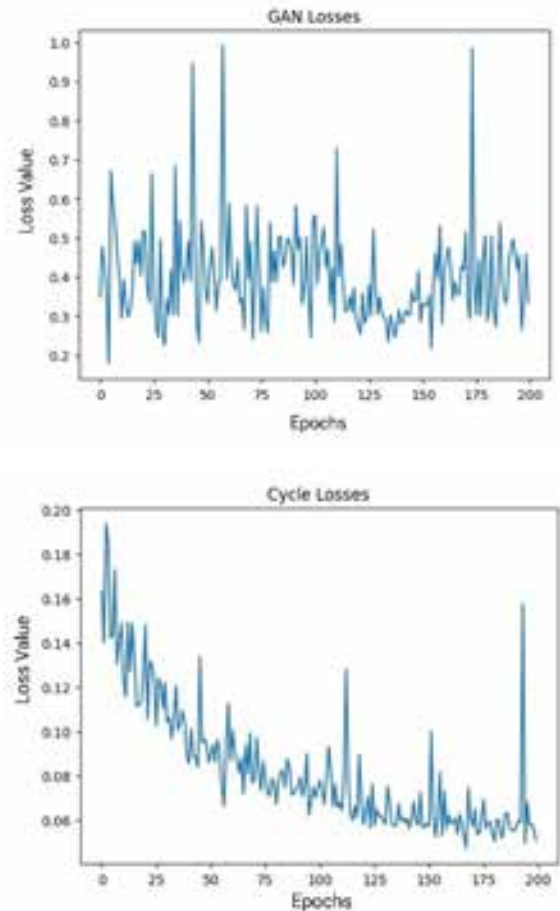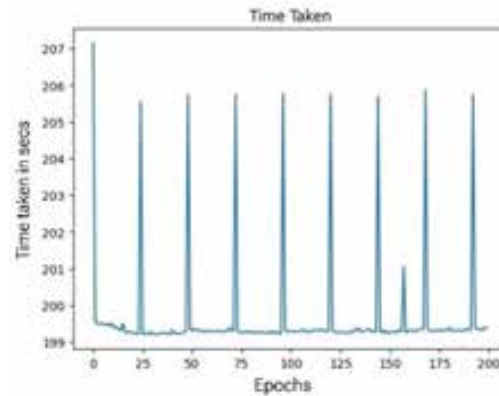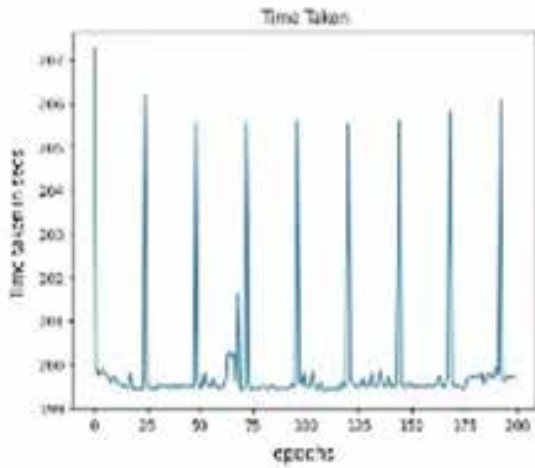
Fig. 3. (a) GAN Losses (b) Cycle Losses (c) Time Taken

Decay of first order momentum of gradient = 0.025

Fig. 4. (a) GAN Losses (b) Cycle Losses (c) Time Taken
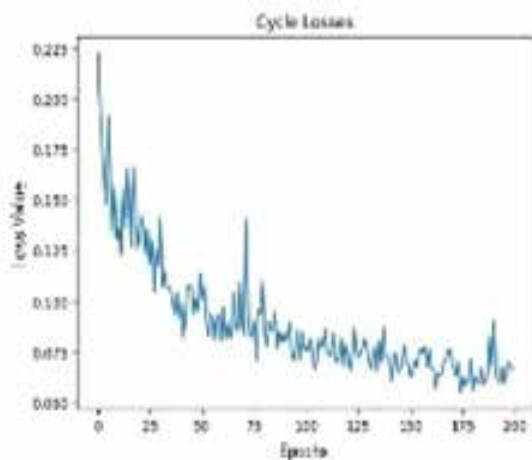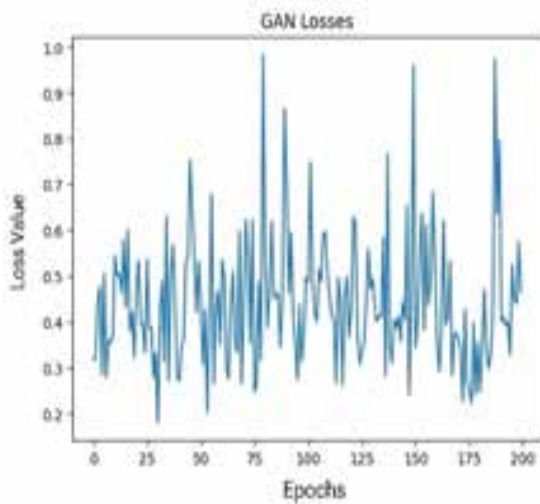
SCOPE

As a solution to recover the information affected by haze in satellite images, the proposed model, which combines Cycle GAN, Huber loss, and Depth-Wise Separable Convolution, has potential for improved image-to-image translation and computer vision research. Future work could include enhancing translation performance by incorporating techniques like attention mechanisms, self-supervised learning, or adversarial training strategies. The model could also handle multi-domain translation, allowing for more complex and diverse translations. It could also be used for transfer learning and generalization, adapting to new image translation tasks with limited data., and in various domains such as agriculture, urban planning, disaster management, and climate change studies. The model's computational efficiency makes it suitable for real-time applications like video processing or augmented reality.

CONCLUSION

In conclusion, this research endeavors to address the pervasive challenge of degraded visibility and image quality in satellite imagery caused by atmospheric phenomena such as haze and fog. Our comprehensive approach to image dehazing integrates cutting-edge deep learning techniques, including Cycle-Consistent Generative Adversarial Networks (CycleGAN), Convolutional Neural Networks (CNN), and Depth-wise Separable Convolutional Neural Networks (DSCNN). This research addresses the critical challenge of enhancing the interpretability and quality of the multispectral satellite imagery captured in

hazy conditions. The training of CycleGAN model of unpaired hazy and haze-free satellite image data helps to understand and utilize the versatility of CycleGAN in demonstrating translation between hazy and haze-free domains.Subsequently, the analysis of various loss functions also aids in exploring their impact on dehazing performance as the spectral accuracy is rigorously evaluated using loss functions. The suggested approach not only raises the bar for satellite imagery picture dehazing, but it also highlights how important it is to consider several models and loss functions to get the best dehazing results.

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E-Commerce Websites Through Containerization, Kubernetes Orchestration, and Istio Service Mesh Monitoring

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ABSTRACT

The concept of microservices has emerged as a transformative paradigm, and departure from monolithic architectures. We will showcase how this architecture enables organizations to achieve enhanced resilience, fault isolation, and improved resource utilization. The utilization of Docker containers empowers e-commerce websites with isolated, lightweight, and reproducible environments, streamlining deployment and reducing compatibility issues. Kubernetes orchestration enhances the system by automating the management of these containers, providing dynamic scaling, high availability, and efficient resource allocation. The pivotal aspect of this study lies in the incorporation of the Istio service mesh, which offers a robust framework for traffic management, load balancing, and security, thereby mitigating potential bottlenecks and enhancing fault tolerance. The Kiali dashboard, a powerful visualization tool, grants operators' real-time insights into the traffic flow, service dependencies, and network performance, facilitating proactive decision-making and optimizing the overall user experience. Through a comprehensive analysis of this integrated approach, we demonstrate how it not only addresses the challenges of scalability and reliability in e-commerce but also provides an adaptable architecture. The findings offer practical insights for businesses aiming to deliver seamless and dependable e-commerce solutions. E-Commerce Websites through Containerization, Kubernetes Orchestration, and Istio Service Mesh Monitoring.

KEYWORDS : *Microservice, Containerization, Docker, Kubernetes, Istio, Traffic monitoring, Kiali dashboard, Load balancing, Visualization, Network dependencies.*

INTRODUCTION

In software engineering, the system development life cycle, is used to describe the process of planning, developing, testing and maintenance. Development is when the real work begins when a programmer, network engineer and database developer work on the project. Maintenance is when the system is put in usage and enrichment are added and errors are fixed as they are discovered. According to the reports average of 40% of time and cost of the system is spent in development, the majority of time and cost is spent on maintenance.

In recent years, there has been a shift from monolithic applications to a microservice architecture. By utilizing a microservice architecture, a software application is split into smaller services. Where each independent services communicate with each other through defined APIs.

The rise of microservice architecture coincided with a growing trend in adopting containerization platforms like Docker. Containers provide a streamlined environment for service execution, facilitating rapid system scalability and accelerating time-to-market for

new features. Utilizing container orchestration tools, such as Kubernetes, enables the automated scaling of containers across diverse servers, contributing to the increased availability and widespread adoption of distributed systems.

Recently a technology called service-mesh has gained admiration in handling the problems with the fallacies of distributed computing, where one example of a service mesh is Istio. As applications scale and the number of microservices increases, monitoring service performance becomes increasingly difficult. Manage connections between services, a service mesh provides new features like monitoring, logging, tracing, and traffic control. it also provides observability features for communication between services.

LITERATURE SURVEY

Thesis by Ennio Mara et al. evaluates using a service mesh as a solution for monitoring network performance metrics like bandwidth, latency, and packet loss. The thesis experiments with Istio and examines if its observability features can be used to monitor inter-service communication in a distributed system. Experiments apply known network faults and evaluate if the faults can be detected from the metrics provided by Istio. The performance impact of using Istio is also measured [1].

The paper by Gagan Mittal et al. underscores the importance of DevOps practices, especially containerization, in e-commerce software development. It highlights the need for specific competencies and cultural patterns for effective software delivery. Emphasizing replicating production environments on developers' machines to minimize discrepancies, the paper identifies containerization as a key solution. It allows reproducibility across various environments, irrespective of the host OS, separating runtime from software and hardware. This separation streamlines maintenance efforts and ensures continuous application delivery [2].

The methods used in Devops in E-Commerce Software Development Demand For Containerization by Roman Zakharenkov et al. to collect data on software delivery practices and evaluate solutions included conducting a survey among professionals at Vaimo Group. The survey was designed to gather information on the perceived value of the implemented CI/CD solution, the existing DevOps culture, and the feasibility of potential capabilities for a new software delivery pipeline. The survey data was then analyzed using Rapid miner software, and manual classification and analysis were carried out for survey questions requiring textual feedback [3].

CONTAINERIZATION IN E-COMMERCE

Daunting task of managing software dependencies where one service requires one version of library where another service "another". Different service is not compatible with the Operating System. Every time something changes in the application; we have to check compatibility between various components and underlying infrastructure. This compatibility metric issue is referred to as "THE MATRIX FROM HELL". Fortunately, containerization emerges as a solution to simplify this intricate challenge.

The concept of containerization, which has significantly transformed IT, may appear to have emerged unexpectedly. However, the roots of containerization trace back to the 1970s when the original idea was implemented on a Unix system to enhance the isolation of application code. Over the years, there have been numerous attempts to address virtualization, isolation, and resource management in applications.

In 2008, a significant milestone was reached with the introduction of LXC (LinuX Containers), representing the first and most comprehensive implementation of a Linux container manager. Utilizing cgroups and Linux namespaces, LXC achieved effective isolation and resource control within a single Linux kernel, eliminating the need for any additional patches.

Upon its establishment in 2013, Docker initially relied on LXC as its default containerization technology, a choice that was subsequently supplanted by the development and implementation of Docker's proprietary libraries. In the Docker ecosystem, each component operates within its distinct container, encompassing its own libraries and dependencies. Notably, these containers operate within the confines of the same operating system, yet they maintain separate environments, ensuring isolation and encapsulation of each component. Definition

of container as being "a standard unit of software that packages up code and all its dependencies, so the application runs quickly and reliably from one computing environment to another." [3].
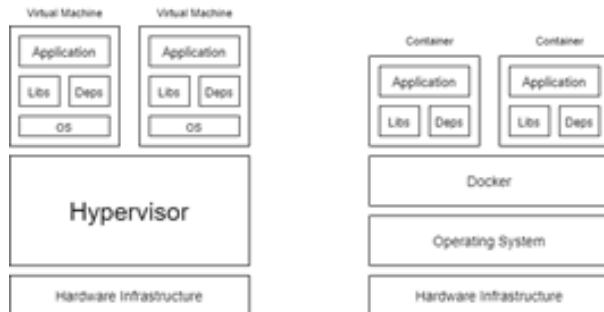
Figure 1. Difference between Virtual Machine and Container

The above figure describes the difference between virtualization and containerization. Each Virtual Machine (VM) has its own its OS inside it, then dependencies, library and application. There is higher utilization of resources as there are multiple virtual OS and Kernel are running.VM make use of hypervisor such as VMware ESXi, is a virtualization platform that enables the creation and management of multiple virtual machines (VMs) on a single physical server. VM have complete isolation from each other as they don't rely on underlying OS or Kernel. Different type of application built in different OS such as Linux based or Windows based on same hypervisor.

Docker containerization make use of which allows for the following capabilities:

• Replicating a production environment on the developer's machine, so as to decrease the delta between the two, ensuring that the product being further developed runs on the production environment as expected from being tested on local machine.

• Reproduction of the application in a given state irrespective of the host operating system, through the deployment of container to the target environment.

KUBERNETES

After developing an e-commerce web-store within a container on the developer's workstation, the subsequent

phase involves delivering the software update to the customer. Employing containers in software development proves cost-efficient for companies, expediting and streamlining the process, as attested by industry professionals. This efficiency not only accelerates development but also diminishes associated costs. Moreover, containerization enhances the the added reliability, scalability and ease of maintenance.

One of the core features behind Docker containers is that they run ignorant of the environment where Docker is installed in and, therefore, they are designed to run on any environment that Docker supports. Even though it is possible with a larger overhead to achieve the same result using a virtual machine, it does not come out of the box and requires more complicated configuration, setup and maintenance efforts later in the exploitation [8].

Following the containerization of software, Kubernetes comes into play, enabling precise control over container deployment. Kubernetes serves as a Container Orchestration Technology, facilitating the orchestration of deployment and management for numerous containers within a cluster environment. This capability empowers organizations to dictate the specific cluster where containers operate and determine the number of instances, referred to as "pods." Consequently, Kubernetes serves as a sophisticated tool for managing containerized applications efficiently.

Kubernetes does not deploy container on worker node directly. Container are encapsulated into Kubernetes object called as "pods". When faced with increased load, the solution doesn't involve adding new container instances within the same pod. Rather, a new pod is created for the same application. It's important to note that pods exhibit a one-to-one relationship with containers.

In scenarios where a single pod is running an application and an unfortunate event, such as a crash, occurs, users lose access to the application. To mitigate this risk, it becomes essential to have more than one instance or pod concurrently operational. This is where the Replication Controller becomes crucial, enabling the simultaneous running of multiple instances of the same pod. It plays a pivotal role in automatically initiating a new pod when an existing one fails.

The Replication Controller diligently monitors pods, allowing for the potential existence of hundreds of pods. Labels are employed as a filter for the replication set, contributing to the efficient and organized management of multiple pod instances.

ISTIO SERVICE MESH

In recent years, the software architecture landscape has undergone significant transformations, marked by a notable shift away from large monolithic applications to more fine-grained deployment units known as microservices.

In the past, monolithic architectures were commonplace, with applications developed as a single unit. A typical monolith comprised a client-side for user interaction, an application layer housing business logic, and a storage layer, often a database. However, as monolithic applications are packaged as a unified entity, issues like a burgeoning codebase, challenges in maintaining modular structure, and scaling problems emerged over time. Scaling difficulties arose because the entire unit had to be scaled up, rather than just the specific component requiring additional resources.

The adoption of a microservices architecture addresses these challenges by breaking down the application into distinct services, each being small and autonomous. Microservices are designed to be small, focused on performing a single task effectively, and operate as independent entities.

While microservices offer advantages, they also introduce unique challenges. The decentralized nature of services, their fluidity, and elasticity make tracking instances, versions, and dependencies a complex task. The management of a growing service landscape further complicates this issue. Services may fail independently, aggravated by unreliable networks. In a large system, some parts may experience minor outages at any given time, impacting a subset of users, often without the operator's immediate awareness.

To navigate these challenges and ensure smooth system operation without adversely affecting customers or overwhelming developers, effective strategies must be employed. Proactive monitoring, robust version control, and comprehensive error handling mechanisms become crucial. Additionally, maintaining clear communication channels, implementing automated testing, and continuously refining system architecture can contribute to a resilient microservices ecosystem.

A service mesh constitutes a dedicated infrastructure layer that can be integrated into applications, offering the ability to seamlessly incorporate features like observability, traffic management, and security without necessitating modifications to the underlying code. The term "service mesh" encompasses both the software utilized to implement this pattern and the resultant security or network domain it establishes.

As the scale and intricacy of distributed services, particularly within Kubernetes-based systems, expand, managing and comprehending them can pose significant challenges. The evolving demands of such deployments encompass facets like service discovery, load balancing, fault recovery, metric tracking, and monitoring. Moreover, a service mesh typically addresses more intricate operational requirements such as A/B testing, canary deployments, rate limiting, access control, encryption, and end-to-end authentication.

SECURITY CONSIDERATION

Jaeger

In contrast to a monolithic architecture, identifying the root cause of issues becomes more challenging in a distributed system. Resolving these challenges requires insights into which service transmitted specific parameters to another service or component.

Traces serve as a valuable visual tool, offering a comprehensive view of our system and facilitating a better understanding of the interrelationships between services. This visualization proves instrumental in investigating and precisely locating issues within the architecture.

Jaeger, an open-source distributed tracing platform developed by Uber in 2015, encompasses instrumentation SDKs, a backend for data collection and storage, a user interface for visualizing data, and a Spark/Flink framework for aggregate trace analysis. Following the Open Tracing specification, Jaeger, like many other distributed tracing systems, operates with spans and traces.

A trace, essentially a list of spans interconnected in parent/child relationships, can be conceptualized as a directed acyclic graph of spans. Traces provide a

clear depiction of how requests propagate through our services and various components.

Grafana

Grafana, a solution for open-source data analytics, plays a crucial role in the field of data analytics making it an essential tool for ensuring the smooth operation of your e-commerce platform. Users can efficiently visualize data by creating integrated dashboards, charts, and graphs that span multiple dashboards, thereby simplifying the interpretation of complex datasets.

Grafana excels in time series analysis, user behavior tracking, application performance monitoring, and assessing error frequency and types in different environments (production, pre-production, etc.), proving invaluable for understanding errors in various scenarios. These insights are crucial for enhancing operational performance and making well-informed decisions.

The platform also simplifies alert management by allowing users to visually define thresholds and receive notifications through platforms such as Slack and PagerDuty for prompt issue resolution. Being completely open source, Grafana provides users with the flexibility to deploy it on their preferred platforms.

The capability to explore large logs efficiently using label filters is a key feature, facilitating rapid data retrieval and analysis. Grafana further allows users to present data via templates or custom reports for easy visualization and sharing of results with internal teams and stakeholders. Report creation and sharing are possible, though this feature is not available in the open-source version and requires an upgrade to the platform.

IMPLEMENTATION

Online Boutique stands as a cloud-first microservices demonstration application, designed as a web-based e-commerce platform. Users engage with the application by browsing available items, adding selected products to their carts, and completing purchases seamlessly. The architecture is composed of independent microservices, each catering to specific functionalities, thereby enhancing the overall user experience. This cloud-native application showcases modern development practices and serves as a valuable example of microservices architecture in the e-commerce domain.

Recommendation Service

The Recommendation service provides personalized product recommendations based on user preferences and historical data.

Product Catalog Service

The Product Catalog service manages the product inventory, providing information and updates about available products.

Cart Service

The Cart service handles user shopping carts, allowing users to add, remove, and manage items before completing the checkout process.

Redis Cache

The Redis Cache service is a high-performance, in-memory data store used for caching frequently accessed data, enhancing system responsiveness.

Frontend

Figure 2 describes the Frontend service represents the user interface, interacting with users and serving as the entry point for various functionalities.

Checkout Service

The Checkout service is in charge of processing and managing the checkout process, handling user orders, and coordinating with payment services.

Shipping Service

The Shipping service manages the logistics and coordination of shipping processes, ensuring timely delivery of user orders.

Currency Service:

The Currency service handles currency conversion, allowing users to view and transact in different currencies based on their preferences.

User Service

The User service manages user-related functionalities, user authentication, registration, and profile management.

Load Generator

The Load Generator service is responsible for simulating

user traffic to assess and optimize the performance and scalability of the entire system.

Ad Service

The Ad service handles the display and management of advertisements, enhancing the user experience by incorporating targeted advertising.

Payment Service

Figure 3 describes the Payment service is responsible for processing user payments securely, integrating with payment gateways and ensuring transactional integrity.

Email Service

The Email service manages the sending of transactional emails, including order confirmations, shipping notifications, and other relevant communication.

In Figure 4, a Docker file outlines instructions and arguments to create a Docker image, serving as an executable package with all necessary dependencies (Figure 6). Figure 5 introduces the Docker build command to construct the image, while Figure 7 highlights the Docker run command for launching isolated containers. Figure 8 shifts focus to efficiently deploying the online Boutique microservice app using Kubernetes for seamless management and scalability. In Figure 9, Kiali visualizes traffic flow between microservices in a Kubernetes cluster. Figure 10 features a Grafana Dashboard for Telemetry, offering insights into various metrics, and Figure 11 details the Client Request Duration chart, aiding in performance optimization. These figures collectively underscore the importance of monitoring and visualization tools for the health and efficiency of microservices in Kubernetes environments.

Fig 2. Online Boutique System Frontend-1

Fig 3. Online Boutique System Frontend-2

Fig 4. Docker File

Fig 5. Docker build

Fig 6. Docker Image

Fig 7. Docker Run

Fig 8. Deploying Online Boutique App

Fig 9. Istio Kiali Dashboard

Fig 10. Grafana Dashboard for Telemetry

Fig 11. Client Request Duration Telemetry.

CONCLUSION

In this project, we have successfully containerized an e-commerce web application and deployed it on a Kubernetes cluster for orchestration and load balancing. By leveraging Docker containers, we can achieve portability, consistency, and isolation for the application across environments.

Kubernetes allows us to easily scale, update, and monitor the application through features like horizontal pod autoscaling, rolling updates, and its metrics server.

Integrating Istio service mesh further enhances traffic management, security, and observability. Its sidecar proxies and rich telemetry provide detailed insights into service communication and performance.

Grafana enable gathering and visualizing metrics from the infrastructure, containers, and Istio data plane. This helps identify issues and optimize services. Jaeger gives request tracing to pinpoint latency problems. Overall, we have an end-to-end observable system.

The use of containers, orchestrators, service mesh and monitoring deliver operational efficiency, scalability, reliability, and visibility. It is a modern cloud-native approach suitable for today's dynamic microservices-based applications.

There are several areas where this system can be enhanced further:

Looking forward, the trajectory of e-commerce websites built on containerization, Kubernetes orchestration, and Istio service mesh monitoring reveals a dynamic future. Emphasis will be placed on optimizing scalability, ensuring these platforms can adeptly respond to varying user demands. The integration of edge computing is poised to enhance user experiences by minimizing latency through the strategic placement of computing resources. AI and machine learning are anticipated to become integral, driving personalized recommendations and bolstering fraud detection capabilities. Security enhancements will persist as a crucial focus, with ongoing developments in container security and service mesh features. Build CI/CD pipelines supporting multiple environments.

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E-FIR Registration using CHATBOT

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ABSTRACT

We are incorporating a conversational agent into the Electronic First Information Report (E-FIR) system for public accessibility. Our choice to implement the online platform stems from the escalating number of cases on a daily basis. Wehave made the decision to adopt the online portal because the number of cases is rising daily and we are currently evaluating the COVID-19 situation at a time when everyone is busy in their own world. Additionally, it aims to close the communication gap between the general public and the authorities. Citizens frequently witness numerous offenses, but the majority of them go unreported because of the time-consuming and stressful process. In this project, we are putting the simplest method into practice so that people can quickly file complaints. To that end, we have introduced a chatbot for filing complaints, though we can also use the option the chatbot provides. The chatbot which is made of Rasa framework asked some basic questions to the user to gain the information required for registration of the E- FIR. The E-FIR are available in the national as well as local languages of the country according to the user's needs in this project. Here, the required details for filling out the E-FIR are extracted directly from the Aadhar card with the help of artificial intelligence (Tesseract). The user can also monitor the complaint that was registered by them. Since then, the government has been working very hard to reduce the cost of information technology and make it equally accessible to all people in both rural and urban areas. It involves utilization of primary factor that all of the computing resources hardware, software, and network infrastructure are hosted online. By doing this, only user complaints will be sent to the police station database, protecting the privacy of current system users' information. The primary web application will be overseen and maintained by the administrator stationed at the police facility.

KEYWORDS : *E- FIR status, Chatbot, Rasa, Artificial intelligence (Tesseract).*

INTRODUCTION

In India, the number of criminal cases is currently rising quickly alongside the number of crimes committed. Yet those are all the offence that do not get reported because of the complicated process. The introduction of Chatbots represents a significant advancement for humans, finding application across diverse fields. This paper outlines the process involved in the planning and implementation of a Chatbot. The Bot can effectively engage with users by discerning their specific needs. In essence, the Chatbot assumes a human-like role, responding to user queries, diverging from the conventional interaction where one human responds to the questions posed by another human. We are using the E-FIR to accomplish this using a chatbot-integrated system. The major goal of this project is to offer a universally accessible solution for all crime management. In this project, the chatbot registers the E-FIR by gaining the information through user interaction and the details extraction from the user Aadhar card. Here, we are utilizing cloud computing, which can provide the government with numerous cost advantages as it implements e- Government programmes. Users of cloud computing, including those in urban and rural settings, benefit from this technology.

It satisfies everyone is needs while maintaining Internet security and privacy, and it makes everything simple to use at the same time. Since this is a severe issue, the project's focus is on developing a system that streamlines the current procedure.

LITERATURE SURVEY

The implementation of a chatbot into the E-FIR system has not yet been carried out. There are currently no available technical documentation that are specific to this particular integration. Nevertheless, we have read a number of technical publications in this field, drawing conclusions that have deepened our knowledge of the topic.

[1] This study focuses on CHATBOT, a learning- cum- assisted technology that is a rapidly emerging tool for learning. A CHATBOT is a virtual being that has been artificially made and communicates with users through interactive text or speech. Using machine learning and artificial intelligence, this CHATBOT converses directly with users. This essay examines the methodology, lingo, and several platforms used in the creation of the CHATBOT.Also, it provides various samples of typical real- world applications of CHATBOT. From this review, it is suggested that the CHATBOT tool be used for Computer-Aided Design (CAD) applications.

[2] In the age of Chatbots, they are capable of complex activities like booking movie tickets and other things in addition to mimicking people. RASA serves as an open- source implementation for NLU and DIET models, among other applications. Its capabilities encompass engaging in conversational flow, interactive learning with reinforcement, and interactions with databases and APIs through a neural system. This research delves into various key properties of RASA to assess its efficacy in handling complex tasks. Specifics of the implementation, such as API and database interfaces, are scrutinized. Modifications to the Tracker Store involve altering the socket.io core file and incorporating metadata into user message data to capture the user's IP address and port. Additionally, the Windows PyCharm IDE is utilized for testing actions, interactive learning, and implementation particulars.

[3] In this, printed text was converted into editable text using the optical character recognition (OCR) technology. Optical Character Recognition (OCR) is a widely utilized and highly advantageous process in various applications. The accuracy of OCR can be influenced by the algorithms employed for text pre- processing and segmentation. Extracting text from images can pose challenges due to variations in size, orientation, style, and the complexity of the background. The history of the open-source OCR tool Tesseract, its architecture, and the experiment results of Tesseract's OCR on various types of photos are explained in the first section of this work. This study's conclusion involves a comparison of this tool with Transym OCR, a different commercial OCR technology, using input from car license plate data. We compared Tesseract and Transym based on a wide range of factors in our attempt to extract the car number from the number plate.

[4] In this work, the chatbot is introduced for crime detection and reporting. The chatbot combines generative and categorization methods. Text is generated by employing encoder-decoder attention mechanism architecture. It is included with capabilities like spam classification of SMS and emails to reduce cybercrimes. It contains a complaint registration system that enables people to submit complaints. A unique named entity recognition model is utilized to extract structured information from unstructured complaints, such as location, time, and crime type, to help the authorities better understand complaints. This work is done to develop effective and user-friendly ways to file complaints utilizing these means and to educate people about the legal system. As a result, we hope to use Natural Language Processing (NLP) for good.

[5] The author discussed about the online crime reporting, The authors discussed online crime Reporting system is an application that includes the entire framework of the executive branch, and that the company will contribute to the organization of all police services headquarters operations. It can be used to record violations and handle all activities of the police agency headquarters use PC to monitor all the grunts, most are looking for offenders, police headquarters and other information. Most of the activities are currently being done material, but by modernizing all operations in the police force seat, executives can quickly and well care for. The model proposed by the authors used to take on: client and

admin login, objection section, view complaint status, criminal save executives, board theft case history,deal with the list of most essential offenders, most Recent news about misconduct in the city and health advice for people, especially women and merchants. This pledge support computerization of police headquarters records, such as grumbles, criminal records, and organization, client and police station manager System, among other things. Target of part of reporting misconduct is providing customers Adjustable and robust complaint recording and interact with the operator programmer. Programme incorporate highlights such as grumpy inscriptions, prisoners enlisted and produced after death reported, among others. Every standard featured throughout the investigation and the configuration steps have been completed, the result is Great programming. The authors conclude that the interactive points are especially easy to understand and Consistent flexibility.

PROBLEM STATEMENT

The Problem Statement revolves around the registration the FIR of the crime happened with the help of chatbot. The goal of the project is that user should register the complaint in the form of FIR to the police department without any hesitation.

Some people are afraid of going to the police station to file a complaint or are hesitant to complete the process in person. The chatbot can assist these people by making it simple for them to file a police report about an occurrence while they are at home.

Lack of personnel at every stage: Owing to a lack of police officers, they are so swamped with cases that they are unable to find the time to diligently complete each step of the investigation. They also have responsibilities such as VIP duties, festival bandobast, application inquiries, preventive actions, etc., in addition to the investigation of cases.

Sometimes it can be very challenging to maintain a large number of FIR records in the police station in hardcopy form, so creating the FIR in softcopy, or PDF, makes it simple to store in the cloud database of the computer system police department computer system and for the user to also properly maintain and monitor it on his electronic device.

DETAILS OF HARDWARE AND SOFTWARE USED

Hardware Requirements

Processor : Intel(R) Core(TM) i5- 10300H CPU @ 2.50GHz 2.50 GHz

Installed RAM : 8.00 GB

System type : 64-bit operating system, x64-based processor

Edition : Windows 11 Home Single Language

OS build : 22621.674

Software Requirements

RASA

It is the open-source framework which is used to build the developing AI powered, industrial grade chatbots.

Pytesseract

The Python-tesseract package encapsulates Google's Tesseract-OCR Engine. This integration enables the reading of various image types supported by the Pillow and Leptonica imaging libraries, such as jpeg, png, gif, bmp, tiff, and others. This functionality makes it convenient for standalone invocation as a script to utilize Tesseract. Additionally, when employed as a script, Python-tesseract will directly print the recognized text instead of saving it to a file.

HTML, CSS

When creating pages for web browser viewing, the widely adopted markup language is HyperText Markup Language, known as HTML. Technologies like Cascading Style Sheets (CSS) and programming languages like JavaScript play a crucial role in enhancing the presentation and interactivity. Cascading Style Sheets, specifically, is a style sheet language used to define the display of documents generated in markup languages like HTML or XML. Alongside HTML and JavaScript, CSS stands as a fundamental component of the World Wide Web.

Python

A widely-used, versatile programming language is Python. Its design philosophy places a strong emphasis on code readability, employing extensive indentation.

Python incorporates garbage collection and features dynamic typing. It embraces diverse programming paradigms such as functional, object-oriented, and structured programming.

FIREBASE

By facilitating secure database access directly from client-side code, the Firebase Real-time Database empowers the development of resilient and collaborative applications. The stored data is available locally, and real-time events persist seamlessly, ensuring a responsive user experience even in offline mode.

NGROK

Without changing any network settings or opening any ports on your router, ngrok Secure Tunnels enable quick access to remote computers. You now have access to a safe, dependable tunnel for your developer box, IoT device, or pretty much anything else with internet connection.

BLOCK DIAGRAM
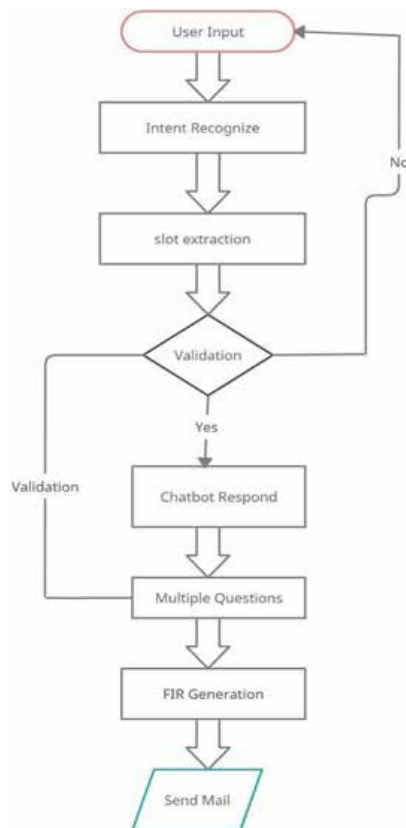
Figure 1: Flow Chart

Above figure shows flow of our system

EXISTING SYSTEM

Several studies have encountered the issue of criminal cases not being recorded. In our nation, there are no technical systems in place for registering a case or overseeing FIR-related operations. The victims must always go visit the police station to file a FIR. Inaccurate registration times can cause a lot of complications, and they can also be linked to accidents. They can also have a big impact on crime. When a FIR is registered slowly, valuable time is lost, which frequently results in bloodshed from local offences that the police could address.

PROPOSED SYSTEM

The research-based concept behind the proposed solution is that there are currently no technological e-governance department systems in our nation that integrate CHATBOT and allow users to submit complaints in the simplest possible manner. As the user cannot submit a tip to the police department without providing personal information, it has come to our attention that there is no such feature. Decision has been made, after great deliberation, to include the anonymous tip capability in our programme since it will be beneficial to the police force. Implementation is the most significant stage in the project for accomplishing a fruitful framework and giving the best results out of it.

The system is mainly divided into three parts. Below are the mentioned parts:

1. Gaining the required information using chatbot and storing in the cloud database.

2. Extraction of Aadhar card details

3. Generating the E-FIR and sending it through e-mail to the user

Working

The project's implementation phase is crucial to completing a successful framework and getting the greatest results possible from it. The system is mainly divided into three parts. Below are the mentioned parts

User

Police

User:

In the final implementation of the project, the user will interact with the application's web page as a user interface as shown in the figure below. Chatbot is available on the homepage of the user- friendly interactive software that helps users to register complaints about incidents occurring by situation in the most easy way such as 2 people, conversational question and answer, just like WhatsApp chat. The details shared by the user with the chatbot will be stored in Firebase which is used for cloud storage known as the cloud database. There are some features included in the software that the chatbot will ask to share a shareable Aadhar tag link with the user, from which the necessary user details will be extracted according to the E-FIR. Aadhaar is a 12-digit unique identification number that can be voluntarily obtained by residents or passport holders of India, based on their biometrics and demographics. The Aadhaar card includes key information about the person like name, gender, and date of birth in plain text along with a QR code. UIDAI has introduced a new secure QR code containing the resident's demographic details such as name, address, date of birth, gender and masked Aadhaar number along witha photo of the Aadhaar number holder. There are two ways to create an app that automatically extracts biological and geological information from cardholders: a) Using OCR technology to recognize characters printed on cards b) Use barcode recognition technology to decode the QR code and then scan it into a human readable format. We have covered the first method i.e. OCR in Python.

According to the details shared by the user, the E-FIR generation process is done by filling in the details shared by the user in the document in FIR format corresponding file. Once the FIR is generated, theFIR is stored in the police department's database for further investigation and sent to the user on their shared email id for future reference.

Police

Once the user has completed the compliant or E- FIR, the Police Administrator will be in charge of it. The police department will do tasks including managing the registered complaints and E-FIRs, examining the E-FIR by simply using the search option to look for the E-FIR by its E-FIR number, and keeping track of

the E- progress FIR's status as displayed on the police administrator page, contacting the user for more investigation, updating the E-FIR status, and assigning a police officer to the complaints in accordance with the circumstances.
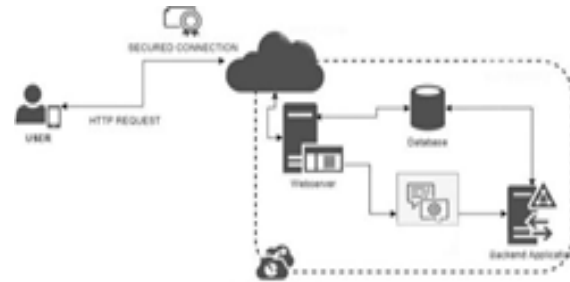
The chatbot and anonymous tip features of our project are additional features. The diagram that shows how the chatbot functionality is incorporated into our system is provided below. The data produced by the software will be stored using Firebase services. Ngrok will be used in this project to host the application on another machine. About the anonymous tip, our web application will simply implement it using the Python framework.

RESULTS

(fig.Homepage)

(fig. Chatbot)

(fig. E-FIR)

CONCLUSION

In this work, we present a chatbot that can assist citizens in all crime related queries. A fully integrated and compact system is developed that can be used by both ordinary people and policemen. This project will be widely used in the future by the police department, ordinary people (for victims of accidents and assaults). The strongest point of this project is that it will help the common man to register the Complaint/FIR easily and track him, what stage the Complaint/FIR is in). This approach to creating custom named entity recognition modelling can be applied to many other areas such as newsletters, resumes, and medical applications. Our chatbot presents a holistic approach to solving crime by enabling crime recording, increasing crime awareness, and helping to create a safer society for all.

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IOT Based Smart Tree Monitoring System

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ABSTRACT

Trees are one of the common species on the earth that plays an important role in protecting ecological environment. It is necessary to keep tree healthy growth to avoid a potential hazard for humans. A Tree Monitoring System using IoT is a technology-based system that allows individuals or organizations to track and analyze the health and growth of trees in a given area. The system can utilize a variety of sensors and tools, such as environmental sensors, and soil sensors, to gather data on the trees' health and growth over time. Also, in addition to this we are implementing smart irrigation system along with tree monitoring. Both the systems will be dependent on each other. In smart irrigation, we determine the parameters that are monitored in irrigation systems regarding water quantity, soil characteristics and weather conditions. In this system we are also using QR code which will contain information about a particular tree and anyone can scan the QR code and get the information about a tree. A Tree Monitoring System with Smart Irrigation can be used in a variety of settings including urban forests, parks, and other natural areas and to monitor individual trees in residential or commercial settings. By providing real-time information about tree health and growth, a tree monitoring system can help to ensure thelong-term health and sustainability of trees in any environment. The sensors are placed in and around the tree to measure important parameters that can affect the growth and health of the tree.

KEYWORDS *: Tree monitoring, Smart irrigation, IoT, Tree health, Environment.*

INTRODUCTION

We exist in a world where automation has become pervasive, controlling and managing various processes seamlessly [2]. However, there remain several crucial sectors in our country that have not fully embraced automation, often due to factors such as cost. Agriculture stands out as one such field where automation has not been widely adopted. Agriculture, a fundamental human occupation since early societies, now demands modern interventions. Monitoring trees and plants holds significant importance in the agriculture and horticulture sectors, enabling the cultivation of plants under precisely controlled climatic conditions for optimal yields. The automation of plant monitoring and control of climatic parameters is essential, as these factors directly or indirectly influence plant growth and, consequently, yield.

[1] Achieving the status of a smart and green megacity hinges on the strategic deployment of information and communication technology infrastructure and governance to meet sustainability objectives. An integral aspect of this strategy involves the incorporation of trees. Trees not only provide valuable green spaces essential for mitigating urban pollution impacts and offering ecosystemic benefits to residents, but they can also serve as bioindicators. Their involvement in communication network monitoring signifies a significant contribution towards establishing a smart, green megacity.

The implementation of smart tree management employs sensors to monitor tree health throughout the megacity, addressing air pollution concerns and promoting additional tree planting through mobile operations. With the rapidly changing climate, landscape, and megacity framework resulting from human activities, effective

tree management is essential moving forward. Greening urban spaces is a pivotal initiative pursued by nearly every administration. Environmental preservation is fundamental to achieving sustainable, adaptive, and inclusive development. The commitment to ensuring a high quality of life for future generations necessitates addressing current environmental challenges promptly and appropriately.

We contend that implementing a connected smart operational solution for trees across the megacity is one of the most environmentally friendly approaches to improving air quality and ecology in urban areas, consequently reducing carbon footprints. A QR Code scanner allows users to effortlessly point to a specific tree, accessing information on its health and air quality details.

LITERATURE SURVEY

[1] This paper addresses significant challenges encountered in transforming urban areas into smart cities and integrating green technologies, initiatives, and existing systems to overcome these challenges. With the increasing population, rapid urbanization, and environmental changes, effective management of trees and plants becomes imperative. This paper presents an innovative Internet of Things (IoT)-based architecture for smart tree management in cities. This system enables the monitoring of various characteristics of individual trees, including air quality, sunlight levels, sound pollution, and other crucial factors essential for efficient city planning, afforestation initiatives, and enhanced quality of life.

The proposed solution comprises three key components: The Sensor Node, The Cloud Integration, and User Experience. A functional prototype of this system has been developed using a Raspberry Pi and a mobile application featuring an intuitive user interface. This interface allows users and growers to access information and insights about specific trees, including relevant warnings. To ensure connectivity between sensors and the cloud, low-power wide-area network modules are utilized. Additionally, a map view is incorporated, equipped with various filters enabling city authorities to visualize the distribution of healthy and damaged trees throughout the city, complemented by a customizable dashboard.

This paper provides a detailed explanation of the functionality and characteristics of each system element. Experimental results demonstrate the feasibility of the application, emphasizing its potential to contribute to the development of smart cities globally. Such smart cities are anticipated to play a pivotal role in mitigating pollution issues and promoting afforestation initiatives, thereby fostering a healthier and more sustainable urban environment.

[2] This paper introduces a plant monitoring system technology that delivers feedback to users through smartphones. The automated system aims to minimize the need for human intervention, thereby reducing errors. In the context of large-scale areas, monitoring the system's effectiveness becomes challenging for farmers. By implementing this technology, growers can conveniently oversee the system using their smartphones. Given the hectic nature of contemporary lifestyles, it is often difficult to provide adequate care for plants, such as watering and ensuring sufficient sunlight. To address this issue, an IoT-based automation system is being developed, enabling users to monitor plant parameters like temperature, moisture, humidity, and administer watering remotely.

The hardware components employed in this system include sensors such as Moisture and DHT11, along with NodeMCU, Relay, and Motor. Programming languages utilized encompass Java, PHP, C, JavaScript, HTML, and CSS. MySQL is employed as the backend for data storage. Software components include Android Studio, Visual Studio Code, Arduino IDE, and the Postman Tool. This integrated approach not only streamlines the monitoring process but also enhances the overall efficiency of plant care, providing users with a convenient and accessible means to ensure optimal conditions for their plants.

[3] This paper introduces a practical and energy-efficient IoT-based anti-poaching framework designed to detect and prevent the illicit trade of trees in both forest and local areas. While numerous methods exist to protect trees, this paper proposes a sophisticated approach by integrating various sensors around trees with a microcontroller. In the event of any adverse incidents within the forested area, the sensors promptly detect and update this information. The architecture employs

Wireless Fidelity (Wi-Fi) support, extending up to 5 km in the forest area, to relay real-time information about the trees' condition to forest authorities around the clock.

This achievement is made possible by the inclusion of GPRS in the installed unit, ensuring continuous monitoring of the tree's status through the integrated sensors. The system is a convergence of IoT (Internet of Things), WSN (Wireless Sensor Network), and AWS (Amazon Web Services) to safeguard the environment. Consequently, a comprehensive system has been devised to counteract tree smuggling, providing a robust solution to monitor and protect trees effectively.

[4] This paper delves into the implementation of a Plant Health Monitoring system, focusing on evaluating environmental parameters such as temperature, humidity, light intensity, and soil moisture that directly impact plant well-being. The data collected from these sensors is transmitted from Arduino Uno development boards to the Ubidots IoT Cloud Platform. The central control in this proposed system is entrusted to Arduino, which acts as the primary controller. Arduino not only acquires data from the environment but also processes it for further analysis.

The hardware components incorporated in this system include the DHT11 humidity and temperature sensor, soil moisture sensor, light sensor, and the Arduino microcontroller. The software utilized is the Ubidots IoT Cloud Platform, responsible for storing data and generating informative charts. Users, particularly farmers and growers, can access this data to stay informed about any fluctuations or deviations in temperature, soil moisture, humidity, and light intensity. Implementing this system empowers users to actively monitor and optimize crop yield, contributing to overall production enhancement.

[5] This paper introduces a proposed project focusing on the implementation of an embedded system for automating irrigation processes. The system incorporates a wireless sensor network designed for real-time monitoring of irrigation activities. Its primary objectives are to ensure a consistent and optimal water supply for agricultural farms while minimizing water wastage. In this setup, the system is programmed to activate the motor automatically when the moisture

level in the soil drops below a predefined threshold. Conversely, when the water level returns to a normal range, the motor is automatically switched off.

The user can access real-time information on the sensed parameters, sensor values, and the current status of the motor through an Android application, presented in a user-friendly dashboard. Key components utilized in this system include the Arduino Microcontroller, Soil Moisture Sensor, Temperature and Humidity Sensor, Relay, among others. This integrated approach not only facilitates efficient irrigation management but also enhances user control and awareness through the convenient display of relevant information on the mobile application.

PROBLEM STATEMENT

Trees play an Important role in the environment by providing oxygen, reducing air pollution and providing habitats for animals. It is important to monitor the health of trees for maintaining health ecosystem. However, traditional methods of tree monitoring and maintenance rely on manual inspection, which can be time-consuming, inefficient, and costly. Therefore, there is a need for an automated tree monitoring system that can collect real-time data, identify potential threats to tree health, and provide actionable insights for tree maintenance. The aim of this project is to design and develop an IoT-based tree monitoring system that can provide real-time data on the health and condition of trees. It should be able to monitor key parameters such as soil moisture, temperature, humidity.

PROPOSED SYSTEM

Working

In this project, we are using Node MCU ESP8266 as a main controller. [5] Also, we are implementing smart irrigation system for watering the tree which is monitored and if the water level of the tree or soil moisture level is less then it'll alert the respective authorities or user and water the plant or a tree.

[2] To monitor a tree we are using vibration sensor, soil moisture sensor, temperature sensor, humidity sensor, smoke sensor, relay and water pump and pipe.

[8] For safety of the tree we are implementing a smoke sensor also so that if some fire incident happens

around the tree or to the tree the Blynk app will send the notification on the mail as well as in the Blynk dashboard which respective authorities or user can view and take an immediate action on the incident.

These sensor's values will be periodically updated in the Blynk cloud mobile application and are saved on the cloud from where user can access the previous readings of the sensor and import the readings in a csv file which will be emailed to the user/respective authority using super chart widget in Blynk App. In this system the tree will be monitored with the help of IoT devices. It will help us to keep the track of tree's health using sensors. It will be helpful all time. The plantation tree monitoring (and inspection) system aimed to eliminate the issues of favoritism and misreporting, and introduce an objective system of monitoring tree planting and survival in the reforestation project.

[10] Also, we are including a QR for individual tree which will consists of information of particular tree and also the real-time parameters of the tree. In QR code, there will be a link to Blynk Cloud website and also the username and password will be provided in the QR code, so that anyone can scan the QR code and get to know about the different parameters of the tree such as soil moisture levels, temperature and humidity around the tree and also if the soil moisture is low then the individual who scanned the QR code can water the tree by turning on the Water Pump through Blynk.

Hardware Components:

DHT11Sensor

Fig. 1 DHT 11 Sensor

The DHT11 sensor serves as a Temperature and Humidity monitoring device, employing a digital signal acquisition technique and advanced temperature and humidity sensing technology. Comprising a resistive type humidity measurement component and an NTC temperature measurement component, the sensor interfaces with a high-performance 8-bit microcontroller. Renowned for its superior quality, rapid response, anti-interference capabilities, and energy efficiency, the DHT11 is a cost-effective sensor well-suited for Arduino applications. Notable specifications include a humidity measuring range of 20% to 90% RH, featuring an accuracy of 5.0% RH, and a temperature measuring range spanning from 0 to 50 degrees Celsius with an accuracy level of 2.0.

Soil Moisture Sensor

The YL-38 + YL-69 soil moisture sensor, also known as a hygrometer, is designed to detect soil humidity. It consists of an electronic board and a probe with two pads for measuring soil water content. The sensor outputs a low or high digital signal based on the soil's moisture level, facilitating applications like automated plant watering systems.

If soil humidity exceeds a predefined threshold, the module outputs a low signal; otherwise, it outputs a high signal, enabling effective soil moisture monitoring and management.

Vibration Sensor

Fig. 2. Vibration Sensor

These electro-mechanical systems measure acceleration to monitor both normal and abnormal vibrations in forest environments. Abnormal vibrations, indicative of potential tree poaching, are swiftly detected and transmitted via Zigbee to enable timely intervention.

NodeMCU

NodeMCU is an open-source IoT platform powered by ESP8266EX, providing a self-contained WIFI

networking solution. It can host applications independently or handle WIFI networking tasks for another processor. With direct boot-up from external flash and integrated cache, it enhances system performance in similar applications.

Smoke Sensor

Fig. 3. Smoke Sensor

Hydrogen, Alcohol, Propane, LPG, Methane, NH3, Smoke, Benzene are few of the gases that are detected using this type of smoke sensors called MQ Gas Sensors which are made of an electrode with a sensing material applied on top, which is heated to improve the detecting material's sensitivity and reactivity.

Relay

Fig. 4. Relay

A relay functions as an electrically operated switch, comprising input terminals for single or multiple control signals, along with a set of operating contact outstations..Relay has a power of electromagnet to either open or close a circuit.

Software Requirements

1. Arduino IDE

2. Blynk IoT Platform

BLOCK DIAGRAM
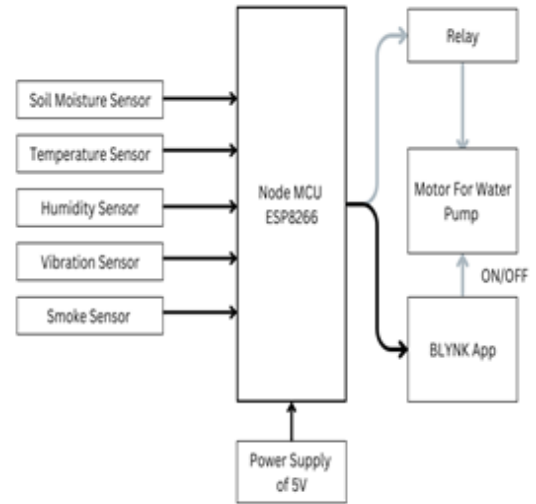
Fig.5. Flow of the Project

RESULTS

Project Model

Fig.6. Model Image 1

Fig.7. Model Image 2

BLYNK APP RESULTS

Fig.8. BLYNK APP RESULT 1

Fig.9. Blynk App Smoke Detection Notification

CONCLUSION

In conclusion, the development of an IoT-based tree monitoring system along with smart irrigation is crucial in ensuring the health and well-being of trees. Trees play a vital role in the environment and human well-being, and it is essential to monitor their health to prevent the spread of diseases, and environmental damage. It can be a valuable tool for cities and organizations looking to preserve and maintain their urban forests, leading to a more sustainable and healthier environment.

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A Study of Application of Group Theory

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ABSTRACT

Group theory, a branch of abstract algebra, provides a powerful mathematical framework that has found applications across a spectrum of scientific and mathematical disciplines. Group theory has evolved into a dynamic field with far-reaching implications. While historical attempts faced challenges, contemporary applications demonstrate the interdisciplinary nature and versatility of group theory.

KEYWORDS : *Quantum mechanics, Crystallography, Particle physics, Cryptography.*

INTRODUCTION

Group theory studies symmetry and the structural properties of mathematical objects. The concept of groups, which encapsulate symmetries and transformations, allows for a unified understanding of diverse phenomena. We will explore some key domains where the application of group theory is significant

APPLICATION

Group theory finds applications in various scientific and mathematical disciplines. Here are a few areas where it is applied:

Quantum Mechanics

Quantum mechanics relies significantly on group theory, especially when investigating symmetries within physical systems. Symmetry operations and their corresponding mathematical structures, known as symmetry groups, are essential for understanding the behavior of quantum systems. The application of group theory helps simplify complex problems and predict the outcomes of quantum experiments. One example involves the application of group theory to analyze the electronic structure of molecules, specifically in the context of molecular orbitals.

Example: Molecular Orbitals in Ethylene (C_2H_4) - Ethylene (C_2H_4) has D2h point group symmetry, which describes the set of all symmetry operations that do not alter the molecule. These operations encompass rotations, reflections, and inversions.. This example illustrates how group theory is applied in quantum mechanics to analyze the electronic and vibrational structure of molecules. The use of point group symmetry and irreducible representations provides a systematic and efficient approach to understanding the symmetries of molecular systems, making it an indispensable tool in the field of quantum chemistry.[1]

Crystallography

In crystallography, group theory is used to analyze the symmetrical properties of crystals. The study of crystallographic groups aids in understanding the arrangement of atoms in crystals and predicting their properties. Group theory is crucial for classifying crystal structures and determining how they interact with different forms of radiation. Following is an example that highlights the application of group theory in crystallography.

Example: Sodium Chloride (NaCl) Crystal Structure- Sodium chloride, or table salt, forms a crystal lattice

with a face-centeredcubic (FCC) structure. The crystallographic point group for an FCC lattice is Oh, reflecting its high symmetry attributed to its cubic nature. Group theory serves as a valuable tool in the symmetries inherent in the NaCl crystal structure.

When considering sodium chloride, group theory becomes a valuable tool for scientists to anticipate the vibrational modes, electronic band structure, and optical properties of the crystal. This systematic approach aids in the comprehension of the inherent symmetries present in the crystal lattice and assists in interpreting experimental observations. The use of group theory in crystallography goes beyond sodium chloride, playing a fundamental role in the analysis of diverse crystalline materials.[2]

Particle Physics

The study of elementary particles and their interactions involves the application of group theory. The classification of particles and the understanding of their behaviors often rely on the use of symmetry groups. Group theory is particularly useful in the context of gauge symmetries in the Standard Model of particle physics. Following is an example that highlights the application of group theory in the context of the electroweak interaction, a fundamental aspect of particle physics described by the Standard Model.

Example: Electroweak Symmetry Breaking - In this example, group theory concepts are fundamental in describing the symmetries and transformations of particles, determining their interactions, and understanding the breaking of electroweak symmetry, leading to the masses of the weak force carriers. Group theory provides a rigorous mathematical framework to articulate the complexities of particle physics within the context of the electroweak theory and the Standard Model.[3]

Chemistry

Group theory is widely employed in chemistry, especially in the analysis of molecular symmetry. It helps predict molecular vibrations, electronic transitions, and other properties based on the symmetry of molecular structures. Group theory is instrumental in simplifying complex quantum chemical calculations. One common application is the analysis of molecular vibrations using

group theory. Let's consider an example involving the water molecule (H_2O).

Example: Water Molecule (H_2O) and Vibrational Modes - By applying group theory to the water molecule, chemists can systematically analyze and predict the vibrational modes, aiding in the interpretation of experimental spectroscopic data. This example illustrates how group theory is a powerful tool in understanding molecular symmetries and their implications for various molecular properties.[4]

Cryptography

In cryptography, group theory is applied to develop secure encryption algorithms. The mathematical structures of certain groups, such as those related to elliptic curves, are utilized in the design of cryptographic protocols to ensure the security of communication and data.

Group theory has applications in various branches of cryptography, particularly in the field of public-key cryptography. Here's an example using the Diffie-Hellman key analysis of the exchange, a widely employed cryptographic protocol, which is based on principles derived from group theory:

Example: Diffie-Hellman Key Exchange - The underlying mathematical concepts, such as modular arithmetic and the cyclic group structure, are essential components of group theory. The Diffie-Hellman key exchange is an example where group theory principles can be applied to establish a secure communication channel between two parties, even in the presence of potential eavesdroppers.[5]

Coding Theory

Coding theory encompasses the examination of error-correcting codes, employed to ensure dependable information transmission in the presence of noise on communication channels. Certain mathematical structures related to groups are employed to create codes that can identify and rectify errors in data that has been conveyed , ensuring the accuracy of communication systems. Group theory has found applications in coding theory, particularly in the analysis of linear block codes. Let's consider an example using a simple binary linear block code.

Example: Binary Linear Block Code and Group Theory - Group theory concepts, such as groups, cosets, and weights, can be applied in coding theory to construct, analyze, and optimize linear block codes. The mathematical structure of groups provides a framework for understanding the algebraic properties that underlie the design and decoding of error-correcting codes.[6]

Differential Geometry and Topology

Group theory is used in geometry and topology to study the symmetries of geometric objects. Transformation groups and symmetry operations help classify and understand the properties of geometric shapes, surfaces, and manifolds. Manifolds provide rich examples where geometry, topology, and group theory intersect. Let's consider an example involving the torus, a two-dimensional manifold.

Example: Torus as a Quotient Space - The torus is a two-dimensional surface obtained by taking a rectangle and identifying opposite edges in a specific way. This identification results in a surface that has no boundary and is topologically equivalent to a doughnut Itillustrates how group theory can be used to construct and understand the topology of manifolds. The torus is a fundamental example in this context, and the group $Z×Z$ captures the symmetries and transformations that leave the torus invariant under translations. The interplay between group actions and topological spaces is a central theme in the study of manifolds.[7]

CONCLUSION

These applications underscore the widespread and diverse impact of group theory, showcasing its adaptability across a spectrum of disciplines—from foundational mathematics to physics, chemistry, engineering, and social sciences. The ability to understand and analyze symmetries proves invaluable in unraveling the complexities of various systems and in offering a systematic approach to understanding and solving complex problems across various disciplines. In conclusion, group theory stands as a unifying mathematical language and itss applications continue to drive advancements, making it an indispensable tool in the contemporary scientific landscape.

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The Adoption of Blockchain Technology in the Trading of Energy: A Review

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ABSTRACT

This study gives a brief literature review on blockchain-based energy trading in the disciplines of energy trading and blockchain because blockchain and energy trad- ing have become popular subjects in business and academics. Following the presentation of the background and development process, a survey and analysis of blockchain applications in the energy trading industry is conducted. Finally, conclusions are summarized and key future prospects in this area are underlined.

KEYWORDS : *Energy trading, Blockchain, review, Transaction mechanism, Platform construction.*

INTRODUCTION

As the problem of environmental pollution gets increasingly serious, the shortcomings of the centralised energy system, such as the high energy loss during long-distance transmission and distribution procedures and the system's limited fault- tolerant capacity, are currently becoming more and more visi- ble. The current centralised system is unable to meet the stor- age and redistribution requirements of decentralised renewable energy technology, despite its rising popularity. In the interim, some researchers advocated blockchain-based energy trading (Zhang et al., 2017; Pee et al., 2019), and some initiatives have already been successfully implemented (Laszka et al., 2018b; Mengelkamp et al., 2018). A hot topic right now is developing a blockchain-based energy trading platform and trade mechanism. This study does a comprehensive analysis of the studies and projects based on blockchain-based energy trade that have been proposed in recent papers. The current research focus is broken down into four aspects in this paper: (1) the creation of the trading platform; (2) the economy, privacy, and security of the transaction mechanism; (3) the redundancy and scalability of the trading platform; and (4) the application of the specific technology of the trading platform. Blockchain-based energy trade is still in its infancy. The rest of the essay is organised as follows. In the section titled "The Background and Development Process," the context of the research problem and the development process are presented. Application of Blockchain in Energy Trading Section reviews the current state of research in four significant areas. Future development trends are covered in the "Conclusion" section.

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THE BACKGROUND AND DEVELOPMENT PROCESS

Microgrid Energy Markets Renewable energy, which may be included into power systems in numerous ways, such as active distribution networks (Li et al., 2018a), integrated energy systems (Li et al., 2020), and microgrids, plays a significant role in redefining the future of the energy industry (Li et al., 2018d). In this environment, controlling micro- grid markets to maximise the use of renewable energy is a hot topic in both academics and industry. Papaefthymiou and Dragoon (2016) went into more detail about how to convert conventional power systems to ones that

use only renewable energy. Similar to this, Hanna et al. (2017) emphasised the significance of policy support. Hanna et al. (2017) discovered that the microgrid can only achieve the lowest cost operation and environmentally friendly factors with the support of poli- cies when determining the best operation mode to model the microgrid. A scheduling plan for microgrids with an electric vehicle battery swapping station was proposed by Li et al. (2018c), taking into account the real-time pricing mechanism. A multi-objective microgrid dispatch technique taking into account the user experience was proposed by Li et al. in 2019. Kuznetsova et al. (2014) proposed the individual objective of stakeholders to optimise microgrid energy management framework in order to guarantee the benefit of microgrid par- ticipants. Additionally, Montuori et al. (2014) introduced the hybrid optimization of multiple energy resources (HOMER) optimization model to assess the economic efficiency of the microgrid with a biomass gasification power plant. De- mand response management (DSM) has seen a resurgence because microgrids need flexible demand-side management to streamline system operations (Palensky and Dietrich, 2011). However, the use of DSM in microgrids does not ultimately benefit from the development of renewable energy sources and instead reflects socio-economic development needs. Noor et al. (2018) offered an upgraded blockchain-based system. Li and Li (2019) proposed a microgrid dispatch approach that took into account the demand response of electric vehicles. Li and Li (2019) presented a game-theoretic model for DSM within blockchain-enhanced microgrid networks that achieved payment mechanisms and intelligent decentralised control by combining the benefits of DSM with blockchain technology.

Blockchain Technology

The implementation of energy trading is made possible by blockchain technology. A peer-to-peer (P2P) network with proof-of-work was introduced by Nakamoto (2019) in 2019. This consensus mechanism can impose any necessary rules and incentives. The blockchain-based study began with that. The blockchain was described as a distributed, redun- dant, chain-connected, ledger-sharing database by Dong et al. (2018). Each node in the network is fault-tolerant and capable of node communication. Blockchain has a huge amount of potential in a variety of industries, including finance, com- puter software, and applications; (3) the information econ- omy and postal economy, such as investment and securities; and (4) the shared health-care data framework, generation, and distribution in the citizen-level microgrid, which may be beneficial (Giungato et al., 2017. Andoni et al. offered a thorough assessment of blockchain technology in 2019, which included 140 blockchain research projects and activities. However, the majority of these studies are still in their infancy. Future blockchain technology development will be influenced by laws, regulations, and other social factors. With regard to the internet of things (IoT), Ali et al. (2018) offered a thorough review, outlining some of the technology's potential advantages in terms of data management, identity, and privacy as well as the generating revenue of IoT data and resources. As a reference for all parties—producers, customers, and managers—involved, Fan et al. (2018) created a model for the pricing and trade of energy-internet electricity based on blockchain technology and big data.Create a web3 object by linking it to ganache blockchain running locally. Get accounts on the blockchain. Get Real time ETH to INR data from Alpha vantage. Get Transaction hash of the contract creation. Get Contract ABI. Create a contract instance using contract address and contract ABI. Initiate the contract with some Ethereum from the admin account. As shown in fig 1 Start Loop for n cycles: a) Generate random values for energy production/consumption for all prosumers and consumers . b)Find the total energy production and total energy con- sumption Get the rate using the required function . c)Send Data to the smart contract. d) Collect data from the smart contract and blockchain. e)Send data to thingspeak . Withdraw the remaining balance from the smart contract to the admin account. Combine the data collected to a single list. Write the created list to a .csv file

APPLICATION OF BLOCKCHAIN IN ENERGY TRADING

This study categories pertinent studies into the following four areas because, according to various research foci, the majority of studies about energy trading based on blockchain are still in their early stages. Building

a trading platform comes first, followed by studies of the economy, privacy, and security of transaction mechanisms, the latency and scalability of the platform, and finally the implementation of the platform's specialised technology.
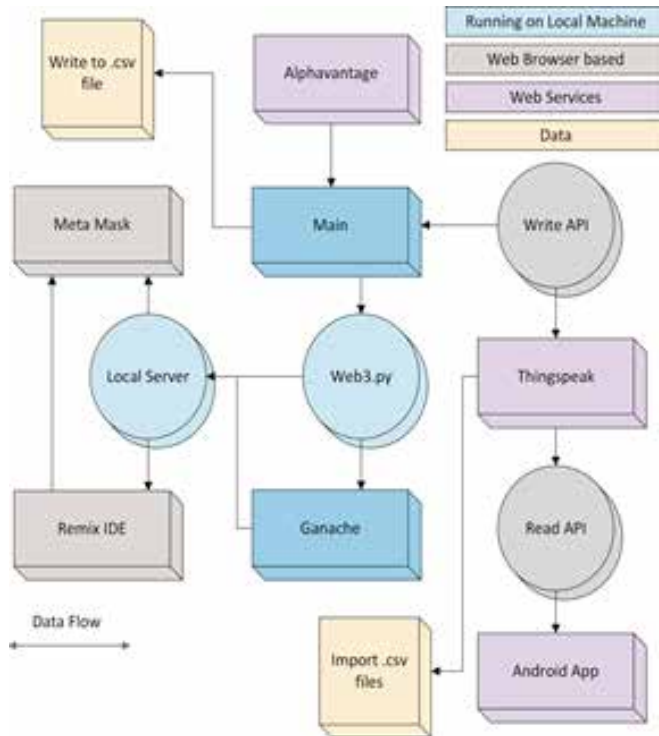
Fig. 1. Block diagram of Blockchain based Energy Trading

Design and Construction of a Trading Platform Through the demand side's flexible loads, energy conversion, and storage equipment, integrated demand response (IDR) has been shown to be beneficial in raising the system's operating flexibility and energy utilisation efficiency (Li et al., 2021). Zhao et al. (2018a,b) introduced an energy transaction mechanism based on the blockchain technology to fully utilise the integrated distributed IDR resources. Additionally, Mannaro et al. (2017) introduced the Crypto-Trading Project, emphasising the crucial significance of blockchain technology and smart contracts in the administration and control of innovative patterns of the energy market.

Privacy, Security, and Economy of Transaction Mechanism

In order to address the issue of energy transactions' privacy, Zhou et al. (2018), Laszka et al. (2018a),

and Tan et al. (2019) each put out a unique solution. The validation of the proposed framework was demonstrated from the perspectives of task offloading and security. Zhou et al. (2018) developed a consortium of blockchain-based energy trading mechanisms and an edge computing-based task offloading for local energy aggregators (LEAGs) and V2G, respectively. Laszka et al. (2018a) provided a cutting-edge distribution application platform that took robustness and privacy concerns into ac- count. On the basis of the energy blockchain network, Tan et al. (2019) created a model for privacy-preserving energy scheduling in which they used smart contracts and Lagrangian relaxation to find a solution to the issue. Park et al. (2018) proposed a blockchain-based P2P energy transaction network and gave simulation results that assessed and contrasted the platform's economic benefit. Hou et al. (2019) created a scheme that allowed nodes to satisfy their power loads through locally stored energy (self-sufficiency), before participating as sellers, if they still had a significant amount of excess electricity. This was done in consideration of the enormous operational overhead caused by a high-frequency transaction. A blockchain-based authorisation system for reliable resource monitoring and trade was presented by Alcarria et al. (2018).

Latency and Scalability of Trading Platform Jindal et al. (2019) proposed a blockchain-based edge-as-a-service frame- work to address the issues of latency caused by processing energy trading decisions at remote control centres and the security concerns, while trading the energy. This framework used a software-defined network (SDN) architecture to reduce the latency and secured the underlying trading transactions by blockchain. Blom and Farahmand (2018) used the Ethereum platform to model a local energy market and came to the conclusion that the Ethereum protocol can handle the provided market with 600 participants and a transaction frequency of once every five minutes. A local energy trading cyber- physical system is enabled by Liu et al. (2019)'s off-chain energy trading method and asynchronous transaction recoding mechanism.

Implementation of Specific Technology of Trading Plat- form The current research topic also focuses on the implementation of the algorithm in addition to the study

and analysis of the properties of blockchain. With the use of an Ethereum smart contract, Kang et al. (2018) deconstructed a platform for trading renewable energy, demonstrated its scalability and adaptability by coding the transaction process and smart contract contents, and provided a straightforward scenario for two nodes. The laboratory scale implementation of the blockchain network for the trading of solar energy was demonstrated by Pipattanasomporn et al. (2018). Tai et al. (2016) offered a better distributed security checking algorithm and demonstrated its viability using an example with six nodes. Furthermore, all of the above-mentioned schemes are still in the exploratory phase, and the size and proven schemes are in a perfect or laboratory setting. As a result, there is still work to be done before the blockchain-based energy trading platform is widely adopted for use in real-world scenarios. E. Renewable Energy Credits (RECs): Blockchain facilitates the tracking and trading of Renewable Energy Credits. Through an immutable ledger, stakeholders can verify the origin and authenticity of renewable energy, promoting a more sustainable and environmentally friendly energy market. Smart Contracts:

Smart contracts, self-executing agreements with predefined rules, automate and streamline energy trading processes. These contracts facilitate automatic execution of transactions when predefined conditions are met, reducing the need for inter- mediaries and enhancing efficiency. G. Data Security and Privacy: The decentralized nature of blockchain enhances data security and privacy. Energy trading involves sensitive infor- mation, and blockchain ensures that data is stored securely, reducing the risk of unauthorized access or manipulation. H. Interoperability: Blockchain promotes interoperability between different energy systems and networks. This is particularly crucial as the energy sector transitions to a more diverse and decentralized landscape with various renewable energy sources. I. Market Efficiency and Flexibility: By automating processes and reducing the need for intermediaries, blockchain enhances market efficiency and flexibility. This is especially valuable in dynamic energy markets where quick response times are essential.

In conclusion, the application of blockchain in energy trading holds great promise for transforming the energy

sector by introducing transparency, efficiency, and sustainability into the trading processes. As technology continues to evolve, the integration of blockchain is likely to play a pivotal role in shaping the future of energy trading.
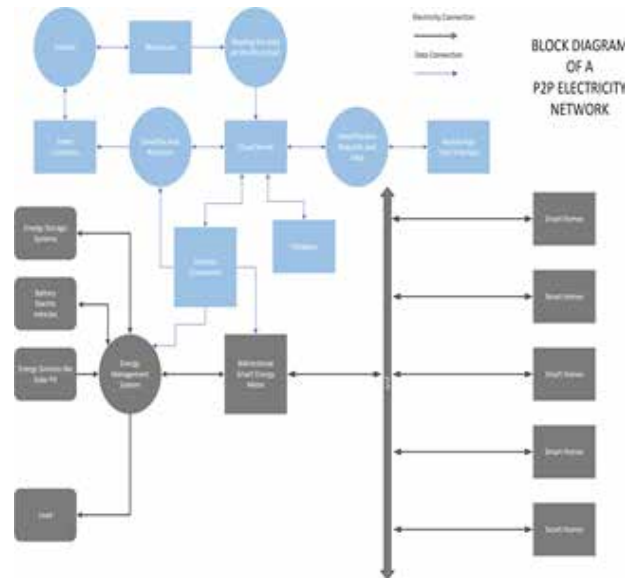
Fig. 2. Process Flow Diagram

CONCLUSION

Blockchain-based energy trading has drawn the attention of many academics as a potent and rising technology. Following a review of the literature, this essay condenses the major issues into the following four points: (1) development of the trading platform; (2) economics, privacy, and security of the transaction mechanism; (3) redundancy and scalability of the trading platform; and (4) application of the trading platform's special technology The development of an energy trading platform and the deployment of effective algorithms will be crucial research directions in the future because the majority of studies are still in the initial stage. Applying machine learning to blockchain-based applications is another fascinating subject (Shi et al., 2008; Li et al., 2018b; Tanwar et al., 2019).

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A State of the Art Exposure Fusion Algorithm for Fusion of Multiple Exposure Images Revisited

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ABSTRACT

We find a method for combining brackted exposures into a single high quality image without resorting to HDR. Skipping the physically streamlined pipeline. A multi-resolution based fusion of images, due to the sequences brightness changing. Image quality is improved brought at par with tone-mapping methods. Saturation, Contrast and Well-exposedness are exploited to combine the image into a whole and coherent image.

KEYWORDS : Exposure, Bracketed, Dynamic, Tone-mapped and Pyramidal.

INTRODUCTION

The dynamic range of digital cameras is inferior to that of the actual world. Underexposed or overexposed images are common in high dynamic range settings. The whole dynamic range can be captured with a single high dynamic range image by using a bracketed exposure sequence [1, 13]. In order to properly display an image, the intensities must be tone-mapped so that they correspond to the normally limited dynamic range of the display device. We propose in this study to instead combine the many exposures into a single high-quality low-dynamic-range image that may be displayed instantly rather than waiting for the high dynamic range image to be computed (like a tone-mapped picture). Portions of the signal that reappearance after a brief interval. The signal's repeated portion is removed. The echoes are eliminated. As seen in Fig. 1, we refer to this procedure as exposure fusion. Our method is based on encoding desirable attributes like saturation and contrast in a perceptual quality score for each pixel in the multi-exposure sequence. To create the final product, we only use the "excellent" pixels from the sequence and merge them using our quality metrics. Image fusion methods like depth-of-field extension [8] and photo montage [7] are quite like exposure fusion. Fusing a multi- exposure sequence is a proposal offered by Burt et al., although in the broader context of image fusion.

Tone mapping operators are numerous, and each has its own set of pros and cons. To reduce the dynamic range, global operators remap the intensity in a consistent manner across the image's physical space [5, 10]. Their primary benefit is speed, but they don't always generate aesthetically beautiful results. For different parts an image, local tone mapping operators use distinct mappings [1, 2, 3]. Although the end result may appear strange at times, it typically produces more beautiful photographs. Many distinct methods, such as bilateral filtering [2], which separates a picture into edge-aware low and high frequency components, and gradient domain [3], are used by the operators to compress the dynamic range. Our strategy is tied to the next two local operators. The HDR pixel values are rescaled based on a multiscale measure computed by Reinhard et al. that is connected to contrast. This is comparable to the standards we use. However, we define all of our metrics on a per-pixel basis. Using a pyramidal image decomposition, Li et al. compress the dynamic range by attenuating the coefficients at each level. Like other pyramid-based approaches, ours utilizes coefficients from individual exposures rather than a

middle ground HDR image. Other tone mappers make an effort to model the human visual system, emulating features like temporal adaptation [8]. Instead, we strive to reproduce as much nuance and color as possible while still making photographs that are aesthetically beautiful. There has been extensive use of image fusion methods for quite some time. Multimodal imaging, video enhancement, and depth-of-field are only a few examples. Using image fusion, we'll combine multiple exposures to produce a single photograph with optimal detail. To address this issue, Burt et al. proposed using picture fusion in the early 1990s. Our technique, on the other hand, is more malleable because it makes use of tweakable image measures like contrast and saturation. Another method for combining multiple exposures was proposed by Goshtasby, however it has trouble with object borders. We get into greater depth about these methods. Two images are cross-dissolved using a pyramid decomposition [2]; this method was developed by Grundland et al. We blend in a similar fashion, but with distinct quality standards. Our results show that our method is a straightforward approach to combining flash and non-flash photos. Whereas the prior art approaches are substantially more involved and are tailored to this particular scenario, our approach may easily be adapted to fit the bill.

EXPOSURE FUSION

The goal of exposure fusion is to create the final image by selecting the "best" bits of a series of many exposures. We use a unified weight map with scalar values based on a set of quality measures to guide this procedure (see Fig. 2). A helpful mental image is to visualise the input sequence as a pile of images. Following this, weighted blending is used to collapse the stack into the final image. We assume the images are properly aligned, perhaps with the use of a registration algorithm [13], as was the case with earlier HDR acquisition methods [1].Blending images seamlessly is a common challenge in computer graphics and image processing. While we employ an image-pyramid-based multi-resolution methodology [1], various options exist. Particularly useful is gradient-based blending [9], which has also been used for picture fusion [4, 6]. The photos are first converted to gradient fields, blended, and then the final image is reconstructed from the gradients. In high

resolution photos, however, reconstruction sometimes entails solving a partial differential equation, which can be time-consuming and resource-intensive. In addition, gradient-based fusion is prone to color shifting and introduces scale and shift ambiguity [6]. Color changes, such as increased saturation [6], and maybe diminished contrast may also result from the application of tone mapping operators. Due to the fact that our blending can be seen as a selection process, it is resistant to outward visual shifts. While contrast and saturation do play a role in our selection process, we do not alter individual pixels to achieve the desired results. Comparing our work to those of earlier efforts in picture fusion [5], where the Laplacian (or another) pyramid decomposition was also applied, reveals some striking similarities. These techniques focus squarely on the coefficients, keeping only the most important pyramid coefficients. For instance, the greatest magnitude coefficients are retained [5].The principle underpinning Burt and Kolczynski's exposure fusion technique is the same. Although these methods incorporate all of the sequence's elements, their output is not guaranteed to be pleasing. We don't directly process individual coefficients across levels of the pyramid, but rather blend them together using a scalar weight map. Saturation and well exposure are two examples of metrics that are difficult to assess directly using pyramid coefficients.

By using our method, we are able to more readily establish quality measurements because the weighting is no longer tied to the actual contents of the pyramid. Each level l of the resulting Laplacian pyramid is computed as a weighted average of the original Laplaciande compositions for level l, with the l-th level of the Gaussian pyramid of the weight map serving as the weights; this is true for any measure that can be computed per-pixel or perhaps in a very small neighborhood. At last, we obtain R by reducing the pyramid LRl to its base form. In, we provide a high-level explanation of our method. Avoiding seams is made much easier with multi resolution blending, which blends image characteristics rather than intensities. Since the blending is calculated independently for each scale, the weight map's sharp transitions can only mimic those found in the source images (e.g. edges). We found that satisfactory results can be achieved when working with color photos by doing the blending of each color

channel independently. Evaluation with a variety of well-liked tone mapping approaches. The final images produced by our algorithm are on par with those produced by competing methods. thorough analysis.

PREVIOUS WORK

Flat, colorless areas are seen in many of the photographs in the stack as a result of under- and overexposure. Less emphasis should be placed on these areas while those with vibrant colors and fascinating features are given the full weight of the filter's response. [6]. A straightforward contrast indicator, C, is thus obtained. Important features, such as edges and textures, are given a higher priority. Multi-focus fusion with a shallow depth of field [7] utilized a comparable metric. Longer exposure times in photographs cause the colors to fade and eventually be clipped. Highly saturated colors are preferred because they add vibrancy to an image. At each pixel, we have also included a saturation measure S, which is the standard deviation of the R, G, and B channels.

Looking at just the raw intensities within a channel, reveals how well a pixel is exposed. We want to keep intensities that are not near zero (under exposed) or one (overexposed). We weight each intensity i b1a1sed on how close it is to 0.5 using a Gauss. Where σ equals 0.2 in our implementation. Multiple color channels can be taken into account by independently applying the Gauss curve to each color channel and then multiplying the resulting measures to arrive at E. We multiply the results of the various measurements against each pixel to produce a scalar weight map. Since we'd like to impose all of the characteristics indicated by the measures simultaneously (like a "AND" selection as opposed to a "OR" election, respectively), we opted for a product rather than a linear combination. Using a power function, we may adjust the relative importance of each metric in the analysis, much like with the weighted components of a linear combination. Even with no optimizations. Our method then allows for nearly interactive feedback after the Laplacian pyramids have been constructed (see timings of update step). An individual can modify the fusion process's outcome by changing the relative importance of different quality metrics. Adjustments to the input images can be made in other ways as well, including linear and non-linear intensity re-mappings

(like brightness adjustment or gamma curves). This can be used to give certain exposures more influence. Motivated by the work of Strengert et. al. [27], we expect that our algorithm could eventually run in real time on graphics hardware.

EXPOSURE FUSION

The goal of exposure fusion is to create the final image by selecting the "best" bits of a series of many exposures as shown in Figure 1. We use a unified weight map with scalar values based on a set of quality measures to guide this procedure (see Fig. 2). A helpful mental image is to visualize the input sequence as a pile of images. Following this, weighted blending is used to collapse the stack into the final image. We assume the images are properly aligned, perhaps with the use of a registration 4 algorithm, as was the case with earlier HDR acquisition methods.

Fig. 1 Series of Multiple Exposures

Fig. 2 Exposure Fused Image

QUALITY MEASURES

Quality Measures Flat, colorless areas are seen in many of the photographs in the stack as a result of under- and overexposure. Less emphasis should be placed on these areas while those with vibrant colors and fascinating features are given the full weight of the filter's response.

Contrast

A straightforward contrast indicator, C, is thus obtained. Important features, such as edges and textures, are given a higher priority. Multi-focus fusion with a shallow depth of field utilized a comparable metric.

Saturation

Longer exposure times in photographs cause the colours to fade and eventually be clipped. Highly saturated colours are preferred because they add vibrancy to an image. At each pixel, we have also included a saturation measure S, which is the standard deviation of the R, G, and B channels.

Well-exposedness

Looking at just the raw intensities within a channel, reveals how well a pixel is exposed. We want to keep intensities that are not near zero (under exposed) or one (overexposed). We weight each intensity i based on how close it is to 0.5 using a Gauss.

PERFORMANCE

Even with no optimizations. Our method then allows for nearly interactive feedback after the Laplacian pyramids have been constructed (see timings of update step). The following Fig.3 shows the comparison of various exposure fusion techniques.

(a)Durand et. al [62]. (b) Reinhard & al. (c) Li & al. (d) Ours
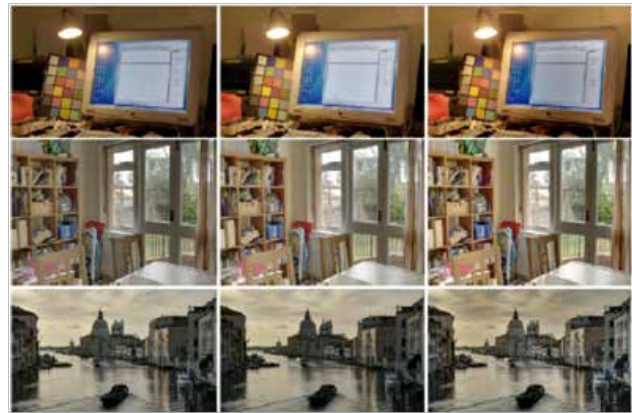
Fig. 3 Comparison of our quality measures. Exposure fusion is performed with each measure turned on separately

An individual can modify the fusion process's outcome by changing the relative importance of different quality metrics. Adjustments to the input images can be made in other ways as well, including linear and non-linear intensity re-mappings (like brightness adjustment or gamma curves). This can be used to Even with no optimizations. An individual can modify the fusion process's outcome by changing the relative importance of different quality metrics. Adjustments to the input images can be made in other ways as well, including linear and non-linear intensity re-mappings (like brightness adjustment or gamma curves). This can be used to give certain exposures more influence. Motivated by the work of Strengert et. al. [27], we expect that our algorithm could eventually run in real time on graphics hardware. Comparison of Quality Measures Blending exposures can be accomplished by increasing contrast, increasing saturation, or increasing the amount of well-exposed areas. Increasing the saturation helps bring forth more detail in the first row desk scene. Having the backdrop too black from using contrast and having the center of the screen too dark from using well-exposure both contribute to an unnatural appearance. Saturation and good exposure give the house scene in the next row its rich hues, while contrast plays a smaller role. Detail in the water and the windows of the houses, for example, is lost in the saturated image but is preserved in the contrast version, as shown in the bottom row. An image with good exposure is intriguing, but it lacks the natural feel of the other two. In most cases, we discovered that properly exposed photos turned out quite nicely.

On the other hand, it always favors intensities around 0.5, which might lead to an unrealistic appearance in some situations. Neither of these issues exists with the saturation and contrast. Nonetheless, the findings from such methods aren't necessarily as intriguing as those from well-exposed studies.

CONCLUSION

We suggested a method for combining images with bracketed exposures into a single high-quality image without resorting to HDR. Removing the need for a physical HDR assembly step.

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Melting of Solids: Scaling with Atomic Parameters

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ABSTRACT

The melting point is a very important parameter in understanding the purity of compounds. However it is very difficult to calculate the exact melting point as there is a huge possibility of human error in the visual detection of melting point and even a small amount of impurity or different pressure at regions of different altitudes can cause melting point to vary, thus melting points are generally calculated in range. Here we have developed a microscopic model for the melting of crystals where the onset of melting is correlated with the thermal fluctuation of the atoms from their respective mean position, after crossing a certain limit. Further, we have inverted the relation to demonstrate that the unknown melting point of some elements can be approximately interpolated from some atomic data sets if known. We also identify an additional scaling with atomic radius, which when implemented leads to a much more tightly bounded parameter space for estimation of melting points.

KEYWORDS : *Melting point, Atomic radius, Scaling relations.*

INTRODUCTION

Melting is a fundamental phenomenon in which the substance experiences a phase transition from a solid to a liquid phase. This occurs when the internal energy of a solid rises, which results in increasing temperature and finally leads a substance to melt. With an increase in temperature, the atoms in a crystal vibrate around fixed positions, thus the ordering of ions or molecules in the solid breaks down to a less ordered state, and the solid melts to become liquid.

The first theory explaining the mechanism of melting in bulk was put forward by Lindemann [1]. According to him, the average amplitude of thermal vibrations increases when the temperature of the solid increases. At some point, the amplitude of vibration becomes so large that the atoms can no longer be said in a particular crystal lattice or structure, and here a crystal will melt when the vibrational amplitudes of its constituent atoms reach some critical magnitude, say 10 to 15% of the interatomic spacing. A recent review of the associated problems is provided by Vopson et al. [2].

Based on this general premise, we have tried to model the melting of solids at an atomistic level. When heat is added to a substance, the molecules and atoms vibrate faster. As atoms vibrate faster, the space between atoms increases. This can be explained as follows.

Consider a crystal lattice as shown in Fig. 1. Panel (a) shows the condition of a sample square lattice in the absence of thermal vibrations. In panels (b), (c), and (d), the extent of thermal fluctuation is increased gradually

to 5%, 10%, and 20% respectively. It can be seen in this case that the long-range crystalline order collapses in the scenario of 20% thermal fluctuations.
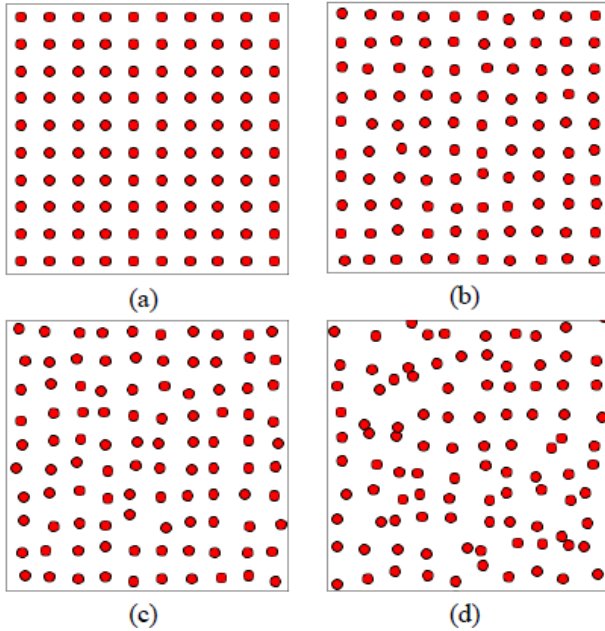
Fig. 1. Sample snapshots of a regular square lattice of atoms, with different levels of thermal fluctuation (a) 0%, (b) 5%, (c) 10%, (d) 20%

FORMULATION OF THE MODEL

Thermal vibrations in a solid

Consider a system of atoms in equilibrium at temperature T. The atoms of the molecule being fixed in space, perform simple harmonic motion (SHM) about their mean position. The Hamiltonian for a vibrating particle performing SHM in three dimensions can be given as follows:

$$H = \frac{p^2}{2m} + \frac{1}{2}\lambda r^2 \qquad (1)$$

where λ is the spring constant. Now, the above expression contains 6 quadratic degrees of freedom in total. According to the equipartition theorem, we know that the energy associated with each quadratic degree of freedom is kT/2. So the average energy of 6 degrees of freedom multiplied by kT/2 we get 3kT.

$$\langle H \rangle = 3kT \qquad (2)$$

where $k = 1.308 \times 10^{-23}$ J/K is Boltzmann's constant.

Now the average potential energy of a particle performing S.H.M. in 1 dimension can be given as:

$$\langle V \rangle = \frac{1}{2}\lambda\langle x^2 \rangle = \frac{1}{2} kT$$

Hence

$$\langle x^2 \rangle = \frac{kT}{\lambda} \qquad (3)$$

Relation to macroscopic properties (Young's modulus)

Now, as we know, from Hooke's law, stress (force per unit area) is directly proportional to strain (change in length per unit original length).
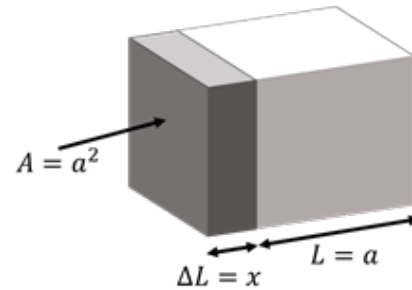
Fig. 2. Unit cell of a cubic crystal and its deformation under stress

$$\frac{F}{A} = Y\frac{\Delta L}{L} \qquad (4)$$

where Y is the proportionality constant known as Young's modulus.

Now, consider the unit cell as shown in Fig. 2. The unit cell has side length L equal to the lattice constant a, and cross-sectional area $A=a^2$. Under stress, assume that it undergoes extension by an amount $\Delta L=x$.

In (3), the spring constant λ is unknown. We obtain an expression for λ in terms of the Young's modulus Y and the lattice parameters of the unit cell. Substituting the harmonic force $|F|=\lambda x$ in (4) yields:

$$\lambda = Y\frac{A}{a} = Y\frac{bc}{a} \qquad (5)$$

where in the general case of a rectangular lattice, a, b, and c are the lattice parameters. In general, the force constant λ corresponds to the direction associated with the lattice parameter which appears in the denominator. Combining (3) and (5), we finally get:

$$\langle x^2 \rangle = \frac{kT}{Y} \frac{a}{bc}$$

or

$$\frac{x_{rms}}{a} = \sqrt{\frac{kT}{Y(abc)}} = \sqrt{\frac{kT}{YV}}$$

(6)

where V=abc is the unit cell volume for the crystal. Here, x_{rms}/a is nothing but the extent of vibration of the atoms in the lattice from their mean position resulting in the structure of the lattice melting, as per the Lindemann hypothesis [1].

The values of V and Y are taken from the Wolfram Element Data database [3]. Using the values of actual melting point T_{melt}, also taken from the same database [3] for various elements, one can estimate the values of x_{rms}/a using (6).

RESULTS AND DISCUSSION

Application of the model to atomic crystal data

Such an estimation has been made by us for 62 different crystalline elements ranging from Z = 3 (Li) to Z = 94 (Plutonium). The result is shown in Fig.3. The estimated values of x_{rms}/a follow a Gaussian distribution, characterized by a mean value of $(x_{rms}/a)_0 = 0.063$, with a standard deviation of 0.019. This indicates that, on average, the melting of the solid takes place when the mean displacement of the atoms is ~ 6% ± 2% of the lattice constant. However, the spread in these values is quite large.
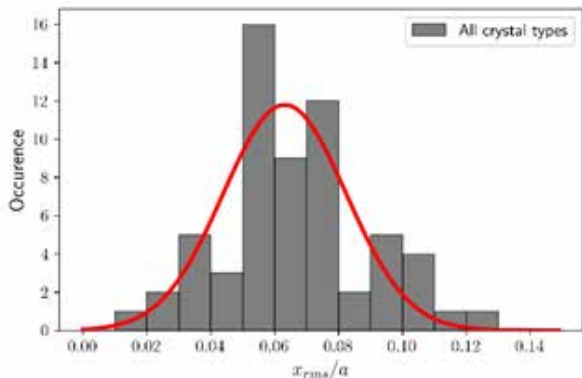
Fig. 2. Distribution of estimated ratio x_{rms}/a leading to melting of the crystal from our model (using a total of 62 elements).

We have also explored how these estimates vary across different crystal structures, such as face-centred cubic (FCC), body-centred cubic (BCC), simple hexagonal (SH), etc. The results are shown in fig. 4 and table 1.
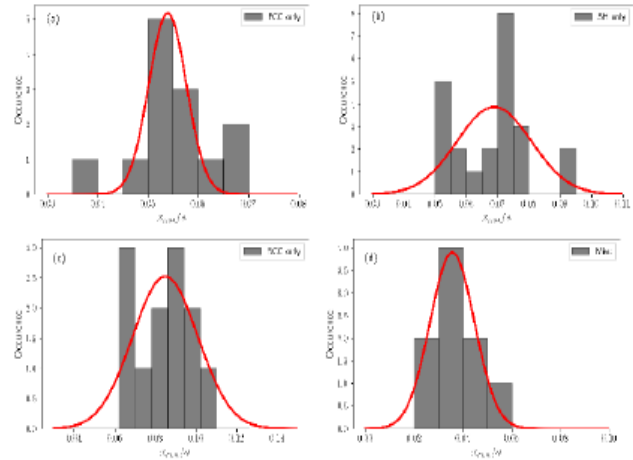
Fig 4. Same as fig. 3, but separately plotted for different crystal structure types: (a) FCC, (b) BCC, (c) SH and (d) miscellaneous structures, including triclinic, trigonal, orthorhombic and monoclinic structures.

Table 1. Estimates of x_{rms}/a for different crystal types

Crystal structure	Table Column Head		
	No. of elements	Meanᵃ x/a	Std. devᵃ.
FCC	13	0.054	0.004
SH	24	0.069	0.012
BCC	14	0.085	0.016
Others	11	0.036	0.009

Additional scaling with Z and atomic radius

To better understand the data, we plot the estimated x_rms/a as a function of atomic number Z in fFig.5. By inspection, the values of x_rms/a appear to follow the same broad period-wise trend as the atomic radius, which is also shown as a grey smeared line. In addition, there seems to be a slight dependence on Z itself, since the correlation between the curves is better at low Z, and it grows worse with increasing Z.
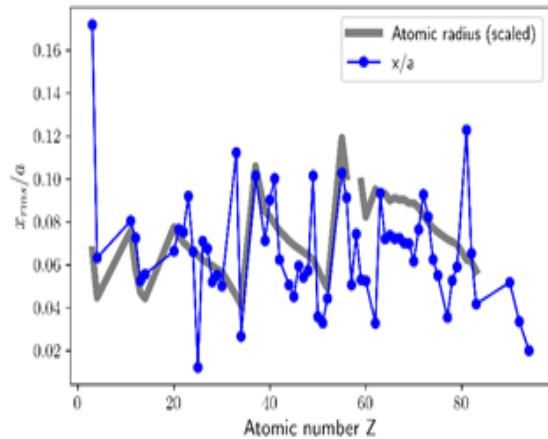
Fig. 5. Estimated x_{rms}/a as a function of atomic number Z (blue data points). Also shown is the dependence of atomic radius on Z (grey line), to emphasize the scaling behavior.

We have empirically arrived at a better-scaling relation than the simplistic Lindemann criterion, using a scaling-based estimator of the form

$$f = \frac{x_{rms}}{a}\frac{Z^{\alpha}}{R^{\beta}}$$

(7)

where R is the atomic radius, and Z is the atomic number. The power law indices α and β are determined empirically. For our dataset, we arrived at the values α=0.2 and β=1, which leads to minimal spread in the values of the estimator f across the entire dataset.

Fig. 6 shows the distribution of values of the estimator f. The attractive feature of this scaling is that the relative Gaussian spread of the estimator function f is now very small ($f_0 = 7.44 \times 10^{-4}$ pm^{-1}, σ = 0.70 × 10^{-4} pm^{-1}). Thus, the relative spread at the 1-σ level is less than 10%.
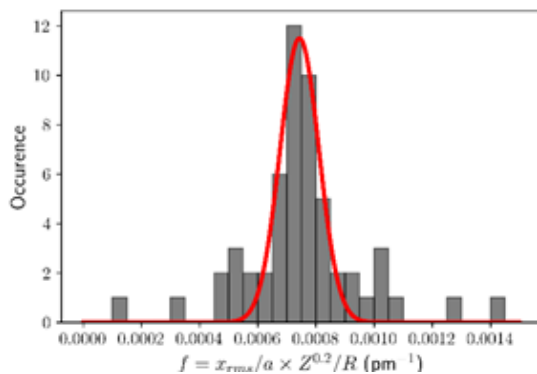
Fig. 6. The distribution of the estimator function f = (x_{rms}/a × Z^{0}.2/R) over the complete dataset of 62 elements.

Extension to determine unknown melting points

Treating the estimator f as an empirical constant across the periodic table, with a value equal to the mean value of the distribution, i.e. $f_0 = 7.44 \times 10^{-4}$ pm^{-1}, one can estimate the melting point T_{melt} of any material, provided Young's modulus, and the lattice constants are known. The estimated temperature T_{est} would then be given by:

$$T_{est} = \frac{YV}{k}\left(\frac{R}{Z^{0.2}}f_0\right)^2$$

(7)

The temperatures T_{est} estimated by this methodology for the current dataset are compared to the actual melting temperature values T_{melt} in fig. 7.
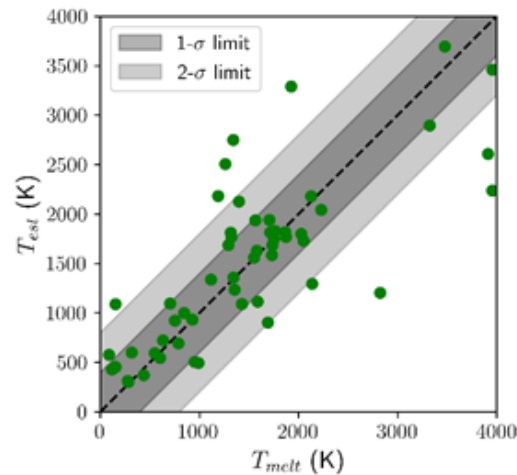
Fig. 7. Estimated melting temperature T_{est} vs actual melting temperature T_{melt}. The dashed line represents $T_{est}=T_{melt}$ (the ideal scenario), and the shaded regions are 1σ and 2σ confidence intervals, i.e. 95% of the crystalline elements considered fall within the light grey patch.

As seen, 95% of the data falls within a spread of ±15% of the estimated values (i.e. the 2σ limit). Thus, our scaling method can be used to estimate the temperature of any crystalline solid with known elastic modulus, lattice parameters and mean atomic radius. This constitutes a significant extension of the simplistic Lindemann scaling model.

CONCLUSIONS

Melting is a bulk phenomenon observed in solids. In our model, as the temperature is increased, the atoms in the closely packed structure start to vibrate about their mean position. This amount or percentage of vibration

was calculated and studied at an atomistic level using empirical data for a compilation of 62 elements in the periodic table, constituting different crystal structures. It was found that, on an average, there needed to be 6% (±2%) of vibration to allow a solid to melt. Further, these numbers differ for different classes of crystal structure. For a BCC lattice – 8.5% (±1.6%), for an FCC lattice – 5.4% (±0.4%), for a simple hexagonal lattice – 6.9% (±1.2%), and for other miscellaneous crystal classes – 3.6% (±0.9%).

We further noted the similarity in the dependence of this ratio on atomic number with that of the atomic radius across the periodic table. Using this as a basis, we formulated a scaling relation with the dependence $Z^{0.2}/R^1$, which enables us to successfully scale the ratio for all elements, reducing the spread in estimated values from 33% (fig. 3) to less than 10% (fig. 6).

Finally, we use our scaled estimator function f (see (7)) to estimate the melting temperature for all the crystalline solids considered in this study, and find that 95% (2σ) of the estimated values lie within a range of ±15% of the actual values, thereby providing a significant improvement upon the classic Lindemann model for the melting of solids.

ACKNOWLEDGMENT

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Whale Optimization for Optimal Power Flow

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ABSTRACT

The optimal power flow (OPF) of power system is to optimize the objective function such as generation cost by adjusting control variables on the premise of satisfying operation constraints and supply–demand balance. Because of its complexities, standard formulae are insufficient for the present scenario. Therefore, the multi-objective optimal power flow problems have been explored in this paper. Optimization is done by Whale Technique.

KEYWORDS : Optimal power flow, Whale optimization, WOA.

INTRODUCTION

The optimal power flow (OPF) is one of the fundamental mathematical tools currently used for the operation of power systems. In general terms, the OPF determines the dispatch of generating units to satisfy the electricity demand at the minimum cost while complying with the technical limits of the system. Most of the real- life issues involving optimization objectives with constraints are expressed as a multi-objective optimization problem. In contrast to single objective optimization problems, multi-objective optimization problems have a set of optimal solutions. Nature inspired algorithms have been extensively used to solve such complex problems. In the modern power systems, appropriate power dispatch schedule of the online power generating units is essential for reliable and clean power supply and it is desirable to attain this at the lowest possible operating cost. Optimal Power Flow (OPF) is a crucial problem in power systems engineering and operation. It is a mathematical optimization problem that aims to find the optimal settings for the control variables in a power system to minimize the overall cost while satisfying various operational constraints. The primary goal is to ensure the economic and reliable operation of the power grid. Here are the key components and aspects of Optimal Power Flow: Objective Function: The objective function in OPF typically aims to minimize the total cost of power generation. This cost includes the fuel costs of generators, the cost associated with transmission losses, and possibly other economic factors. The formulation may also include penalties or incentives for certain operating conditions. Decision Variables: The decision variables in OPF are the control parameters that can be adjusted to optimize the power system. These variables may include the generation levels of individual generators, transformer tap ratios, and other control settings. Constraints: OPF involves a set of equality and inequality constraints that must be satisfied for the solution to be considered feasible. These constraints ensure the physical and operational limits of the power system are not violated. Common constraints include power balance equations, voltage limits, thermal limits on transmission lines, and generator capacity limits. Types of OPF: OPF can be categorized into different types based on the specific objectives and constraints considered. These include Economic Dispatch (ED): Minimizing the cost of generation while meeting the demand. Security-Constrained OPF (SCOPF): Considering the impact of potential contingencies on system security. Multi-Objective OPF (MO-OPF): Optimizing multiple conflicting objectives simultaneously. Stochastic OPF (SOPF): Incorporating uncertainty in load demand or generator availability. Solution Methods: Various optimization techniques can be used to solve OPF problems. These include linear programming (LP), nonlinear programming (NLP), quadratic programming (QP), and evolutionary algorithms such as genetic algorithms and particle

swarm optimization. The choice of the solution method depends on the complexity of the problem and the desired accuracy of the solution Real-Time and Day-Ahead OPF: OPF can be applied in different timeframes. Day-ahead OPF is used for planning the next day's operation, while real-time OPF is employed for making operational decisions during actual system operation. Real-time OPF may need to consider real-time measurements and contingencies. Integration with Renewable Energy Sources: The increasing integration of renewable energy sources, such as wind and solar, adds complexity to OPF. These sources are variable and intermittent, requiring advanced optimization strategies to manage their integration efficiently. Market-Based OPF: In the context of deregulated electricity markets, OPF is closely related to market mechanisms. Market-based OPF considers bidding strategies, market clearing prices, and the economic interactions between market participants. OPF plays a critical role in the efficient and reliable operation of power systems, providing a foundation for decision-making in both regulated and deregulated power markets. Researchers and engineers continually work on developing advanced algorithms and techniques to address the evolving challenges in power system operation and planning.

Power system optimization is essential for several reasons, and it's critical to maintaining the electrical grid's sustainability, efficiency, and dependability. In a power system, power optimization is crucial for the following main reasons: Stability and dependability: Power optimization contributes to preserving the power system's stability and dependability. The system can better handle fluctuations in supply and demand by effectively controlling the generation, transmission, and distribution of power, lowering the danger of outages and blackouts. Cost Efficiency: One way to make a power system more cost-effective is to optimize its power. Operational expenses can be reduced by making effective use of resources, such as transmission lines and generating plants. It may also lessen the need to spend money on new infrastructure. Load balancing: Power optimization makes certain that the network's electrical load is dispersed equally. This reduces the possibility of equipment failures and keeps some components from being overloaded. Stabilizing the voltage profile is another benefit of load balancing.

Integration of Renewable Energy: Power optimization becomes essential for controlling the variability and intermittency associated with renewable energy sources, such as solar and wind, as their integration grows. Efficient integration of renewable energy sources into the grid is made possible by sophisticated optimization techniques.

Demand Response Management: Efficient demand response management is made possible by power optimization. During peak times, utilities can proactively manage and shape the demand for power, which lowers the need for costly peaking units and improves system reliability. Grid Planning and Expansion: The planning and growth of the power grid depend on power optimization. It aids in determining the best sites for transmission lines, substations, and new generation facilities, guaranteeing that the grid can effectively handle rising demand.

Impact on the Environment: Improving power systems can help lessen the negative effects that producing electricity has on the environment. The electricity industry can help achieve sustainability goals by reducing carbon emissions and making the most of cleaner, more efficient technologies.

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Grid Resilience: Power optimization makes the electricity grid more resilient to unplanned occurrences like equipment breakdowns or natural disasters. Systems that are optimized can withstand disruptions and continue to provide critical services more rapidly.

Regulation Compliance: Regulations that establish requirements for dependability, efficiency, and environmental performance are frequently applied to power systems. Power utilities can avoid fines and comply with these laws with the use of optimization.

Transmission and Distribution Efficiency: Reducing energy losses during the transmission of electricity can be achieved by optimizing power flow in transmission and distribution networks. Reducing losses increases the amount of electricity that reaches end consumers and boosts the power system's overall efficiency.

Power system engineering and operations research are expanding quickly and merging more and more. By presenting specific power systems issues and the theoretical operations research methods used to address them recently, this review seeks to deepen the linkages between the two communities. Numerous applications of optimal power flow are covered, such as markets, regular operation, unit commitment, network resilience, and expansion planning.

Significance: The OR community is now formulating methods to assist in simulating and tackling these challenges. Techniques like Benders decomposition and various distributed optimisation approaches that have emerged (or re-emerged) in recent OR research continue to be attractive directions for further investigation across all applications of OPF. Similarly, growing kinds or amounts of uncertainty make an issue bigger and are a prevalent characteristic of OR research nowadays. The OR community has numerous opportunities to contribute because of the different types of uncertainty in OPF. Approaches that could be taken include incorporating many sources of uncertainty into problem modelling and implementation. Moreover, this field does not address the question of what kinds of uncertainty (in stochastic, robust, or distributionally robust optimisation models, for instance) should be taken into individual OPF applications.

The aspects of the actual power network that should be incorporated into the models that researchers examine constitute the second interpretation of scale for OPF. This is the main area of smart grid integration, and the OR community initially appears to be the least prepared to manage it. In essence, the OR community needs to decide which choices and technologies to include in a well-thought-out model for an OPF application. This raises questions about how to narrow down the solution space, particularly in relation to the discrete variables required to make these decisions. These could include production technology (like molten salt solar plants), transmission control technologies (like transmission switching, FACTS devices), or smart grid-enabled communications breakthroughs. One of the basic mathematical methods used today to operate power systems is the optimal power flow, or OPF. The power transfer distribution factors (PTDF) can be used to linearize the power flow equations under specific assumptions, producing the so-called DC-OPF.

The DC-OPF problem was originally formulated as a deterministic problem, however it has been rewritten to account for uncertain input parameters. Several DC-OPF formulations are shown in this article to help producing units find the best way to dispatch their power when the demand for electricity is unpredictable. We formulate the problem in terms of chance-constrained, stochastic, and resilient programming. Due to their increasing complexity as a result of growth and interconnection, today's power systems are very prone to experience interference from various stability kinds and related control activities. When control action is considered in an attempt to enhance one stability phenomena, it may worsen the others while leaving out the ways in which they interact in a thorough investigation.

WHALE OPTIMIZATION

Whales are the largest Animal on Earth, are Intelligent as they have spindle cells in their brain. There are 7 types of whale and hump back whale is one of it. They are able to develop their own dialect. Humpback whale size is almost as a school bus. Whale Optimization is a Meta heuristic algorithm, population-based method, proposed by Seyedali Mirjalili et. al in 2016. Humpback Whale hunting strategy includes Prey is discovered, Humpback whale dive 12 metres deep in the sea and Bubble nets are created.

Mathematical models are hence needed for Searching the prey, Encircle prey and Hunt/Attack. Mirjalili and Lewis (2016) introduced the whale optimisation algorithm (WOA), a nature-inspired metaheuristic optimisation technique. This algorithm has demonstrated its capacity to resolve a wide range of issues. A comprehensive and meta-analysis evaluation of WOA is carried out to assist researchers in utilising it in various contexts or combining it with other widely used algorithms.

Fig.1 Hunting Strategy of Whale

In this case, the co-efficient vectors are C and a, the maximum iteration is MaxT, the distance vector is D, and the location is X. Over the course of the iterations, the elements of a linear decrease from 2 to 0, where r is a random vector in the interval [0;1]. The search agent can reach any point surrounding the reference person by changing the values of A and C.

- a= 2-2*t/ MaxT

- D =|C* Xrand (t) – X (t) |

- X (t+1)= Xrand (t) – A*D

- C = 2*r where r is random value [0,1]

Determining whether the Whale Optimization Technique (WOA) is better than Particle Swarm Optimization (PSO) or vice versa depends on various factors, including the specific problem at hand, the characteristics of the optimization landscape, and the preferences of the user. Here are some points of comparison between WOA and PSO:

Nature of Inspiration: WOA is inspired by the social behaviour of humpback whales, while PSO is inspired by the social behaviour of bird flocks or fish schools. The different sources of inspiration lead to distinct algorithms with unique search mechanisms.

Search Mechanism: WOA imitates the movements of whales by incorporating both stages of exploration and exploitation. Particle- social interactions, on the other hand, are what define PSO. Every particle modifies its location according to both its individual and the swarm's collective best-known solutions. The two algorithms have different tactics for exploration and exploitation.

Parameter Settings: Both WOA and PSO require tuning of parameters for optimal performance. The choice of parameters, such as inertia weight and acceleration coefficients in PSO or coefficients in the equations

of WOA, can significantly affect the algorithms' convergence and exploration capabilities.

Convergence Speed: The convergence speed of an optimization algorithm is an essential factor. Some problems may benefit from a faster convergence, while others may require a more balanced exploration-exploitation trade-off. The convergence speed can vary between WOA and PSO, and the superiority of one over the other depends on the characteristics of the optimization problem.

Handling constraints: Both WOA and PSO can be adapted to handle constraints in optimization problems. However, the specific approaches may differ. PSO often uses penalty functions or repair mechanisms, and WOA may employ similar techniques. The effectiveness of constraint handling depends on the algorithm's ability to explore and exploit the search space while satisfying constraints.

Robustness and Sensitivity: The robustness of an optimization algorithm refers to its ability to perform well across different types of problems. Sensitivity to problem characteristics may also play a role. Some algorithms may be more versatile, while others may be tailored to specific types of problems.

Research and Application Context: The field of optimization is dynamic, with on-going research leading to improvements and adaptations of existing algorithms. The choice between WOA and PSO may be influenced by the specific needs of the application and the availability of well-established implementations or modifications.

Ultimately, the "better" algorithm depends on the specific optimization problem, and it is common practice to compare the performance of different algorithms on benchmark problems or real- world applications.

Experimentation and empirical evaluation are crucial for determining which algorithm is more effective for a given task. Researchers and practitioners often choose algorithms based on their experiences, problem characteristics, and computational resources available.

OPTIMIZATION TECHNIQUE

SEARCH THE PREY: A is used to search for prey. If A>1, new individual is far away. A= 2*a*r- a where A

is convergence factor. Whale optimization Algorithm is being run on MATLAB and result is being checked and it's obtained as shown in Figure 2.
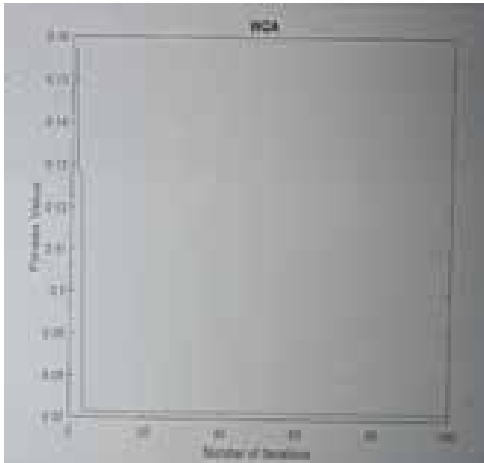
Fig. 2 Results

Encircle The Prey: Humpback Whale will encircle once prey location is confirmed.

- D=|C* X~(t) – X (t)|

- X (t+1)= X~(t) – A*D

where X~(t) denotes position vector of the best solution. Shrinking Encircling Mechanism includes Decrease the value of a, When | A| <1, agent approaches to current optimal solution, Components which are of 'a' are decreased in a linear fashion from 2 to 0 over various course of iterations, Value of A is another random value in the interval of [-a, a].

Hunting Method: The best candidate solution is the intended prey, and bubble net feeding is the behaviour of whales foraging. Other search agents will adjust their places in relation to the best search agent once it has been determined WOA assumes current optimal solution as Prey position. Current best fitness values is consider minimum value among all (i.e., near to optimal point). We can test algorithm on different benchmark function. Prey = Optimal Solution / best candidate solution and other are candidate solutions. e power bl value in the equation is exp (b*l). p is random value. in between [0,1]. Each time you will get different random value. Calculate the distance between Whale and Prey position.

D'=|X*(t) – X (t)| is the distance between the prey, the best solution, and the ith number; in it, l is a random number in [-1;1] and b is a constant. X (t+1) = X*(t) + D'.ebl. Cos (2−l). X (t+1) = X*(t) – A. D, p<0.5, and X (t+1) = D'.ebl. Cos (2−l) + X*(t), p<0.5, are the results. In [1] The algorithmic underpinnings, features, restrictions, adaptations, hybridizations, and applications of WOA are covered in detail. WOA performances are then shown to address various issues. The most popular optimization techniques and WOA are contrasted with the statistical outcomes of WOA alterations and hybridizations. The survey's findings show that WOA outperforms other widely used algorithms in terms of convergence speed and exploration-exploitation balance.

According to the comparison of results in [2], the EWOA-OPF outperforms earlier comparing algorithms in solving single- and multi-objective OPF problems. The OPF problem considers three factors: fuel cost reduction, reactive power loss minimization, and active power loss minimization. The system's control parameters are changed to address these issues. The Flower Pollination Algorithm (FPA), Particle Swarm Optimizer (PSO), and other well-known techniques are compared to the results obtained by WOA in [3]. When compared to these and other well-known strategies, the findings show that WOA delivers better optimisation values for the scenario, proving the effectiveness of the recommended methodology. [3]

Using the centralized and decentralized control modes, various optimization techniques are shown in[4] to solve the security- constrained optimal power flow between two connected regions. The method that is most frequently employed is called decentralized control, in which each power system manages its own variables independent of the boundary buses. The two elements that can lessen changes in comparison to the decentralised control technique are the voltage buses on the borders and/or the active power of the producing units. For this reason, centralised control has recently been utilised to increase system security. The optimization methods suggested use the Genetic Algorithm (GA) as a tool to confirm the outcome of the Whale Optimization Algorithm.

CONCLUSIONS

Many researchers work with different optimization techniques but still the issue is not solved. Simulation result does not reproduce exact result that would be obtained on site. Very accurate weather forecasts are needed. Finding the best design takes less time when energy modelling and optimization are handled by MATLAB on a single platform, and compatibility problems are avoided. The optimization outcomes and the consequences of real-time control still varied somewhat. Improved discrete variable integration in the optimization problem. Better integration of discrete variables in the optimization problem definition is needed. The optimization problem becomes stiffer with increase in the degrees of freedom. As more and more variable renewable energy resources are added to the system, with constant increase in the energy demand, need of flexibility becomes more important.

ACKNOWLEDGMENT

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Beam Scheduling scheme for Interference Suppression in Millimeter-Wave Cellular Network toward 5G

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ABSTRACT

Nowadays IoT is becoming a main contributor to a drastic and rising wireless communication. Millimeter wave communication is investigated to be an obligatory alternative for the next generation system .The purpose of this paper is to give an outline on the problem of interference and its impact on performance metric during scheduling .This problem becomes more interesting and significant when two technologies are partially blended. In particular, this technology need a data transmission from more than single user that can not coexist successfully in the same time slot .But adjusting the transmission power and bit rate ,several user can communicate successfully simultaneously. Advance beam scheduling technique SINR is proposed in this paper to achieve more enough resource allocation. Comparing new scheduling described below and basic RR scheme ,simulation experiment were carried out for comparing their ability to restrain the interference between beam at millimeter wave pico station. To solve the above interference issue ,we tend to plan beam scheduling technique in this paper .Specifically signal to interference noise ratio(SINR)simulation result for performance indicator, indicate that cell latency and throughput shows the improvement in their performance in respective user equipment. In 5G mm wave network, competent data retransmission and better bandwidth resource with lower latency and higher throughput are the best outcomes of scheduling scheme described in this paper .The simulation result described that the proposed scheme significantly perform better than that basic round robin scheduling scheme. The SINR achieve the gain 70% at 60 GHZ over the Round Robin scheme

KEYWORDS : *Millimeter wave, SINR, 5G,Wireless communication.*

INTRODUCTION

The first millimeter wave communication was experimented by bose more than 100 years ago reasoning to frequencies from 30-300GHZ range. In recent years wireless communication has alleged amazing enhancement of mobile data communication .It is even conceptualized that to complete a current requirement ,cellular networks require to deliver as much thousand times of the available capacity. Today's cellular suppliers aim to deliver higher limits and quality for wireless devices. But suppliers are limited to carrier frequency spectrum and hence offer limited available bandwidth. In 5th generation mobile networks, some of the vastly probable technologies such as massive multiple input multiple output(MIMO)which employs the large bandwidth such as 5G mm wave bands with the wide range from 30GHZ to 300 GHZ in one of the most favorable directions of employed wireless networks. .Recent research has demonstrated the feasibility of mm wave cellular communication wave at 28 GHZ.In this paper we demonstrated mm wave communication with 60 GHZ. Through the propagation measurement directed in a metropolitan environment ,continuous exposure can be achieve with the potential of offering an amount of magnitude add to in capacity in current 4th generation network(4G).Millimeter wave

band is effective in the scientific, industrial and research purpose in spectrum between a wide range of 30GHZ to 300GHZas shown in figure 1.
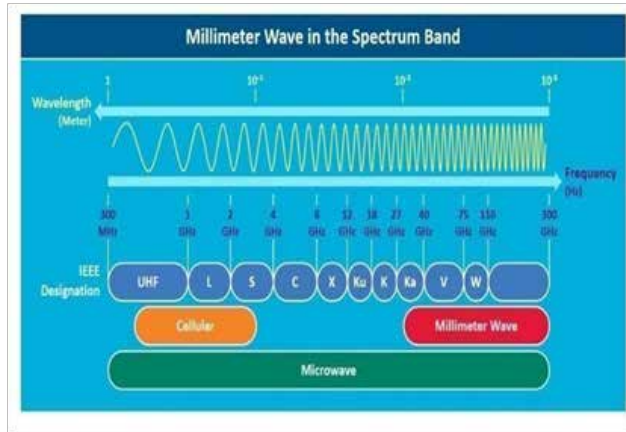
Fig. 1 The band of spectrum ranging from 300 MHz to 300 GHz.

This band is available to researchers for 5g wireless broadband technology on millimeter wave spectrum .Millimeter wave technology is being speedily adopted by users varying from enterprise level , data center to single consumer demanding a higher bandwidth for the wireless devices. Therefore newer and advanced technologies are invented to relieve this higher data transmission rates which seems bigger than ever before in wireless communication. A wide choice of technologies occur for the delivery of high outturn through fiber optic cable .Fiber optic is matchless in consideration of economic factors.MM wave technology offer the potential to hand over competence like that of the fiber optic .Mutual interference against the different network and different user is unavoidable factor which affect the system performance accordingly consider in the system performance in network design .Wide investigation in mm wave communication for 5G wireless communication is intended by the result of studies of multiple gigabyte per second transmission for indoor and outdoor environments. The Prospective band of Frequency range from 27 GHZ to 300 GHZ is called millimeter- wave region or millimeter wave spectrum millimeter wave. (mm wave)spectrum is being explored and permitted to supply a massive, developed bandwidth for individual and industrial usage. Recently modified 3gpp (third generation partnership project)has invented to acquire the features of 4G in allied inspection in

a range of 5G wireless communication It tends to conclude to mobile device to line up a right away link while not traversing a bottom station that considerably reduce the network load and increase spectrum potency. Beamforming is one of the ways to atone wave that boost the signal receiving probability in mm wave communication. It can be shaped normally distributed in a specific domain .In order to capture the specific area to come in range ,one of the most feasible features of next generation wireless communication systems that make it reachable is to form a sizable amount of narrow beam to meet the growing traffic explosion and reduce an obligated amount of interference. Looking ahead to the years beyond 2030, the proliferation of data-intensive applications and the exponential expansion of wireless networks will necessitate the development of sixth-generation (6G) communication systems. These systems will represent a substantial advancement from 5G networks, encompassing coverage across nearly the entire surface of the Earth and extending into near outer space. Millimeter-wave technologies will continue to play a pivotal role in achieving the envisioned network performance and fulfilling communication requirements in both 5G and future 6G networks.

RELATED WORK

Some of the contradictory issues in scheduling schemes can be compared on the basis of algorithms used to develop the scheduling scheme. In comparison of the performance of three scheduling scheme such as round Robin ,power factor scheduler and proportional fair scheduler in different environmental situation of user equipment by transmitting a real time voice packet to examine the behavior of each scheduler [1]. In a particular communication channel performance metric such as throughput delay and channel capacity at uplink as well as downlink can also be determined for comparison of three scheduling method such as round robin, power factor scheduler and professional fair scheduler[2]. In hybrid wireless and wired network one of the powerful approach to report the serious error occur in system parameter in communication channel is a cross layer design [3].It can improve the performance metric such as spectral efficiency as well as channel capacity in a different communication channel But major and immense complexity in system is ,it is easy

to find a suitable cross layer retransmission scheme for each service class[4] .To overcome ambiguous difficulties in cross layer ,end to end procedure should implement to decide if parameter suitable for each service class. Scheduling is the process of allocating processes to the machine in order to optimize function [5][6].There are many algorithms used for scheduled processes. The RR algorithm is very helpful in time sharing techniques and a real time operating system to schedule the beam[8]. Different CPU scheduling algorithms use various recital characteristics for the selection procedure using various criteria in order to implement in system[9] . While millimeter waves offer advantages such as high data rates and increased bandwidth, they also pose challenges. One significant challenge is their limited ability to penetrate obstacles like buildings and vegetation, which can affect their range and reliability. To address this, technologies like beamforming and phased array antennas are often used to focus and direct millimeter wave signals[10]. This paper reviews pertinent millimeter-wave enabling technologies, encompassing recent advancements in system architectures, active beamforming arrays, beamforming integrated circuits, base station and user terminal antennas, as well as system measurement, calibration, and channel characterization. Additionally, it briefly examines the requirements of each component for future 6G communications[11].

PROPOSED METHOD

The simulation environment is set up and experimental results in the form of accurate data are presented and analyzed in this section. The simulation experiment involved simulating the 5G mm wave network architecture through matlab simulating code. The performance of the proposed interference suppression scheme is evaluated by a system simulation program executed in matlab software based on the system model in which mmwave pico stations are superimposed with a macro cellular network. . In every simulation one pico station from six pico cell groups are randomly dropped in each microcell forming a small network .Inside each pico cell 20 UE are randomly distributed .In the described network scenario , micro cellular network is accumulated by mm wave pico station.

The distance between UE and pico station ranges from 5m to the maximum pico cell radius 45m UE chooses to communicate to either micro cell or pico cell. Basically preliminary simulation assumption and parameter configuration of macro network are taken for the 60GHZ.There are 16(4x4) antenna element mounted on the plate of the pico cell to form one transmitter beam and the maximum antenna gain is 28dB with about 7 beam width on both azimuth and elevation planes. The simulation is performed in 5G mm wave network architecture by setting the experimental scenario in the MATLAB software compatible simulation program. In the network scenario, a micro cellular network is accumulated by mm wave pico stations ,to evaluate relevant performance metric continuous simulation tests were carried out. Two performance parameters, throughput and cell latency are measured when SINR and original RR were simulated and tests were carried out using 10, 20, 50, and 100 UEs for throughput and 20, 60, 80, and 100 UEs for cell latency.

RESULT ANALYSIS

In this paper we publish the result of mutual interference in the 5G MM wave network , a simulation experiment is carried out using 5,10,30 and 100 UEs(user equipment). Experimental program code for this simulation is executed in Matlab software simulation program to exhibit the performance metric such as throughput and cell latency shown in fig 2 and fig 3.In SINR method presented in this paper ,cell latency is lower and higher throughput than basic RR can be achieved. Moreover with the increase in UE quantity ,the reduced cell latency was significant, on the contrary of simulation results of RR with the different UE can hold the higher cell latency according to the simulation performed in these new scheduling techniques, throughput can get higher values compared to the RR. In addition to increase in the user quantity ,simulation results indicate significantly greater throughput and lower cell latency.

From the simulation performed in the network scenario as described above and table I and table II it is observed that the interference in 5G MM wave wireless network is primarily influencing the interference depending upon the number of active link. This result provide practical observation and reference of MM wave design in 5G deploying network.
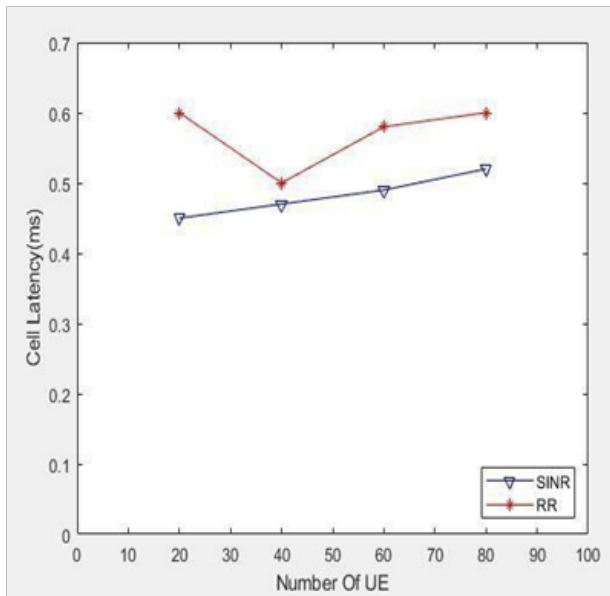
Fig. 2:Cell latency comparison of SINR and RR

Table 1. Cell Latency Comparison of SINR and RR

Sr. no.	Cell latency comparison of SINR and RR		
	UE	RR	SINR
01	20	0.6	0.44
02	40	0.49	0.45
03	60	0.55	0.47
04	80	0.6	0.5
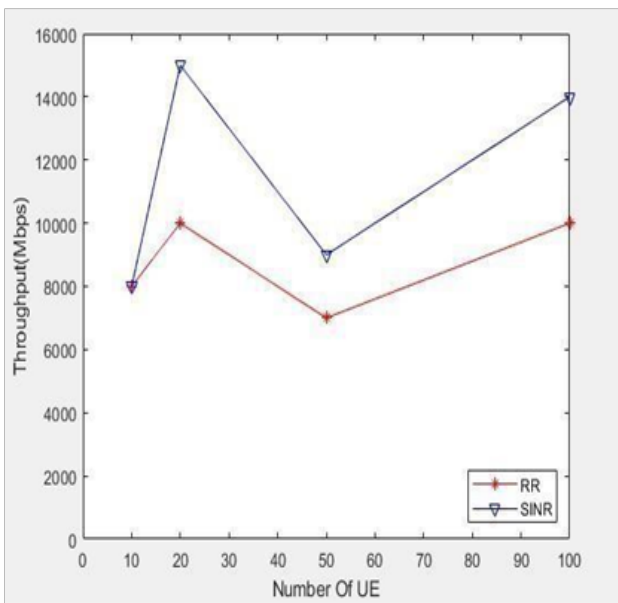
Fig. 3: Throughput comparison of SINR and RR

Table 2. Throughput Comparison of SINR and RR

Sr. no.	Throughput comparison of SINR and RR		
	UE	RR	SINR
01	10	8	8
02	20	10	15
03	50	7	9
04	100	10	14

CONCLUSION

This paper concluded that to make the improvement in original RR issues of 5G MM wave, SINR scheduling scheme is proposed. For the resource allocation of 5G network ,basic RR scheme facing the problem in the data transmission in effectiveness and interference causing the network resource loss ,hence SINR scheme reduces losses due to interference by scheduling the beam in the network scenario described by the 5G wireless technology in the basic RR issues of the 5G MMwave network. Through the SINR scheduling proposed in this paper ,transmitted signals are scheduled and thereby reducing the cell latency by increasing throughput. Also we performed the simulation to compare SINR with RR scheme for the performance indicator like cell latency and throughput . The simulation result indicates cell latency reduces and improves in the Throughput and spectral efficiency. In the present RR issues of 5G mmWave to make improvements and put forth the SINR scheme. Through the SINR scheme proposed in this paper, transmitted signals are scheduled and thereby reducing Cell latency, increasing Throughput. Also, we performed simulations to compare SINR with RR schemes using Key Performance Indicator in terms of Cell latency and Throughput. The simulation results indicate that Cell latency reduces and Throughput can get improvement in 20UEs, 40UEs, 60UEs, 80UEs and 10UEs, 20UEs, 50UEs, and 100UEs, respectively. Consequently, experiment results have proven that the SINR scheme is more effective and efficient that RR under the 5G mm wave network. In the future we will perform more simulations to consider other performance indicators like cell loss probability and data failure ratio and evaluate this in the described network scenario to enhance the fair allocation of network resources and better processing performance under the 5G MM wave architecture.

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Employee Attrition Prediction: A Machine Learning Approach

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ABSTRACT

Employee attrition poses significant challenges for organizations globally, particularly in the dynamic Indian job market. The goal of this research project is to create an employee attrition rate prediction model specifically for the Indian environment. Machine learning techniques are utilized to construct a strong attrition prediction model by utilizing past employee data. The model takes into account a number of variables, such as work-life balance, salary, job satisfaction, and demography. The outcomes of this project empower Indian organizations with a valuable tool to anticipate and mitigate attrition, fostering a stable and productive work environment.

INTRODUCTION

Employee attrition has become a major worry for enterprises worldwide in the changing modern employment landscape. The loss of key talent not only impacts business continuity, but also results in significant hiring, training costs and loss of productivity. In the context of India, where a diverse array of industries thrives and a burgeoning job market exists, the challenge of employee attrition takes on unique dimensions. This project sets out to address the pressing issue of Employee Attrition Rate Prediction. Our study aims to create a strong predictive model that can foresee staff attrition by utilizing data and machine learning. By leveraging historical employee data collected from diverse Indian organizations, we aim to uncover the underlying patterns and drivers of attrition. Our study aims to create a strong predictive model that can foresee staff attrition by utilizing data and machine learning.

Need and Motivation

High attrition rates impact organizations economically and operationally. This research aims to save resources by predicting attrition, maintaining workforce stability, and preserving institutional knowledge. Proactive measures can be taken, such as knowledge transfer and succession planning, to mitigate the negative effects of attrition.

Basic Concept

The Employee Attrition Rate Prediction project involves using historical employee data to build a predictive model for managing employee turnover. Preprocessing, feature selection, model training, evaluation, and data collecting are all included. The intention is to enable businesses to lower attrition, cut expenses, and establish more morally and productive work environments.

RELATED WORK

Numerous researchers have tackled different elements of the problem, used a variety of approaches, and made substantial contributions to the fields of workforce management and employee attrition prediction. A few noteworthy works in this field are highlighted in the literature review that follows:

Predictive Model of Employee Attrition

A reciprocal learning-based prediction model was presented by Chung et al. [1]. Their research examines the developments in artificial intelligence, specifically

as they relate to human resource management. By leveraging ensemble learning techniques, the model aims to enhance efficiency and reduce employee attrition rates.

Handling Business-to-Business Relationships under Conditions of Employee Attrition

The relationship between business-to-business interactions and employee churn is examined by Kumar and Yakhlef [2]. In order to lessen the negative effects of employee attrition on customer relationships, the study highlights the significance of relationship transparency, proactive information sharing, knowledge preservation, and prompt management action.

Attrition in Software Companies: Reasons and Measures

Pallathadka et al. [3] focus on the software industry, a sector with a unique set of challenges related to attrition. The paper discusses the strategic approach that top IT companies in India adopt, emphasizing the need for meticulous assessment of an employee's career phases and investment in initiatives prioritizing professional development.

Applying Machine Learning Algorithms to Predict Employee Attrition

Fallucchi et al. [4] carried out a thorough examination of the objective elements affecting employee attrition. The goal of the study is to pinpoint the primary factors that influence an employee's choice to depart from a company. The application of machine learning techniques, such as the Gaussian Naïve Bayes classifier, produced encouraging outcomes.

Stacking-Based Employee Attrition Prediction and Its Assessment

In order to forecast employee attrition, Rema et al. [5] investigate the use of several classification methods, including SVM, Random Forest, Decision Tree, Logistic Regression, and an Ensemble model. To create a forecast model that is more accurate, their method entails evaluating both historical and current data.

Improving Employee Retention by Predicting Employee Attrition of employees

Salunkhe [6] makes a contribution to the field by emphasizing enhancing worker retention. The dissertation uses a multi-phase methodology that includes analyzing what influences an employee's intention to resign, anticipating attrition, and identifying valuable personnel.

Predicting Employee Attrition through Machine Learning

Kadlag et al. [7] stress the significance of employee retention in HR analytics. The study investigates the correlation between employee attributes like job role, overtime, and job level with attrition. Various classification algorithms, including Random Forest, were used to predict attrition probability.

Approach for Predicting Employee Churn by Using Data

To forecast employee churn, Yigit and Shourabhizadeh [8] use popular classification techniques such Decision Tree, Logistic Regression, SVM, KNN, Random Forest, and Naive Bayes. Their research offers useful information for forecasting employee attrition status, which can assist businesses in cutting human resource expenses.

Analysis of a Random Forests Model

Biau [9] focuses on the prediction of employee attrition using machine learning classification models, particularly Decision Trees, Support Vector Machines, and Artificial Neural Networks. Finding the most effective model to anticipate attrition and make timely interventions is the goal of the project.

Using Machine Learning to Forecast Employee Turnover

A thorough examination of a random forests model for forecasting staff turnover is carried out by Mansor and Aliff [10]. In order to provide light on the mathematical underpinnings of the technique, the paper investigates the statistical characteristics of random forests.

PROPOSED METHODS

Data Collection

In this research, the data collection process draws inspiration from several established works in the field of employee attrition prediction. Doohee Chung et al. [1]

and Nishant Kumar et al. [2] emphasize the significance of demographic and relationship-related factors in predicting attrition. We aim to collect a comprehensive dataset covering these aspects, including demographics, job-related information, and performance metrics, aligning with the methodologies outlined in these references.

Data Preprocessing

The preprocessing steps are influenced by the insights provided by Fallucchi et al. [4] and Rema V et al. [5]. Using exploratory data analysis approaches, standardizing features, and addressing missing values are all part of our strategy. As these earlier research demonstrate, this preserves the integrity of the dataset and increases the resilience of our predictive model.

Feature Selection

Harikumar Pallathadka et al. [3] describe the importance of identifying factors that influence abuse in software companies. Leveraging their insights, our feature selection process aims to pinpoint the most influential variables using advanced techniques, contributing to the efficiency and interpretability of our model.

Model Selection and Training

Building upon the predictive modeling frameworks proposed by Rema V et al. [5] and Gerard Biau [9], we plan to consider a variety of machine learning algorithms, including stacking ensemble learning. The training process will be conducted on carefully partitioned datasets, emulating the methodology demonstrated in these referenced works.

Model Evaluation

The evaluation criteria for our model are aligned with the performance metrics discussed by Doohee Chung et al. [1] and Ibrahim Yigit et al. [8]. We guarantee a thorough evaluation of the prediction model's efficacy by integrating measures like accuracy, precision, recall, and F1-score, which align with the industry norms mentioned in these sources.

Deployment and Integration

Taking cues from Tanmay Prakash Salunkhe [6], we recognize the importance of seamless integration into HR systems for real-time decision-making. Our

deployment strategy aligns with the principles outlined in this reference, ensuring practical applicability in organizational settings.

Ethical Considerations

The ethical considerations in our study are influenced by Abhilasha Kadlag et al. [7] and the insights provided by Norsuhada Mansor et al. [10]. We emphasize fairness, transparency, and responsible use of the attrition prediction model, addressing the ethical concerns raised in these referenced works.
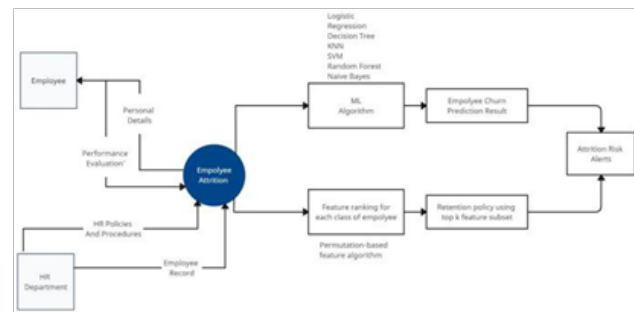
Fig. 1 Control Flow Diagram
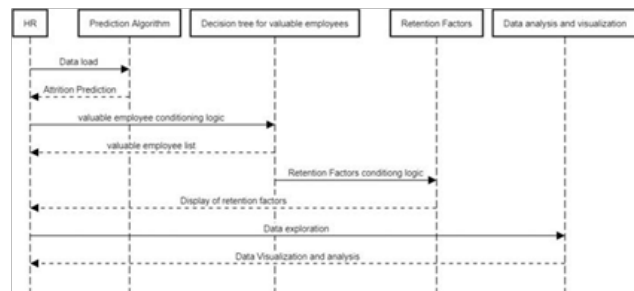
Fig. 2 Sequence Diagram

IMPLEMENTATION

In this section, we present the outcomes of our project on Employee Attrition Rate Prediction. The research focused on developing a predictive model to anticipate employee turnover and identify key drivers of attrition within the Indian job market.

Data Collection

We gathered historical personnel data, such as records of departures, performance indicators, job-related information, and demographics. The dataset was preprocessed to handle missing values, standardize features, and ensure compatibility with machine learning algorithms.

Predictive Performance of model

We used a variety of machine learning algorithms, such as neural networks, logistic regression, random forests, and decision trees. The model is assessed according to its F1 score, recall, accuracy, and precision.

With an overall accuracy of 0.8370, the predictive model performed admirably. The recall score was 0.2186 while the precision score was 0.520.

Key Attrition Drivers

Through analysis of feature importance, we identified key factors influencing employee attrition. Notable drivers included satisfaction level, last evaluation, time spend company.

Visualization

Ethical Considerations

We ensured compliance with data privacy regulations and ethical standards throughout the project. All data handling procedures adhered to ethical guidelines.

CONCLUSION

In conclusion, the proposed predictive model, specifically tailored to the nuances of the Indian job market, holds considerable promise in addressing the critical concern of employee attrition. As organizations grapple with the dynamic challenge of retaining talent, the developed model stands as a valuable tool in predicting and managing attrition effectively. By leveraging additional data and refining the model further, there is a clear opportunity to enhance its accuracy and applicability. The commitment to ongoing monitoring and HR intervention feedback underscores our dedication to ensuring the project's sustainability and its ability to support organizations in navigating the ever- evolving employment landscape in India.

FUTURE SCOPE

The future work for this project entails several avenues for improvement and expansion. First and foremost, refining the model with additional data will be crucial to enhancing its predictive capabilities. Additionally, exploring real-time prediction capabilities can elevate the model's responsiveness and relevance in a fast-paced business environment. Furthermore, extending the application to other geographical markets beyond India could broaden its impact and utility. As employee attrition remains a critical concern for organizations globally, the continuous effort towards improvement and adaptation ensures that the project stays relevant and valuable in helping organizations thrive amid the complexities of the modern employment landscape.

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From Theory to Practice: Implementing Effective Database Management Techniques

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ABSTRACT

Meeting ever-increasing data management needs requires a solution that guarantees unlimited Achieve while maintaining high performance, massive parallelism, and high availability New sorts of uses, for example, business insight, venture investigation, client relationships the executives, report handling, person-to-person communication, and cloud computing require large collections of structured and unstructured data sets that traditional RDBMSs require. is. Processing requires horizontal scaling to thousands of nodes as needed. Manage failure. In processing distributed processing and big data applications using huge numbers of servers The speed with which interactive applications generate data from large numbers of concurrent users exceeds the capabilities of relational databases, leading to the adoption of SQL databases receiving increasing attention. SQL database systems are related to Relational databases and have several common issues, including scalability, performance, data redundancy, and data integrity. Solutions to these problems include sharing, indexing, normalization, and transactions. Other types of databases have also been developed, including B. NoSQL databases address some of these issues in different ways. This paper describes various database management systems and evaluates their basic design principles: ACID, and basic rules to store the data.

KEYWORDS : MySQL, Database, ER diagram, Relational algebra, ACID, RDBMS, Normalization.

INTRODUCTION

Data and types of data

Before we can define a database, we need to know what data is, what kinds of data there are, and how to categorize them. Information are snippets of data that have been changed into a configuration that can be effectively moved about or handled by PCs. Data is information that has been converted into binary digital form for use in today's computers and transmission technologies Information can be alluded to in either the particular or plural The simplest digital form of When we refer to data that has not been processed or analysed, we call it "raw data." From a database perspective, there are three types of data: structured data, unstructured data, and Semi-organized information.

Let us elaborate on them:

Structured data

Many of us are familiar with working with structured data, which is mostly quantitative in nature. This type of data neatly fits into the defined rows and columns of information bases and bookkeeping sheets. Instances of organized information incorporate names, dates, addresses, Visa numbers, stock information, geolocation, and other comparable information. Machine learning can quickly and accurately process highly organized data.

Unstructured data

Unstructured data is commonly referred to as subjective information, which cannot be processed or evaluated by traditional data tools and methods. Examples of unstructured data include text, audio and video files, social media posts, mobile activity, satellite imagery, surveillance images, and more. Due to the lack of a predetermined data model, it is challenging to analyze unstructured data, and it cannot be organized in relational databases. Non-relational or NoSQL databases are ideal for managing unstructured data. Another way to handle it is to allow unstructured data to flow into a data lake and remain unprocessed.

Semi-organized information

Semi-organized data is a kind of data that falls among organized and unstructured data. It doesn't utilize a formal or severe information model, yet it incorporates names and semantic labels that sort out information into records and fields inside records. An illustration of semi-organized information is JSON. Unstructured data is more complex than semi-structured data, but semi-structured data is simpler. It is likewise simpler to store than unstructured information and can overcome any barrier among organized and unstructured information.

Clients of social information bases can rapidly enter, look for, and control organized information with a social data set administration framework.

This is the most appealing element of efficient information. Organized Inquiry Language (SQL) is a coding used to oversee organized information. This language, developed by IBM in the early 1970s, stands out for its handling of database-related issues..SQL makes it easy to connect to databases and build management information systems.SQL Server Integration Services is very useful for large enterprises that need to store and manage large amounts of data. Storing and collecting data from different departments can be difficult, but Visual Studio for SQL can simplify these services. To become an expert in this programming language and analyse analytics services, you may need to use a basic SQL project. Further practice with SQL software analysis projects can be beneficial in advancing your career and allowing you to acquire relevant skills. This paper introduces some SQL project ideas for beginners, intermediate, and advanced users.

A database is a collection of data Usually one person or Other related organizations. For example, one University databases may include: Information about:

- Units such as students, teachers, students, etc. courses and classrooms.

- Relationships between entities.

Registration of students to courses, departments Regarding courses, and room usage for courses.

Database management system or DBMS is Maintaining and using large collections of Data and the need for such a system because its use is increasing rapidly Instead of using a DBMS, you can also use ad hoc. An approach that cannot be taken alone Application to another.

For example, for storage

Write application-specific code to save data to files and manage it Utilizing a DBMS to oversee information enjoys benefits.

Data independence

The application program looks like this: It is as independent as possible from displaying and storing data details. You can provide an abstract view of your data and separate your application code from such specifics with a DBMS.

Data security and integrity

If you want data to be accessible at all times, a DBMS can enforce consistent data limits. For example, you can use the DBMS to check the department before entering an employee's salary information. The budget has not been exceeded. Another thing a DBMS can do is implement access controls and manage targets. The data is visible to different classes of users.

Efficient information access

DBMSs use a variety of functions. Advanced storage technology and efficient data retrieval. This feature is especially important when storing data. External storage device.

Data management: When multiple users share data, centrally managing data, Provides significant improvement. experience Experts who understand the essence What data is managed and how is it different? The user group that uses it may be responsible for this

Composition of data representation Minimize and fine-tune redundancy Saving data for searching Efficient.

Simultaneous access and crash recuperation

DBMS plans simultaneously Access the data in the following ways: Users can think of data as She can only be gotten to by one client at a time. Much further away

A DBMS safeguards clients from the accompanying impacts:

Error in the system. Diminish application advancement time: DBMSs support a large number of these. Significant highlights normal to everybody Numerous applications access put away information

DBMS. In this connection,

High-level interface to data facilitated Rapid application development. like that Applications can also be more robust As an application developed from scratch, many important tasks have been completed and Handled by the DBMS rather than implemented Through the application.

What does a DBMS do?

The database management system also provides some features Simple file management:

•   Simple record the board:

•   Enabling data independence

•   Providing a non-procedural query language Performing automatic query optimization

•   Controlling redundancy

•   Ensuring data integrity

•   Providing backup and restore

Data Perception

Interconnected files and numerous programs Allow users to access and modify these files. The main purposes of a database system are: Provides an abstract view of the user data. That is, certain details regarding the storage and care of data are hidden by the system.

Abstraction of data

For the framework to utilize it, information should be recovered proficiently. Designers have used complex database data structures in ways like this Express as a result of the need for efficiency. Developers use multiple levels of abstraction to hide complexity from users in order to simplify user and system interaction because there are numerous databases and system users do not have computer skills.

•   Physical level: lowest level

The term "abstraction" refers to a description of the data that has been stored.

•   Legitimate level:

The whole arrangement of the data base, for instance, the relationship among data, the plan of data, etc are depicted at this level. Informational collection goals and security are furthermore done in this level of plan. The DBA maintains this level.

•   External level:

The client doesn't have to know the data set composition subtleties, for example, information structure, table definition, and so on. client is just worried about information which got once again to the view level after it has been brought from the data set (present at the inner level).

The outer level is the "high level" of the Three Level DBMS Engineering.

Instance and Schema

Plan of data set at sensible level is called legitimate diagram, software engineers and data set chairmen work at this level, at this level data can be depicted as specific kinds of data records moves set aside in data structures, yet the internal nuances, for instance, execution of data structure is hidden at this level (available at genuine level). An instance of a database is the data that is currently stored in the database.

Types of Database

The Data Model provides us with an idea of the final system's appearance following its full implementation.

It characterizes the information components and the connections between the information components.

1. Hierarchical Model 2. Network Model 3. Entity-Relationship Model 4. Relational Model 5. Object-Oriented Data Model

Hierarchical Model model

This particular model is designed to arrange data in a hierarchical tree structure. The structure begins with a root that contains the root information and extends in a tree-like style by adding youngster hubs to parent hubs. This model is particularly useful in representing some real-world relationships such as food recipes, website sitemaps, and so on.

The Network Model

This model is an expansion of the different evened-out models. It was the most eminent model before the social model.

This model is indistinguishable from the different levelled out model; the essential capability is that a record can have more than one parent.
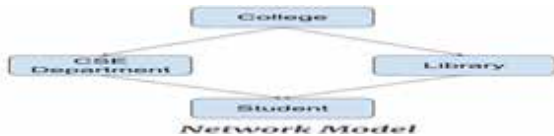
Element Relationship Model

The Substance Relationship Model, also known as the Trauma Centre Model, is an advanced data model diagram. It addresses real-life issues in a simplified way through its pictorial design, making it easier for partners to understand. By just looking at the emergency room graph, designers can easily comprehend the framework. The visual gadget used in this model is the cable car place frame. The Trauma Center Graph is divided into three sections: Entities, which refer to anything tangible such as a person, place, or concept. Example: Instructors, Understudies, Courses, Structures, Divisions, and so on are a portion of the elements of a School the executive's Framework.

Attributes, Entity, relationship

The element relationship model (emergency room model) depicts the design of an information base with the assistance of a graph, which is known as the Substance Relationship Chart (Trauma Center Outline).

Model of Relationship

In database management, the Relational Model is the model that is used the most. In this model, all of the data is stored in rows and columns in a two-dimensional table. The fundamental plan of a social model depends on tables, which are otherwise called relations in the social model.

Emp-id	Emp-name	Job-name	salary	mob	Dept-id	Project-id
001	adam	engineer	50000	98787	E1	EP
002	john	analyst	60000	77285	A1	AP
003	neha	manager	80000	45289	M1	MP

Model of Object-Oriented Data

The Social Model is the most generally utilized information model. A two-layered table is used to organize the data in this model. Each piece of data is represented as a row and column. The fundamental structure of a Social Model consists of tables.

In the relational model, therefore, the tables are also referred to as relations.

Links connect two or more objects in this model. To connect objects, make use of this link. This can be perceived from the accompanying model.

Data set question language:

The report objects and database query language make it possible for users to interact with the database, analyse its data, and update it by their requirements. privileging access to data Likewise, Information base security. information security

Seen by unapproved clients, Refreshing information base. utilizing passwords; A subschema, also known as access to the entire A database, is made available to the user. For example, you can do this with your employee database. Contains all data about an individual Can include groups of users as well as employees Grant permission to view salary data only Others can only access work Medical history and medical data. If your DBMS provides a way to do this

Enter and update the database interactively. This

ability as well as questioning it Manage your database. However, there may be no audit trail left Act or provide a type of control This is required in multi-user organizations. These controls are only available if the set exists. Part of the application program is customized for All data entry and update functions. data A structure is a logical representation of:

Relationships between individual elements and data.

Transaction Management in DBMS

An exchange is a bunch of sensibly related tasks. If you were to transfer money from your bank account to the account of a friend, for instance, the sequence of operations would look like this:

Simple Transaction Example

1. Read your record balance

2. Take the sum from your account balance. Make the abundance balance to your record

4. Peruse your companion's record balance

5. Add the sum to the equilibrium of his record.

6. In his account, write the updated balance.

A transaction is the entire arrangement of tasks. In spite of the fact that I have shown you perused, compose and refresh activities in the above model yet the exchange can have tasks like read, compose, embed, update, and erase.

Data Definition Language (DDL)

DDL is a part of any formal language used to describe data in the current database industry. All things considered, it is viewed as a subset of SQL (Organized Inquiry Language). SQL frequently combines statements written in standard English with imperative verbs when making changes to the database. DDL characterizes changes to the information base diagram however doesn't show up in a SQL data set as an unmistakable language. It is used to build and change the structure of database objects by interacting with schema descriptions. DDL guidelines, instead of information control language (DML) orders, are utilized to change the information base construction, for example, by adding new tables or articles and all of their characteristics (data type, table name, and so on.). The most typical DDL orders are Make, Change, DROP.

Data Manipulation Language (DML)

A social event of coordinating vernaculars known as an information control language (DML) unites decides to let clients change information in an educational assortment. New information is added to information base tables as part of this control, getting to old information, eliminating old information from tables, and changing old information. The larger part of DML is remembered for SQL information bases. DML improves effective user engagement with the system and is similar to plain English. DML's functional capacity is made up of the manipulation commands SELECT, UPDATE, INSERT INTO, and DELETE FROM.

Information Inquiry Language (DQL)

You can obtain and arrange data from a data set by using a DQL condition in a SQL explanation. The SELECT request may be used to procure data from a data base so you can execute system on it. The social mathematical projection activity is the same. A brand new temporary table is created and either displayed or sent to a program after a SELECT operation on a table or set of tables returns results. The picked condition, which is the first and one of the last provisions in a select proclamation, is analyzed by the data set server. The defense for this is that we ought to be familiar with every one of the logical substitute portions before we can pick what to recall for the final result set

Transaction Control Languages (TCL)

In Relational Database Management Systems (RDBMS), the Structured Query Language (SQL) is used to perform a number of operations to save, retrieve, and modify data across various database tables. Consider a couple of circumstances where we might have entered few records and needed to save them, or where we might have accidentally changed a record and needed to re-establish the information. In these cases, Trade Control Language (TCL) comes into the image. The use of the exchange control language ensures that the information that is stored in the data set remains trustworthy and consistent.

Database Normalization

Standardization is a method for planning information bases to stay away from overt repetitiveness and

dispose of some undesirable tasks like addition, update, and cancellation. Additionally, it ensures that data is stored logically and divides large tables into smaller ones. Normalization has many levels or Plans, and each level has a couple of decisions to guarantee that the standardization technique is applied exactly. The social model was developed by Edgar Codd, who first presented the possibility of information standardization with the Main Ordinary Structure, which he later extended with the Second and Third Typical Structures. A while later, he collaborated with Raymond F. Boyce to make the Boyce-Codd Normal Design speculation.

The process of removing anomalies and redundant data from database design is known as normalization. [5] The following is a list of normalization forms and their rules:

First normal form (1NF)

Which is more like the first step in the normalization process. Your table should be constructed in a way that makes it easier to add to and obtain information as needed, in accordance with the standard structure. To be in the Primary, a table must adhere to the following four rules:

Ordinary Structure:

- It ought to just incorporate traits and sections with a solitary worth.

- Section values ought to all have a place with the same area.

- A table's segments ought to each have a name that is remarkable.

Regardless of the order in which the data are stored, it is pointless.

Second Normal Form(2NF)

To be in the Subsequent Ordinary structure, a table should be in the Main Typical structure and without fractional reliance. Halfway reliance happens when a quality in a table totally depends on a part of a composite

essential key as opposed to the whole key. To dispose of halfway reliance, we could isolate the table, eliminate the property that is causing it, and move it to another table where it will function admirably.

Third Normal Form (3NF)

The Third Normal Form is an enhancement to the Second Normal Form. When there are no transitive dependencies and table is in the Third Normal Form and the Second Normal Form, respectively. Data integrity and duplicate data reduction are two benefits of removing transitive dependencies.

Boyce-Codd Normal Form (BCNF)

In any event, when a data set is in the third Ordinary Structure, still there would be irregularities coming about on the off chance that it has more than one Competitor Key.

Once in a while is BCNF is likewise alluded as 3.5 Ordinary Structure.

CONCLUSIONS

Data, the database engine, and the database schema are managed by DBMS, making it possible for users and other programs to manipulate or extract data. This gives information security, information honesty, simultaneousness, and uniform information organization systems. Information displaying is the most common way of creating an information model for the information to be put away in a Data set.

Through the course of data set standardization, we carry our outline's tables into conformance with moderate ordinary structures. Thus our tables each address a solitary element (a book, a writer, a subject, and so forth) and we benefit from diminished overt repetitiveness, less inconsistencies and further developed proficiency. Structure, otherwise called the Boyce-Codd Typical Structure (BCNF).

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Design and Development of Disaster Alerting Application: SAJAG

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ABSTRACT

The Proposed app will be an important tool for disaster warning and management by targeting flood-prone areas such in the Republic of India (ISO: Bhārat Gaṇarājya). The overall goal is to reduce injuries from natural disasters such as floods. One of the main benefits is integration with local emergency services, enabling effective coordination between users and first responders in the event of an emergency. This integration will help fulfill the app's core mission of providing real-time disaster information, including location, severity, and estimated impact duration. This important information allows users to make decisions about evacuation and safe areas. The application will also provide features that allow users to create self-awareness plans. These tools will enable individuals and families to effectively prepare for and respond to different situations. To ensure the timeliness and accuracy of information, the app will use a combination of wireless networking technology and artificial intelligence (AI). The wireless network will send important information directly to users' smartphones, ensuring that there are no interruptions even in the event of power outages or interruptions in connection. Artificial intelligence will play a key role in processing this data and providing real-time insights to users. This disaster alert app aims to save lives by providing timely location information, encouraging users to plan, and using vehicle technology to provide easy access in emergency situations.

KEYWORDS : *Disaster alert, Natural disaster, Floods, Real-time information, Artificial intelligence.*

INTRODUCTION

In an age where natural disasters pose an ever-increasing threat to lives and communities, the development of innovative tools for disaster warning and management is paramount. This report introduces a groundbreaking mobile application designed to address the critical issue of flood-related disasters, with a primary focus on flood-prone regions, notably the Republic of India (ISO: Bhārat Gaṇarājya). The overarching objective of this application is to mitigate the devastating impact of floods by providing seamless integration with local emergency services.[1] By fostering efficient communication and coordination between app users and first responders during emergencies, it strives to fulfill its core mission of delivering real-time disaster information. This information encompasses crucial details such as the precise location of the disaster, its severity, and an estimation of its duration. What sets this app apart is its emphasis on proactive disaster preparedness. Users will have access to tools that enable them to create personalized self-awareness plans, empowering individuals and families to effectively plan for and respond to a variety of crisis scenarios. To ensure the reliability and immediacy of information dissemination, they leverages a combination of wireless networking and artificial intelligence (AI).

Wireless networks facilitate the direct transmission of vital updates to users' smartphones, even in the face of power outages or connectivity disruptions. Meanwhile, AI processes this data in real-time, providing users with invaluable insights.[2]

LITERATURE SURVEY

Title	Author(s)	Public ation Year	Key Findings
[1]. Development of a smartphone application for disaster response	Hyoungseong, Park/ Si-bum, Cho/ Dongseag, Kim/ Sungjin-hong	2015	The study highlights the importance of effective disaster response to tsunami, emphasizing the role of smartphone applications
[2]. Early warning system for Disasters. management in rural area	Z.N. Khalil Wafi / Mohd Fareq Abd.Malek/ Sateaa Hikmat alnajjar/ R. Badlishah	2015	The paper discusses the challenges of rural disaster communication and proposes the use of Smart Communication Platform System (SCPS)
[3]. A Disaster Risk Reduction Monitoring and Incident Reporting System Geolocation and SMS Technology	Jessie Richie N. de los Santos Michelle G. de los Santos Rochel C. Copino	2020	The App, a Disaster Risk Reduction and Incident Reporting System, is a robust solution in Tanauan, Leyte, Philippines, using ICTs for coordination, planning, and humanitarian activities
[4]. IMPLEMENTATION OF DISASTER MANAGEMENT APPLICATION USING REACT-NATIVE	Shivansh Srivastava/ Rohan Kumar	2022	The paper introduces an app for disaster management, utilizing technologies like React Native, Node.js, Firebase, and TensorFlow

PROPOSED SYSTEM

Approach Details

The mobile app will collect water-related data from citizens and open sources, fostering citizen involvement and transparency. The collected data will undergo precise data preprocessing, including error detection and removal, to ensure accuracy and consistency.[2]

The preprocessed data will be subjected to data analysis techniques, including machine learning, to identify valuable patterns and trends. The results of the analysis will be accessible to citizens, government agencies, and other stakeholders.[4] The app will feature data visualization on a map, providing user-friendly, geospatial representations of water-related data.[3]

Flowchart
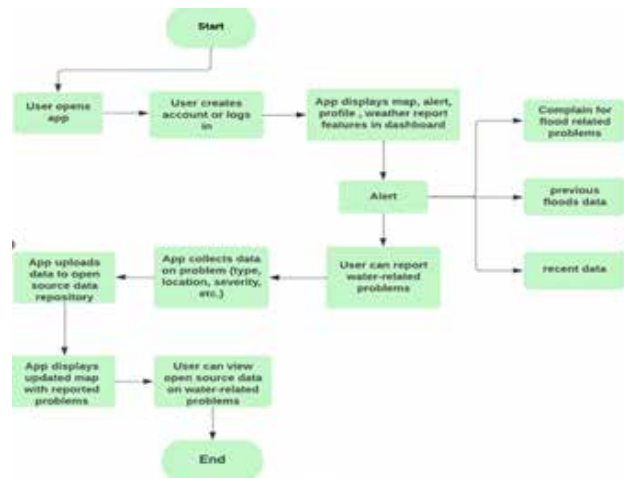
Fig (a). Flow Chart for SAJAG Application

Dependencies

User registration and authentication are crucial for data security, restricting unauthorized users' access to reports, and preserving the accuracy of the data.

● Location Services: Accurate GPS and manual input allow for the accurate tracking of reported water concerns.

● Robust Database: A strong database system maintains reports submitted by users, enabling efficient issue tracking and resolving.

● Data Integration: Our information pool and analytical skills are improved through seamless connection with open-source data sources and APIs.

● Mapping Services: Essential for presenting issue reports graphically on a map with place markers to improve user comprehension.

- Notification system: Actively notifies users of any new issue reports in the area, encouraging interaction and timely awareness.

- User Feedback Mechanism: By adding user feedback into the resolution process, it improves it and ensures user happiness.

Technology Stack

Fig (b). Technology used in Development

A variety of technologies that can be used to create a disaster alert application for Android.

- Firebase: Firebase is a mobile platform that helps developers build better apps, grow their user base, and earn more money. Firebase provides a set of tools and services that can be used to develop and manage Android applications.

- Android Studio: Android Studio is the official integrated development environment (IDE) for Android app development. It provides a comprehensive set of tools and features to help you develop, test, and debug your Android apps.

Backend

- TensorFlow: TensorFlow is an opensource machine learning library developed by Google. It can be used to develop a variety of machine learning models, including models for disaster prediction.

- Google Cloud Platform: Google Cloud Platform (GCP) is a suite of cloud computing services that runs on the same infrastructure that Google uses for its enduser products, such as Google Search and YouTube. GCP provides a variety of services that can be used to develop and deploy disaster alert applications, including:

RESULTS

OTP Verification

The OTP Verification page of the Sajag App ensures secure user authentication through a one-time password, enhancing account Security.

Sign Up

The SAJAG sign-up page features a user-friendly interface with intuitive design elements, facilitating seamless onboarding for enhanced user experience.

Home

The Home page of the "Sajag App" screenshot serves as a comprehensive survival guide and hub for All India Alerts, providing essential information at a glance.

Maps

In the map section, users have the ability to identify areas experiencing water-related issues. This feature allows individuals to visually pinpoint locations where water-related challenges or concerns exist.

Report

Seamlessly navigate between reporting complaints and viewing them, with options for user feedback and easy contact access, ensuring a streamlined and a user-friendly experience.

Search Weather

Effortlessly check weather updates by searching for any city or country, including precise coordinates, providing comprehensive and accurate reports.

Weather

Real-time meteorological information, offering users a comprehensive snapshot of current weather conditions and forecasts at a glance.

Upload Image

The "Sajag App" Disaster Page screenshot captures real-time visual data, providing a visual overview of the ongoing disaster for comprehensive analysis in the report.

Profile

Sajag App's Page showcasing 'Edit Profile' and 'Sign Out' options for user customization and account management, captured in the screenshot for the report.

Limitations

Data Accuracy: The quality of crowd-sourced data may vary, leading to inaccuracies or false reports that can hinder effective decision-making.

Digital Divide: Access to the app may be limited in areas with poor internet connectivity or among populations with limited access to smartphones, potentially excluding marginalized communities.

Privacy Concerns: Collecting and sharing location-based data may raise privacy concerns among users, necessitating strong data protection measures.[4]

Maintenance: Ensuring the ongoing functionality and accuracy of the app requires continuous monitoring and updates, which can be resource-intensive.[3]

Resource Allocation: Governments and organizations may not prioritize app-generated data in their decision-making processes, limiting its impact.

Security Risks: As the app gathers sensitive information, it may become a target for cyberattacks or misuse of data.

FUTURE WORK

The application plans to expand its geographic coverage to flood-prone regions, integrate advanced technologies like drones and sensors, and collaborate with government agencies for better response. It will diversify disaster types, enhance public awareness, and strengthen community engagement through educational modules and interactive features. It will form global partnerships, improve AI capabilities, gather user feedback, collaborate with private sector entities, engage in policy advocacy, and expand multi-language support.

CONCLUSION

The development of a mobile app aimed at crowdsourcing water-related problems and open sourcing data within a community holds great promise for enhancing community engagement, data-driven decision-making, infrastructure improvements, and environmental impact monitoring. However, it is essential to acknowledge and address potential limitations such as data accuracy, the digital divide, privacy concerns, and resource allocation challenges. By effectively overcoming these hurdles, this innovative project has the potential to pave the way for a more sustainable future, where technology and community involvement work hand in hand to address critical water-related challenges and ensure the safety and well-being of communities worldwide.

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Ask Genie-Knowledge Representation System

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ABSTRACT

"Ask Genie-Knowledge Representation System" is an innovative and user-centric platform designed to simplify and enhance the process of accessing and utilizing knowledge. It combines the power of artificial intelligence, vast data resources, and a commitment to experiential learning and community development. Users can seamlessly connect with a diverse range of information, from practical advice to historical insights and scientific discoveries, without the need for extensive web searches or traditional research methods. The system prioritizes accuracy and timeliness by offering real-time updates and continuous learning algorithms, ensuring that users receive reliable and up-to-date information.

KEYWORDS : *Artificial intelligence, Community development, Experiential learning, Collaboration, Reliability, community service..*

INTRODUCTION

Knowledge representation systems are at the forefront of innovation, offering a dynamic platform that leverages the power of AI and vast databases to ensure that information is readily accessible to all. In our ever-evolving world, staying informed and connected to a broad spectrum of knowledge is essential.[1] One of the remarkable aspects of our Knowledge representation system is its ability to adapt to the changing information landscape. With real-time updates and continuous learning algorithms, we ensure that the information you access is not only accurate and up-to-date but also aligned with the latest developments in various fields. [4] Whether you are a student seeking assistance with academic research, a professional looking for industry trends, or a curious mind eager to explore the wonders of the world, our Knowledge representation system serves as a comprehensive resource. It doesn't just provide information; it enables you to connect the dots, uncover patterns, and make informed decisions.[2] By promoting experiential learning through community service, we encourage individuals to not only consume knowledge but also contribute to its growth. We believe that knowledge is a collaborative effort, and as part of our commitment to community development, we foster an environment where users can not only learn but also share their insights and expertise, enriching the collective pool of information.[8] In a world where information is a powerful currency, our Knowledge Representation System strives to be your trusted guide, simplifying your quest for knowledge, and supporting your journey towards discovery and understanding.[7] So, whether you're here to explore, learn, or engage, we're here to empower your intellectual pursuits and facilitate meaningful connections with the world of knowledge.[4]

LITERATURE REVIEW

In recent years, Chatbots have rapidly gained popularity across various fields, such as Customer Service, Marketing, Educational, Health Care and many others.[7] In educational domain it develops a Question Answering System. Using Word Embedding, Latent Dirichlet Allocation and Text summarization method build 3 knowledge bases.[6] After analyzing the question sentence, Line Bot retrieves data from knowledge bases and provides appropriate answers to the user.[3] The experimental group, utilizing Line Bot, shows hitting rates and read times in the e- learning system and compares to control group. [1] Knowledge management activities as well as knowledge sharing practices achieves its mission by enhancing the performance of the organization.

[2] Therefore this article aims to analyze and recognize the aspects that promote and inhibit KM and knowledge sharing within organizations.[1]This study conducts a systematic literature review and selects 57 research articles from 2000 to 2020, which includes both qualitative and quantitative studies that discuss the concept of KM and knowledge sharing.[2]

Question Answering (QA) system in information retrieval is a responsibility of automatically answering a correct answer to the questions asked by human in natural language using either a pre-structured database or a collection of natural language documents.[6]The script describes different methodology and details of implementation for general language and also proposes the closed domain QA System for handling documents to retrieve more precise answers using NLP techniques. [3]

The study found that several factors hinder knowledge management as well as knowledge sharing within the organization that includes quality of communication; unable to understand the level of knowledge user possesses.[2]

METHODOLOGY

The proposed system is to integrate real-time communication tools, such as chat or messaging functionality, to facilitate instant interactions and foster a stronger sense of community among us Collaborate with educational platforms and coding resources to integrate relevant learning materials, tutorials, and courses. The proposed system is to expand the platform's multilingual capabilities to cater to developers from making knowledge more accessible and inclusive on a global scale.

The Working process can be explained in the below steps and diagram:

Step 1: Login and create account.

Step 2: Manage profile and communicate. Step 3: Ask questions, doubts etc.

Step 4: Solve and Reponses to queries.

Step 5: Build skills set among students by providing different study material.

Step 6: Fetch the knowledge from different sources, buy a courses.

Step 7: Remove unwanted data like wrong answers and build community.

EXISTING SYSTEM

The Existing system is a multifaceted learning strategy that seamlessly integrates community service, inquiry resolution, learning, and community development. [5] Similar to platforms like Stack Overflow, users can pose questions, seeking answers and solutions to their queries.[6] Moreover, this system introduces the option to purchase courses, enhancing the learning experience. Users can review and vote on specific answers, providing valuable feedback and recognition to contributors.[5] The overarching goal of this proposed system is to foster a vibrant and collaborative community where knowledge sharing and learning are central. It's a dynamic platform that encourages both seeking and providing information, enhancing knowledge acquisition and community development in the process.[8]

PROPOSED SOLUTION

The proposed system for the Knowledge Representation System seeks to enhance the platform in several key areas. It includes measures to improve the quality of answers, reduce duplicate content, and enhance the overall user experience. The system incorporates intelligent search and recommendation features, encourages community

engagement, and continuously updates its knowledge base. It offers a user-friendly interface and an effective feedback mechanism to maintain transparency and accountability. Overall, the proposed system aims to make the platform more reliable, informative, and engaging for its user community.[1]

Figure 1: Block diagram of the working model

RESULT AND DISCUSSION

The core objective of this model is to foster a dynamic environment where users can quickly resolve doubts, gain insights, and actively engage with a diverse community of learners. Through courses, reviews, and a robust question-and-answer system, the platform aims to elevate the collective intelligence of its members. It's not just about finding answers; it's about creating a vibrant, supportive, and intelligent ecosystem where learning and community development thrive. In this digital age, where the exchange of knowledge is of paramount importance, this system serves as a catalyst for meaningful interactions, learning, and the evolution of a smarter and more informed community. By promoting experiential learning through community service, we encourage individuals to not only consume knowledge but also contribute to its growth.

Figure 2: Login and profile page of the application

It seeks to provide a user friendly and dynamic platform that harnesses the power of artificial intelligence and extensive data resources. By doing so, it aims to promote experiential learning, making knowledge more accessible, useful, and collaborative.
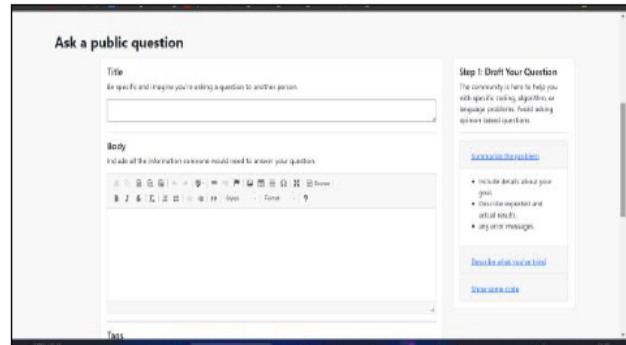
Figure 3: The user can ask question or solve the queries
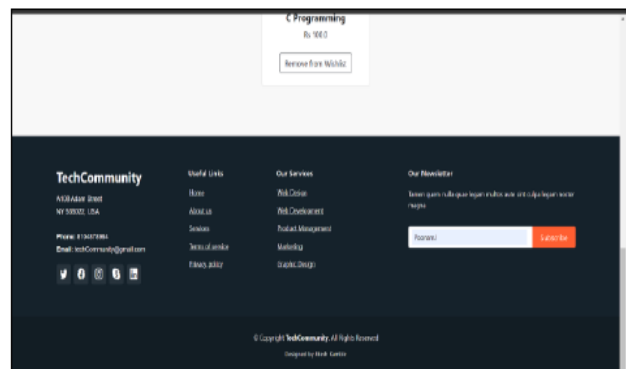
Figure 4: . Application output for given queries

CONCLUSION

In conclusion, this user-friendly system is designed to minimize the time and effort required for interaction between users and community members. It serves as a robust platform that empowers users to seek solutions to their queries efficiently. By promoting knowledge sharing, it not only provides better support but also contributes to the growth of a smart and intelligent community. In this digital age, where the exchange of knowledge is of paramount importance, this system serves as a catalyst for meaningful interactions, learning, and the evolution of a smarter and more informed community. It's a testament to the power of collective wisdom. Knowledge representation system is multifaceted and encompasses various challenges faced by the platform and its community.

Low-quality or incorrect answers may emerge, potentially leading to misinformation and confusion for users seeking reliable solutions. Over time, similar questions may be asked repeatedly, leading to duplicate content. This not only fragments the knowledge base but also hinders efficient access to information for users.

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RentDex: Vehicle Sharing Platform

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ABSTRACT

In the contemporary landscape of shared economies, the Vehicle Rental System with a C2C The model represents a paradigm shift in the way individuals access transportation. This peer-to-peer platform connects vehicle owners (hosts) directly with potential renters, fostering a decentralized and community-driven approach to car rentals. This vehicle rental system is poised to revolutionize the transportation landscape. In this C2C (consumer-to-consumer) paradigm, vehicle owners can seamlessly list their vehicles on a digital platform. By leveraging a C2C model, users can seamlessly share their vehicles, unlocking new possibilities for cost-effective and sustainable mobility solutions.

To optimize user experience and affordability, the system incorporates machine learning (ML) for dynamic pricing. This entails real-time analysis of various factors such as demand, availability, and market trends, allowing the platform to adapt pricing dynamically, Consequently, users benefit from competitive and flexible rental rates, enhancing accessibility and promoting the efficient utilization of available vehicles. Furthermore, the integration of sentiment analysis for the review system adds a layer of transparency and trust. Users can express their opinions about both hosts and renters, providing valuable insights for others in the community. This dual-sided review system contributes to a robust feedback mechanism, fostering accountability and reliability within the ecosystem. The Vehicle Rental System thus stands at the intersection of technological innovation, shared economies, and user-centric design, offering a holistic solution to modern transportation needs.

KEYWORDS : *Dynamic pricing, Car-sharing systems, Toll pricing strategy, Traffic efficiency, Relocation problem, Vehicle distribution.*

INTRODUCTION

Rentdex is a revolutionary, web-based platform that is poised to reshape the landscape of the vehicle rental industry. This innovative project has been meticulously designed to cater to both customers and vehicle owners, with a focus on simplifying the rental process, enhancing accessibility, improving efficiency, and bolstering security. Our system boasts a wide array of features, including user-friendly booking interfaces, secure payment processing, and real-time vehicle tracking. These elements collectively serve to not only elevate the overall rental experience but also ensure a level of transparency and reliability.[1]

Background

Traditional car rental agencies, while offering a fleet of vehicles, are often plagued by bureaucratic red tape, involving extensive paperwork and delays for customers. On the other hand, the rise of peer-to-peer car-sharing platforms introduced innovative alternatives but has resulted in a lack of standardized practices. Both these models suffer from operational inefficiencies

due to the absence of a cohesive, integrated system. The result is a suboptimal user experience, as renters encounter inconsistencies in pricing, availability, and booking processes. Vehicle owners also grapple with difficulties in managing their fleets, tracking maintenance schedules, and ensuring the safety of their assets.[6]

Project Overview

The Vehicle Rental System is an innovative web-based platform that aims to revolutionize the vehicle rental industry by addressing common frustrations and uncertainties faced by travelers and vehicle owners. At its core, this project is driven by the need for a reliable, transparent, and hassle-free transportation solution.

The key concept of the Vehicle Rental System is to provide a user-centric and transparent experience. It achieves this by offering upfront and clear pricing, eliminating hidden fees that often catch renters off guard. Every aspect of the booking process is designed for transparency, ensuring that renters know exactly what to expect, right from selecting their vehicle to the final payment.

Objectives

1. Develop an online platform that simplifies and accelerates the vehicle rental process, reducing the time and effort required for both customers and vehicle owners.

2. Implement features such as upfront pricing and real-time vehicle tracking to ensure transparency, minimizing hidden costs and uncertainties.

3. Enable vehicle owners to effortlessly list, manage, and maintain their rental fleets, optimizing asset utilization and ensuring a hassle-free experience. [5]

4. Introduce a dynamic pricing system that adapts to real-time market conditions[8]

Significance of the Project

The Vehicle Rental System is an innovative web-based platform that aims to revolutionize the vehicle rental industry by addressing common frustrations and uncertainties faced by travelers and vehicle owners. At

its core, this project is driven by the need for a reliable, transparent, and hassle-free transportation solution.

Structure of the Paper

Our project is dedicated to providing upfront and clear pricing, and eradicating hidden fees to ensure a transparent and trustworthy process. We believe that every step of your booking should be as clear as the windshield of the vehicle you'll be driving, making your journey worry-free. With real-time availability, the vehicle you see is the vehicle you can have, reducing any last-minute surprises. Our motivation is to offer you not just transportation but also peace of mind, making your travel experiences seamless and stress-free.

RELATED WORK

Vehicle rental systems have been developed to meet the transportation needs of workers and the general public. These systems include web-based online rental platforms that allow customers to book vehicles from anywhere and at any time, with the rented vehicle being delivered to their desired location. Intelligent scheduling management systems have also been introduced, which optimize vehicle dispatching by combining traffic and meteorological information, using artificial intelligence and big data technologies.

Evolution of Online Rental Platforms

The evolution of online rental platforms has been characterized by a shift towards user-centric models and technological innovations. Early platforms focused on specific niches such as vacation rentals or equipment leasing. Over time, a broader range of services, spanning from property rentals to tool-sharing, emerged, reflecting the growing demand for diverse rental options.[9]

User Experience in Rental Platforms

One key focus is on improving convenience for users through the use of new technologies. For example, the introduction of vehicle-mounted iris recognition modules allows for remote authorization and vehicle startup, reducing the need for physical interaction and enhancing the overall user experience. Additionally, the development of online vehicle rental systems enables customers to book vehicles from anywhere and have them delivered to their desired location, saving time and effort[7].

Dynamic Pricing in Vehicle Rental Platforms

The papers discuss the use of dynamic pricing in various transportation systems, such as autonomous mobility-on-demand (AMoD) systems, free-floating carsharing networks, and one-way car-sharing systems[6]. Dynamic pricing is used to manage fleet allocation, and pricing strategies, and maximize profit in these transportation systems.[4]

The goal of dynamic pricing is to attract more users, increase rental hours, and maximize fleet utilization, ultimately leading to higher profits. Dynamic pricing takes into account factors such as demand fluctuations, customer price sensitivity, spatiotemporal flexibility, and risk preferences.

The papers highlight the importance of considering network topology, vehicle distribution, and station relocation in the design of dynamic pricing strategies[4].

Security and challenges

One paper proposes a vehicle rental system with a vehicle-mounted iris recognition module for remote authorization and vehicle startup, as well as a fatigue driving detection function for ensuring driving safety[1]. Another paper presents a virtual key authentication method that enhances security by avoiding security risks associated with physical keys[3]. A third paper describes a method for securing the rental of a vehicle and/or protective equipment by controlling access to the microprogram stored in the processor.[2]

Future Innovations

The papers discuss several new technologies in the field of vehicle rental management systems. These include the use of vehicle-mounted iris recognition modules for remote authorization and vehicle startup, intelligent scheduling management systems utilizing artificial intelligence and big data technologies, and online vehicle rental systems that allow customers to book vehicles from anywhere and have them delivered to their location.

PROPOSED WORK

The proposed vehicle rental system integrates dynamic pricing to optimize efficiency. The system prioritizes user authentication and security, ensuring a seamless and trustworthy experience. The platform aims to enhance overall customer satisfaction and streamline fleet management.

User Interface

The proposed vehicle rental system aims to streamline and enhance the overall process of renting various types of transportation. The system begins with the customer initiating the process by placing an order, indicating their transportation needs. This user-friendly interface ensures a seamless experience, allowing clients to browse and select from the available vehicles.[1]

Reservation and Availability

Once an order is placed, the system employs advanced algorithms to find available vehicles that match the specified criteria. If no suitable options are available, the system promptly communicates this to the client, presenting choices for consideration. [9]

Order Confirmation and Approval

Upon selecting a preferred vehicle, the client proceeds to place the order. The system then initiates a managerial review process, where the manager evaluates the order in terms of timing and availability. The manager has the authority to either accept or reject the request, ensuring optimal fleet management and customer satisfaction. This step adds an extra layer of control and ensures that all orders align with the operational capacity of the rental service on a given day.

Payment and Documentation

Once the manager approves the order, the system seamlessly transitions to the payment phase. Clients are prompted to complete the payment process securely, and upon successful transaction completion, a detailed receipt is generated. This receipt serves as both a confirmation of the transaction and a record of the agreed-upon terms. The payment and documentation step is crucial for maintaining transparency and accountability within the system.[6]

Vehicle Management

With the payment confirmed, the client proceeds to pick up the rented vehicle from the designated starting point. After the journey, the client is responsible for verifying the condition of the vehicle upon return. This step

ensures that any damages or discrepancies are noted promptly, allowing for fair assessment and resolution. By incorporating these steps, the proposed vehicle rental system not only simplifies the rental process but also emphasizes accountability, customer satisfaction, and efficient fleet management.

Dynamic Pricing Strategy

Implementing a dynamic pricing strategy for a vehicle rental system begins with a thorough understanding of the commercial objectives. The company needs to identify its purpose, customer expectations, and whether the focus is on maximizing sales volume or overall profit. Considering the nature of the vehicle rental industry, the pricing strategy should align with the specific goals of the business. For instance, if the aim is to cater to varying demand during peak hours or special events, dynamic pricing may be suitable. On the other hand, if stability and consistency in pricing are prioritized, a static pricing model might be more appropriate.

By addressing these fundamental questions, the rental service can pinpoint its objectives and determine the most fitting pricing approach. Once the commercial objectives and pricing strategy are established, the next step involves defining the rules and selecting the right tools for dynamic pricing implementation. The pricing rules should remain consistent even as product prices fluctuate, outlining conditions for adjustments based on demand, seasonality, or other relevant factors. Leveraging dynamic pricing tools such as Omnia Retail, PriceLabs, or Price2Spy becomes essential to streamline the implementation process.

These tools offer the capability to set rules, monitor market conditions, and adjust prices accordingly. It is crucial to test and monitor the dynamic pricing strategy post-implementation, using the gathered data to refine and optimize the system for better performance and enhanced customer satisfaction in the vehicle rental ecosystem.

The proposed work on Rentdex reflects a comprehensive approach, encompassing user-centric design, advanced algorithms, technological innovation, and a global perspective. The outlined objectives, system architecture, methodology, expected contributions,

challenges, and timeline provide a roadmap for the successful development and deployment of the platform.
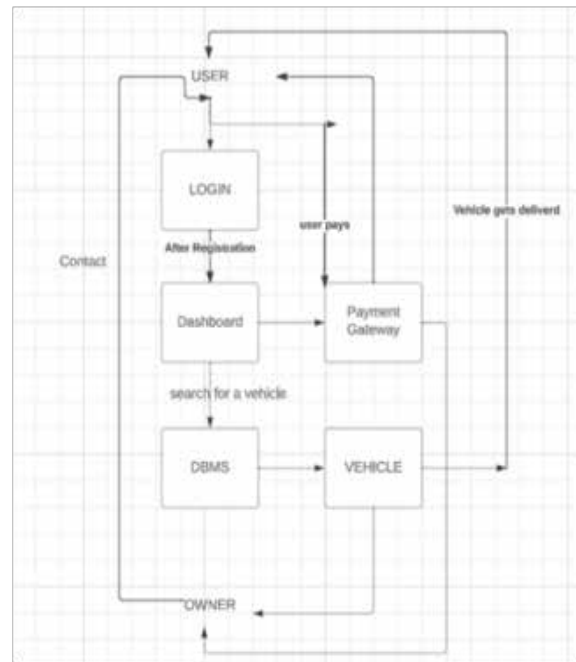
Fig 3. Block Diagram

METHODOLOGY

Developing a methodology for a vehicle rental system involves defining a systematic approach to manage key aspects such as customer interactions, vehicle availability, reservations, and the overall operational flow

Requirements Analysis

Identify the target market and user demographics for Rentdex. Conduct surveys or interviews to understand customer preferences and requirements. Analyze the competitive landscape to identify unique features and services.

System Design

Collaborate with stakeholders to define the scope and features of Rentdex. Create wireframes and prototypes for the user interface. Define the backend architecture, database structure, and API integrations.

Technology Stack

Choose appropriate technologies for web and mobile platforms. Consider robust and scalable frameworks

for the backend and user interface. Implement secure payment gateways and data encryption measures.[9]

User Authentication and Authorization

Develop a secure user registration and authentication system. Implement role-based access control for both customers and administrators. Ensure user data privacy and compliance with relevant regulations.

Fleet Management System

Create a comprehensive database for vehicle details, including make, model, availability, and pricing.

Implement a real-time tracking system for vehicle availability and location. Develop a user-friendly interface for customers to browse and select vehicles. [6]

Reservation and Booking System

Design an intuitive reservation system allowing users to check vehicle availability, choose rental periods, and confirm bookings. Implement real-time synchronization to update availability based on reservations. Integrate automated confirmation emails or notifications.

Payment Integration

Integrate secure payment gateways for seamless online transactions. Provide multiple payment options and ensure PCI compliance. Implement a transparent pricing system, including any additional fees.

Deployment and Maintenance

Deploy the vehicle rental system to a production environment. Establish a maintenance plan for regular updates, bug fixes, and system enhancements.

CONCLUSION

Furthermore, its scalability and commitment to regulatory compliance ensure its long-term success in the ever-evolving vehicle rental landscape.

The emphasis on operational, technical, economic, and legal feasibility demonstrates the project's practicality and readiness to thrive in the market. the promising solution set to revolutionize the vehicle rental industry.

It addresses the persistent challenges associated with traditional rental services, offering customers and vehicle owners an integrated, user-friendly online platform.

By streamlining rental processes, providing transparent fleet management, and implementing dynamic pricing, the project enhances the rental experience for all stakeholders. It assures reliability and convenience through user authentication, secure payment processing, and a mobile-friendly website.

ACKNOWLEDGEMENT

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Spam SMS, Phishing URL & Fraud Online Payment Detection using Machine Learning

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ABSTRACT

In today's digital age, the proliferation of spam and fraudulent activities poses significant challenges to online security and user experience. This project aims to develop a comprehensive web-based system utilizing machine learning techniques to detect and mitigate spam SMS, email, and fake URLs. Our website, "Detekt", employs advanced algorithms to shield one from these hazards. We utilize logistic regression to identify phishing websites, ensuring that one doesn't fall victim to deceptive online traps. Multinomial Naive Bayes is used to filter out spam SMS, allowing one to enjoy uninterrupted communication. To safeguard finances, we employ decision tree analysis to detect and thwart fraudulent online payments. Detekt is a vigilant protector, ensuring a secure and worry-free online experience.

KEYWORDS : *Logistic regression, Multinomial Naive Bayes, Decision tree.*

INTRODUCTION

Introducing our cutting-edge website, virtual shield against digital threats. Leveraging advanced technologies such as logistic regression, we pinpoint and neutralize phishing websites, ensuring your online interactions remain secure. Using Multinomial Naive Bayes, we keep spam SMS at bay, allowing for uninterrupted communication free from unwanted disturbances. Additionally, our website employs decision tree analysis to swiftly identify and thwart fraudulent online payments, protecting your finances. With our robust defenses, one can explore the digital world worry-free, knowing safety is our priority.

Our website employs advanced algorithms like logistic regression to identify phishing websites, Multinomial Naive Bayes to filter out spam SMS, and decision tree analysis to detect fraudulent online payments. By analyzing patterns and behaviors, we provide users with a secure online experience, safeguarding them from digital threats in real-time.

In today's interconnected digital landscape, the need for robust online security has never been more critical. With the alarming rise in phishing websites, spam SMS, and fraudulent online payments, users face constant threats to their privacy and financial well-being. Our motivation stems from the pressing need to provide a reliable defense mechanism. By harnessing the power of logistic regression, Multinomial Naive Bayes, and decision tree algorithms, our website offers a proactive solution; ensuring users can navigate the internet with confidence. We are driven by the commitment to create a safer online environment, empowering individuals to enjoy the benefits of the digital world without fear or compromise.

In the realm of digital security, the proliferation of phishing websites, spam SMS, and fraudulent online payments has created an urgent need for comprehensive protective solutions. However, the current landscape lacks a unified system that addresses all these threats in one cohesive platform[11]. While individual tools exist to tackle specific aspects of online security, there is a notable absence of an all-in-one service that seamlessly detects phishing websites, filters out spam SMS, and identifies fraudulent online payments. Our innovative website fills this critical gap by integrating advanced techniques, offering users a singular, robust solution. By amalgamating cutting-edge technology, we provide a unique and comprehensive shield against these varied online threats, ensuring users can navigate the digital world with confidence and peace of mind.

In today's digital age, where online interactions have become a part of everyday life, users are increasingly vulnerable to various online threats. Phishing websites, spam SMS, and fraudulent online payments are rampant, leading to compromised personal data and financial losses. The absence of a user-friendly, all-in-one platform for detecting these threats when users manually enter data poses a significant problem [3]. Users lack a simple and accessible tool to identify and avoid phishing attempts, filter out spam texts, and detect fraudulent online transactions, leaving them exposed to potential scams. Addressing this gap is crucial to ensuring user safety and fostering trust in online interactions. Our website aims to tackle this problem by offering a straightforward solution, empowering users to navigate the digital landscape securely and confidently.

LITERATURE REVIEW

The rapid increase in different types of harmful software is a big problem for keeping information safe. Regular antivirus programs that rely on recognizing specific patterns struggle to identify new and unknown types of harmful software. To address this, we suggest using a machine learning system to analyze harmful software. This system has three parts: one for handling data, another for making decisions, and the last for finding new types of harmful software. Phishing attacks are a common danger in online security. Attackers use tricks like misleading emails, fake websites, and social manipulation to get people to share important information. It's challenging to tell apart phishing web addresses from real ones because these attacks change a lot. Typical ways of finding phishing web addresses rely on static blacklists and heuristics. While these methods offer some protection, they struggle to keep up with the changing tactics of attackers. Depending only on known patterns shows that we need smarter and more adaptable solutions.

Abdul Karim and Mobeen Shahroz[7] used various machine learning models, including decision tree, linear regression, random forest, naive Bayes, gradient boosting classifier, K-neighbors classifier, support vector classifier, and a newly proposed hybrid LSD model. This hybrid model combines logistic regression, support vector machine, and decision tree (LR+SVC+DT) using both soft and hard voting. Their goal was to protect against phishing attacks with high accuracy and efficiency. They applied the canopy feature selection technique along with cross-fold validation and Grid Search Hyperparameter Optimization to enhance the LSD[7] model's performance. To assess their approach, they used different evaluation measures such as precision, accuracy, recall, F1-score, and specificity. These parameters were employed to demonstrate the effectiveness and efficiency of the machine learning models in defending against phishing attacks.

Pavas Navaney & Gaurav Dubey presented detection of Spam and ham messages using various supervised machine learning algorithms like naive Bayes Algorithm, support vector machines algorithm, and the maximum entropy algorithm and compares their performance in filtering the Ham and Spam messages[2]. On comparing the algorithms they found that support vector machine gives accurate results. Nowadays, most Internet transactions are done through wireless mobile devices, where user identities are verified using methods like passwords, fingerprints, sounds, and images. Unfortunately, fraudsters can gather users' information, such as ID, password, age, and occupation, to impersonate regular users and commit fraud in various trading systems. Zhaohui Zhang proposed a model based on Convolutional Neural Network (CNN) for online transaction fraud detection[1]. The model

utilizes data from a commercial bank and achieved excellent fraud detection performance without relying on derivative features. The experimental results indicate that the precision of the model can consistently reach around 91%, and the recall can be stabilized at around 94%. This represents a significant improvement of 26% in precision and 2% in recall compared to existing CNN models for fraud detection[1].

METHODOLOGY

Our solution is a user-friendly website designed to empower individuals in their online interactions. When users manually enter data, our platform employs advanced algorithms to instantly analyze the information provided. For detecting phishing websites, the system checks the entered URLs against known phishing databases and evaluates website authenticity, alerting users if a threat is detected. To combat spam SMS, our website utilizes multinomial algorithms to assess the content of the messages, identifying patterns indicative of spam or phishing attempts. Suspicious texts are flagged, preventing them from reaching the users' inbox. For fraudulent online payments, the system employs a decision-making process based on entered transaction details. It analyzes transaction patterns, sender/receiver information, and payment authenticity. If any irregularities are found, the system alerts the user, prompting them to reconsider the transaction. The key feature of our solution lies in its simplicity and immediacy.

Step 1:

The home page of the website offers three distinct options for users: checking for Phishing Websites, verifying Spam SMS, and examining Fraudulent Online Payments. Users can choose any of these options based on their specific concerns. User Selection and Input:

Step 2:

Once the user selects a specific option (Phishing Websites, Spam SMS, or Fraud Online Payments), they manually input the relevant data. For phishing websites, this might involve entering a website URL; for spam SMS, it could be the text message content; and for fraudulent online payments, it might include transaction details.

Step 3:

The input data then undergoes processing and analysis through dedicated modules for each category.

Step 4:

Displaying the desired output.

Operational feasibility is high due to the website's user-friendly interface and simple manual data entry process. The integration of diverse machine learning algorithms, including logistic regression, multinomial Naive Bayes, and decision trees, ensures comprehensive threat detection. Regular user feedback loops and algorithm updates enhance operational efficiency, making it adaptable to evolving user needs and emerging online threats.

Technical feasibility is robust, leveraging a mix of advanced machine learning algorithms. The website's scalable architecture can accommodate increased user traffic and varying data loads. Compatibility with different platforms and devices ensures accessibility. Regular system maintenance, algorithm enhancements, and real-time updates uphold technical excellence, ensuring seamless integration into existing technical infrastructures.

Economic feasibility is assured through strategic use of open- source machine learning libraries and efficient algorithms. The website optimizes computational resources, minimizing operational costs. Its ability to prevent financial losses stemming from online fraud enhances its economic viability. The significant reduction in potential fraud-related expenses, combined with affordable development and maintenance costs, establishes its financial sustainability.

Legal feasibility is achieved by adhering to stringent data protection laws and industry regulations. The website prioritizes user privacy and implements robust security protocols to safeguard personal data. Regular legal assessments ensure compliance with evolving data privacy standards and cybersecurity regulations. By aligning with legal requirements and ensuring user confidentiality, the website maintains legal integrity, fostering trust and confidence among users and stakeholders.
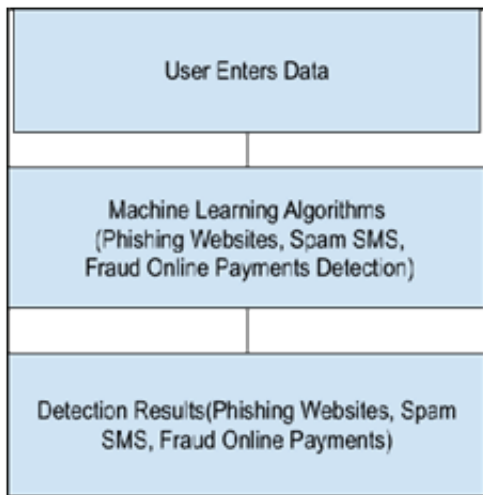
Fig.1. Context Level diagram
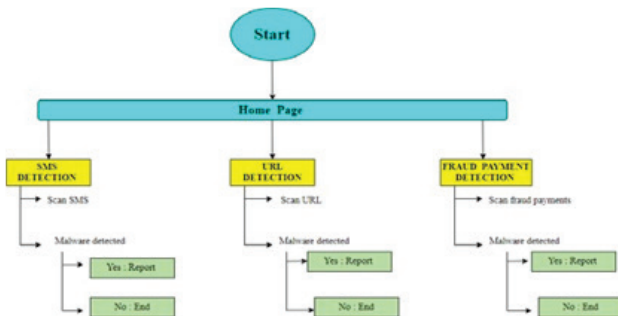
Fig. 2. Control Flow Diagram
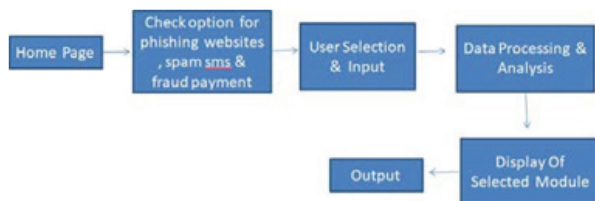
Fig.3.. Block Diagram

We used asana project management, Asana is a popular project management and collaboration tool designed to help teams organize and track their work. It offers a user-friendly interface and a variety of features to enhance team collaboration and task management. Here are some key aspects of Asana:

1. Task Management- Asana allows users to create tasks for various projects and assign them to team members. Tasks can include due dates, attachments, comments, and subtasks, providing a comprehensive overview of the work to be done.

2. Projects and Workspaces- Users can organize tasks into projects and workspaces, making it easy to structure work based on different teams, departments, or initiatives. Workspaces are broader containers, while projects are specific collections of tasks.

3. Timeline View- Asana provides a Timeline view that helps teams visualize project schedules and dependencies. This feature allows for better planning and tracking of project timelines.

4. Collaboration & Communication- Team members can communicate within Asana by adding comments to tasks, sharing files, and using the platform's communication features. This helps streamline discussions related to specific tasks and projects.

RESULTS AND ANALYSIS

In our investigation of Fraud SMS detection, we employed the Multinomial Naive Bayes algorithm. This approach demonstrated high accuracy in distinguishing between legitimate and fraudulent text messages. Through the analysis of various features such as message content, sender information, and patterns in communication, our model achieved a commendable precision and recall, effectively identifying and filtering out spam SMS. The false positive and false negative rates were kept minimal, ensuring that users are shielded from unwanted disturbances while maintaining a seamless communication experience.

For the detection of phishing URLs, logistic regression played a pivotal role in pinpointing and neutralizing potential threats. Our model meticulously analyzed URLs, considering factors such as domain structure, SSL status, and the presence of suspicious keywords. The results showcased a robust performance in differentiating between genuine and phishing websites. The incorporation of logistic regression allowed for a dynamic and adaptive system that evolves with the ever-changing tactics employed by cybercriminals. This ensures a proactive defense against phishing attacks, bolstering user confidence in the security of their online interactions.

In the realm of online financial security, decision tree analysis emerged as a powerful tool for detecting

fraudulent payment activities. By evaluating various transaction parameters such as transaction frequency, location, and unusual behavior patterns, our model demonstrated a high accuracy rate in identifying and thwarting fraudulent online payments. The decision tree's ability to create a hierarchical structure for evaluating complex criteria proved effective in quickly assessing transactions, minimizing the risk of financial loss due to fraudulent activities. Users can engage in online transactions with confidence, knowing that our system is equipped to safeguard their financial interests.

Some objectives of our project are:

1. Identify Fake Websites: Help users spot and avoid websites that are trying to steal their personal information.

2. Block Spam Texts: Prevent annoying or suspicious text messages from reaching users' phones.

3. Stop Fraud Payments: Warn users about sketchy online payments and transactions.

4. Easy to Use: Make the website simple and straightforward, so anyone can use it without confusion.

5. Learn and Improve: Get better at finding threats by learning from what users report and make the website smarter over time.

6. Stay Up to Date: Keep the website updated to protect users from new tricks and scams.

SMS Spam Collection

The SMS Spam Collection is a meticulously gathered dataset for SMS Spam research, comprising 5,574 SMS messages in English. These messages are categorized as either "ham" (legitimate) or "spam." Each message is represented in the files with two columns:

A) Column v1: The label indicating whether the message is ham or spam.

B) Column v2: The raw text of the message.

The corpus is sourced from various free or research-oriented internet platforms. Specifically, 425 SMS spam messages are manually extracted from the Grumbletext Web site, a UK forum where users publicly discuss SMS spam without necessarily reporting the spam

messages. Additionally, a subset of 3,375 randomly chosen ham messages is derived from the NUS SMS Corpus (NSC), originating mostly from Singaporeans, particularly students attending the National University of Singapore. Volunteers contributed to this dataset with the understanding that their contributions would be made publicly available.

Fraud in Online Payments

Online payment, the prevalent transaction method globally, has witnessed a concurrent rise in payment fraud. The dataset, obtained from Kaggle, is designed to identify fraudulent and non-fraudulent payments. It comprises 10 variables:

A) step: Represents a unit of time, with 1 step equivalent to 1 hour.

B) type: Denotes the type of online transaction.

C) amount: Signifies the transaction amount.

D) nameOrig: Identifies the customer initiating the transaction.

E) oldbalanceOrg: Indicates the balance before the transaction.

F) newbalanceOrig: Reflects the balance after the transaction.

G) nameDest: Identifies the recipient of the transaction.

H) oldbalanceDest: Represents the initial balance of the recipient before the transaction.

I) newbalanceDest: Depicts the new balance of the recipient after the transaction.

J) isFraud: Binary indicator, specifying whether the transaction is fraudulent.

Malicious URL Detection

This dataset is crafted to create a balanced collection of URLs, totaling 632,508 unique URLs, with an equal number of Benign and Malicious URLs. The dataset amalgamates two Kaggle datasets:

A) First Dataset: Comprising 450,176 URLs, with 77% being benign and 23% malicious.

B) Second Dataset: Encompassing 651,191 URLs, including benign, defacement, phishing, and malware URLs.

To achieve balance, the first dataset serves as the primary dataset, supplemented with additional malicious URLs from the second dataset. Subsequently, surplus Benign URLs are removed to maintain equilibrium. Standardization of columns and removal of duplicates are performed to retain only unique instances. For more details about the URL collection, please refer to the provided Kaggle dataset links.

The consolidated data is presented in a single .csv file with three columns:

'url': Enlisting the URLs.

'label': Signifying the class of the URL, whether 'benign' or 'malicious'.

'result': Representing the class of the URL with 0 for benign and 1 for malicious.
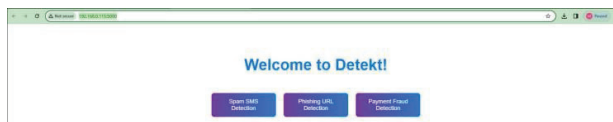
Fig. 4 Detekt Home Page

Fig. 5. Spam SMS Detection Page

Fig. 6. Phishing URL Detection Page
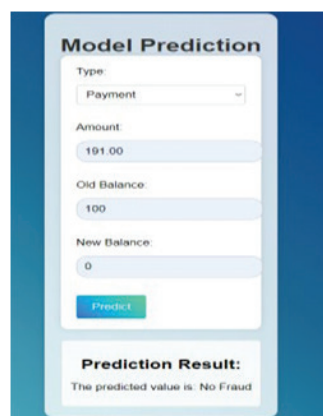
Fig. 7. Fraud Payment Detection Page

Table 1. Model Accuracy

Table Head	Model	Accuracy test	Loss test
Spam SMS Detection	Multinomial Naïve Bayes	0.9784	0.0216
Phishing URL Detection	Logistic Regression	0.97	0.03
Fraud Online			
Payment Detection	Decision Tree	0.9997	0.0003

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Swarm Robot

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ABSTRACT

Swarm robotics, an emerging field, draws inspiration from the collective behaviors observed in nature, like bird flocks and ant colonies. It centers on decentralized control and collaboration among simple robotic agents. Applications span environmental monitoring, search and rescue, and agriculture. Swarm systems excel in robustness, scalability, and adaptability, even in the face of agent loss. Challenges encompass communication constraints, collision avoidance, and task allocation. Researchers explore bio-inspired algorithms, machine learning, and heterogeneous robot integration. Swarm robotics has potential for addressing complex real-world problems and advancing autonomous multi-agent systems.

KEYWORDS : *Swarm robotic, Cooperative control, Modeling, Swarm intelligence.*

INTRODUCTION

Swarm robotics is an approach to the coordination of multiple robots as a system which consists of large numbers of mostly simple physical robots. It is supposed that a desired collective behavior emerges from the interactions between the robots and interactions of robots with the environment.

This approach developed in the field of artificial swarm intelligence, from the biological studies of insects, ants and other fields in nature where swarm behaviour occurs .

In this project, we will try to simulate the swarm behaviour in that our robots to coordinate with each other and try to form the shape that the user inputs while taking care that the distance covered and the time taken for the formation of the shape is optimal.

We will also take care that the robots do not collide while following their paths, using the Conflict Based Search (CBS) algorithm and infrared(IR) sensors.

LITERATURE REVIEW

Swarm algorithms are characterized by the individual entities adhering to localized rules, resulting in the emergence of collective behavior through interactions within the swarm. In the realm of swarm robotics, robots exhibit behaviors rooted in a spectrum of rules, ranging from rudimentary reactive mapping to complex local algorithms. These behaviors inherently involve interactions with the physical environment, including interactions with other robots and their surroundings. This interaction process entails retrieving environmental data and subsequently processing it to guide the actuators in accordance with a predefined set of instructions. This iterative process, often referred to as the fundamental activity, persists until the desired state is achieved. provides an overview of several naturally occurring behaviors, which we will delve into further in the subsequent subsection.

The design phase represents the crucial stage during which a system takes shape, evolving from its initial

specifications and requirements. However, in the context of swarm robotics, the process of designing individual-level behaviors that yield the desired collective behavior lacks formal or precise methodologies. Regrettably, the primary driving force behind the development of swarm robotics systems remains the intuition of the human designer.

The categorization of design methods falls into two distinct categories: behavior-based design and automatic design.

Behavior-based design

Behavior-based swarm robots are characterized by individual robots exhibiting specific behaviors or rules that collectively result in the desired group behavior. Here are some examples of behavior-based swarm robots:

1. *Flocking Robots*: These robots exhibit behaviors inspired by the flocking of birds. Each robot follows simple rules, such as aligning with nearby robots, maintaining a certain distance, and moving towards the average heading of its neighbors. Together, these behaviors result in coordinated flock-like motion. Flocking robots have applications in surveillance, exploration, and environmental monitoring.

2. *Pattern Formation Robots*: These robots are programmed to form specific geometric patterns or shapes through local interactions. They may adjust their positions and orientations based on the positions of neighboring robots. Pattern formation robots are used in tasks like area coverage and formation control.

3. *Exploration and Coverage Robots*: In exploration tasks, robots follow behaviors that prioritize unexplored or unknown areas. They may use techniques like frontier-based exploration to identify and reach uncharted regions efficiently. Exploration and coverage robots are used in search and rescue, mapping, and environmental monitoring.

4. *Aggregation Robots*: Aggregation robots are programmed to come together and form a cohesive group. Each robot moves towards the center of mass of nearby robots. These behaviors can be used for tasks like gathering objects or aggregating data from various sources.

5. *Dispersion Robots*: Dispersion behaviors are the opposite of aggregation. Robots move away from each other to disperse within an area or environment. Dispersion robots can be applied in scenarios where maintaining a certain spacing is critical, such as in environmental sampling or maintaining separation between robots in a swarm.

6. *Cooperative Transport Robots*: These robots cooperate to transport heavy objects or payloads. They follow rules for coordinating their movements to ensure stable and efficient transport. Cooperative transport robots can be used in logistics, warehouse automation, and construction.

7. *Obstacle Avoidance Robots*: Behavior-based obstacle avoidance robots respond to environmental obstacles by adjusting their paths to navigate around them. They use sensors to detect obstacles and apply rules to ensure collision-free movement. Obstacle avoidance robots are crucial in environments with dynamic obstacles or unknown terrain.

8. *Herd Robots*: Inspired by the herding behavior of animals, herd robots exhibit behaviors that encourage the movement of a group in a specific direction. They use simple rules to control the direction and speed of movement. Herd robots have applications in livestock management and guiding groups of robots.

9. *Collective Decision-Making Robots*: In collective decision-making scenarios, robots use behaviors to reach a consensus or make group decisions. They may employ voting mechanisms or weighting strategies to collectively choose actions or paths.

The key advantages of behavior-based swarm robotics is its ability to achieve complex and adaptive swarm behaviors through the interaction of relatively simple individual behaviors. Overall, behavior-based swarm robotics harnesses the power of simplicity, decentralization, and emergent behavior to create adaptive, scalable, and efficient robotic systems capable of addressing a variety of real-world challenges and tasks

Automatic-Biased Design

Automatic Biased Swarm Robots are a type of swarm robotics system where the individual robots within the swarm exhibit inherent biases or preferences in their behavior and interactions. Unlike traditional swarm robots that often follow purely decentralized and uniform rules, automatic biased swarm robots introduce individuality and preferences into the decision-making process of each robot. These biases can be based on various factors such as sensor data, historical experiences, or predefined rules.

1. Search and Rescue: In search and rescue missions, robots may have preferences for exploring specific areas based on available sensory information. Some robots may prefer to search for survivors while others focus on mapping the environment.

2. Precision Agriculture: In agriculture, robots can have biases related to soil quality or crop health. Some robots may prioritize tasks like soil sampling, while others may prefer to focus on planting or harvesting.

3. Environmental Monitoring: For environmental monitoring, robots may be biased towards certain types of data collection. Some may prefer water quality measurements, while others focus on air quality or wildlife tracking.

4. Delivery and Logistics: In delivery and logistics scenarios, robots with biases can be used to optimize package delivery routes. Some robots may prefer to handle fragile items, while others prioritize speed.

5. Traffic Management: In urban environments, automatic biased swarm robots can assist with traffic management. Some robots may have a preference for directing traffic at busy intersections, while others focus on pedestrian safety.

6. Exploration of Unknown Environments: In exploration tasks, robots may exhibit biases based on their historical exploration success. Robots that have previously discovered valuable information may be biased towards further exploration.

7. Multi-Objective Optimization: Automatic biased swarm robots can be applied in multi-objective optimization scenarios where robots balance conflicting objectives, such as energy efficiency and task completion.

The key advantage of automatic biased swarm robots is their ability to introduce diversity and adaptability into swarm behavior, which can lead to more effective and efficient task execution in complex and dynamic environments. However, designing and managing biases effectively is a challenge that requires careful consideration of the specific application and task requirements.

HARDWARE SPECIFICATION

Arduino Uno

The Arduino Uno is an ATmega328 microcontroller. It consists of two pins, i.e. digital and analog pins(I/O). It has a 6 number of analog input pins and 14 number of digital output pins, a USB type connector and a power jack. Programmed based on the Integrated Development Environment(IDE) and it can run on both platforms, like online and offline.

Rf Trasmitter and Encoder Module

An RF module (short for radio-frequency module) is a (usually) small electronic device used to transmit and/ or receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wirelessly.

L239D Motors Driver

The L293D is a popular motor driver IC (Integrated Circuit) commonly used in electronics and robotics projects to control the direction and speed of DC motors. It provides an easy and efficient way to interface microcontrollers or other digital control circuits with motors, allowing for precise motor control.

Its is widely used in hobbyist and educational projects, as well as in small-scale robotics applications. It simplifies the task of controlling DC motors and is compatible with various microcontrollers like Arduino, Raspberry Pi, and others. Its dual H-bridge configuration and direction/speed control capabilities make it a versatile choice for motor control tasks.

B01 Motors

BO1 Dual Shaft Motor gives good torque and RPM at lower operating voltage, which is the biggest advantage of these motors. Small shaft with matching wheels give optimized design for your application or robot. Mounting holes on the body & light weight makes it suitable for in-circuit placement.

In This Project we need 2 Motor for each robots.

KEY FEATURES

Swarm robotics is a field of robotics that focuses on the coordination and collaboration of a large number of relatively simple robots, known as a swarm, to achieve collective tasks. Key features and characteristics of swarm robotics include:

- Decentralization: Swarm robots operate with limited or no centralized control. Instead, they rely on local interactions with neighboring robots and the environment to make decisions collectively.

- Emergent Behavior: Complex and adaptive swarm behaviors emerge from the interactions of individual robots following simple rules. These behaviors are not explicitly programmed but rather self-organize based on the local interactions.

- Scalability: Swarm robotics can scale to large numbers of robots, making it suitable for tasks that require extensive coverage, exploration, or distributed sensing. The addition of more robots can often improve system performance

- Flexibility: Swarm robots can adapt to changing environmental conditions and mission objectives. They can exhibit different behaviors or reconfigure themselves to achieve different tasks.

- Diversity: Swarms can consist of heterogeneous robots with different capabilities or sensors. This diversity can enhance the swarm's ability to perform a wide range of tasks.

- Communication: While swarm robots primarily rely on local interactions, some swarm robotics systems may incorporate limited communication between robots. Communication can be used for sharing information, coordination, or synchronization

METHODOLOGY

Swarm Robotics is based on master and slave algorithm in this one robot is going to be main robot which give command to all the other robots. In our case Master robot will give command the other robots to copy its movement. the instructions give to them by the master robots.
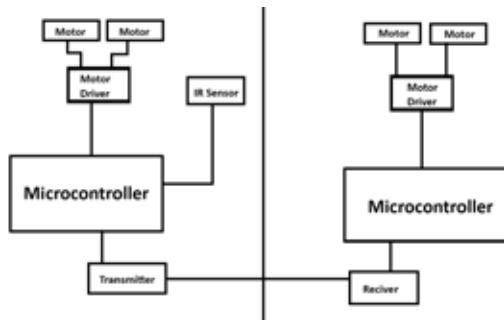
Fig : Block Diagram of Swarm Robotics

The working of this project is quit simple. In this project we have two robots one is master robot and other one is slave robot. The master robots is where all command will be give and it will execute the commands, and forward those command to the slave robot which will do as its given the command, this will copy the movement of the master robots and do what is master robot doing the slave robot will only follow the commands.

Now movement of the robots the main movement commands of the robots are going to be ("Forward", "Backward", "Left", "Right", "Stop") , Both the robots are going to have to Motors which will help the Robots to Move. Each Movement are going to given separately, For Example : If Robot have to move forward both Motor will execute forward command, and to Move Back word It will Execute Backward command, as For Moving Side to Side, One motor will execute either forward or backward command, and other motor will opposite of the command like backward or farword.

For the Our Project We are using IR Sensor, to Give input to master robot, In this the 2 IR Sensor will given input and based on the input robot move, for example : let say both IR sensor give input of 500 or above then its command to move forward, and if its given input of 100 or less then its commands to stop, if only one get the reading of 500 and other get 100 it will go left or right based on with side of motor get 100 or less reading. And all the cammond will follow by the slave as well

CONCLUSION

In conclusion, swarm robotics represents a fascinating and promising field at the intersection of robotics, biology, and artificial intelligence. By drawing inspiration from the collective behaviors observed in natural swarms, researchers and engineers have developed innovative approaches to solving complex problems and performing tasks that are challenging for individual robots or centralized systems.

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Sending Alert Message to the user for Controlling and Interacting in the IoT Environment

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ABSTRACT

To send an alert message before a tragedy occurs is one of the significant requirements in a particular environment. Casualties can cause human life and also loss of money. So, to overcome such causalities in an Internet of Things environment, an alert message can be set for the user. If the value crosses a particular threshold, a buzzer or an alert message should pop up so the person can take specific preventive measures to stop any significant tragedy. In this manuscript, Arduino programming language, which reads the potentiometer value, is used. If the value crosses a particular threshold, it shows a warning message to the Serial Monitor.

KEYWORDS : *Alert message, ESP 32 board, Potentiometer, Serial monitor.*

INTRODUCTION

A program is written in the Arduino programming language to send an alert message in this manuscript. It is designed to read the value of a potentiometer connected to GPIO 34 (Analog ADC1_CH6) on an Arduino board [1]. It continuously reads the potentiometer value and prints it to the Serial Monitor. If the potentiometer value exceeds 2000, it also prints a "warning" to the Serial Monitor. In the same way, if any value like temperature, humidity or any other important parameter in a particular environment exceeds a particular limit, preventive measures can be taken before a situation becomes out of control [2].
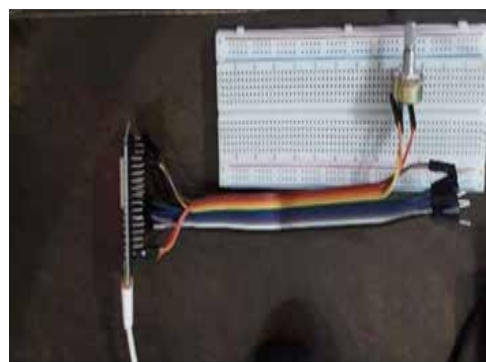
Fig. 2. Potentiometer connected to the ESP-32 board

Fig. 1. An ESP-32 board

Fig. 3. Connection of ESP-32 Board

IMPLEMENTATION

The hardware requirements are ESP-WROOM 32 board, Micro USB Data Cable, bread board, Potentiometer 10K, Male to female wires, Laptop/PC and for software requirement are Arduino IDE.

Connections

First, connect the data cable to the ESP 32 board as shown in Fig.1, check out the notch and insert the cable in a straight manner, without any tilt [3]. Connect the other end of the cable to the USB port of the Laptop/PC, and a blue light glow. Connect the potentiometer to the breadboard, as shown in Fig.2. Use the male-female cables to connect the potentiometer to ESP 32 [4]. The potentiometer's middle pin (yellow) is connected to GPIO 34; the red pin is connected to 3.3 V, and the orange pin is connected to the ground as shown in Fig.3.

Open Arduino IDE, then go to File→Examples→ESP32→Analog Read. Analog reading is helpful for reading values from variable resistors like potentiometers or analog sensors [5]. Upload the code of the program to ESP32. Before uploading the code, check if the correct port is selected. If the port is not selected, it will get an error message. Then go to Tools→Ports Install CH340g Driver from Google (exe file). Now check on the port. It should show com3 or com4. Select the port. After uploading the code and pressing the ESP32 reset button, open the Serial Monitor at a baud rate 115200. Rotate the potentiometer and see the values changing. Read potentiometer ESP32 analog Read [6]. The maximum value will get is 4095, and the minimum is 0, as shown in Fig.4. Now rotate the potentiometer. If the potValue exceeds 2000 V, it issues a "warning" message and prints the value to the Serial Monitor.

Procedure

A constant integer variable, potPin, is defined and assigned the value 34. It represents the GPIO pin to which the potentiometer is connected. Next, declare an integer variable potValue and initialize it to 0. This variable will be used to store the value read from the potentiometer. Then, the setup function runs once when the Arduino board is powered up or reset. After this, initializes the serial communication with a baud rate of 115,200. This is used for printing messages to the Serial Monitor. A delay of 1000 milliseconds (1 second) is added to ensure that the Arduino has enough time to initialize before the loop function starts executing [7]. The loop function runs continuously after the setup function is executed.

Next, it reads the analog voltage on the potPin (GPIO 34) and stores the result in the potValue variable. The analogRead function converts the voltage on the pin to a digital value between 0 and 4095 (assuming a 12-bit ADC resolution) [8].

Suppose the value of potValue is greater than 2000. In that case, a "warning" message is printed to the Serial Monitor, as shown in Fig.5. This condition detects when the potentiometer's value exceeds a certain threshold. Then, it prints the current value of the potentiometer to the Serial Monitor [9]. A delay of 500 milliseconds (0.5 seconds) is added before the next iteration of the loop function [10]. This helps slow down the rate at which potentiometer values are printed to the Serial Monitor.

Fig. 4. Potentiometer values (max and min)
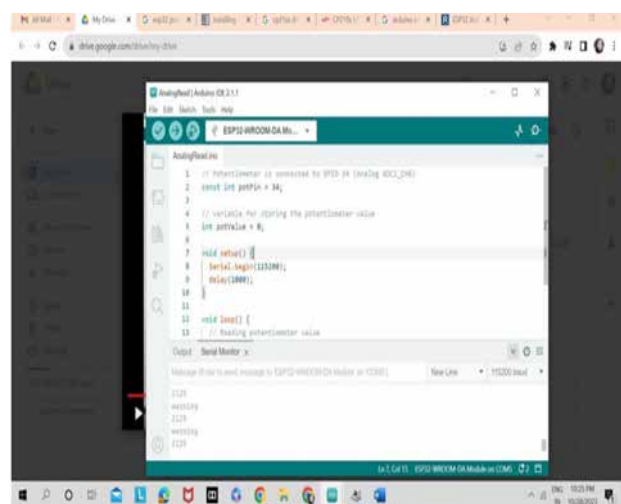
Fig 5. Warning message printed on the Serial monitor

CONCLUSION

To conclude, this program reads the analog value from a potentiometer, prints the value to the Serial Monitor, and issues a "warning" message if the potentiometer value is greater than 2000. It does this repeatedly in a loop with a 0.5-second delay between reading.

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IoT Processing in Cloud for Healthcare

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ABSTRACT

IoT (Internet of Things) processing in the cloud for healthcare has emerged as a transformative paradigm with the potential to revolutionize the healthcare industry. This innovative approach leverages IoT devices, cloud computing, and advanced data analytics to enhance patient care, improve healthcare operations, and drive medical research. This abstract provides an overview of the key aspects and implications of IoT processing in the cloud for healthcare. IoT devices such as wearable health trackers, medical sensors, and remote patient monitoring equipment are increasingly integrated into healthcare settings. These devices collect real-time patient data, including vital signs, activity levels, and treatment adherence, and transmit it securely to cloud-based platforms. In the cloud, this data undergoes rigorous processing and analysis, enabled by machine learning algorithms and AI technologies. The insights derived from this analysis empower healthcare providers with timely information, enabling early intervention and personalized care. Cloud computing offers scalability, cost-effectiveness, and data storage capabilities that are critical for handling the ever-growing volume of healthcare data. Furthermore, cloud-based solutions facilitate the seamless integration of IoT devices with existing healthcare IT systems, ensuring interoperability and efficient data flow. Despite the potential benefits, IoT processing in the cloud for healthcare presents challenges, including data security, privacy concerns, ethical considerations, and compliance with healthcare regulations such as HIPAA and GDPR. These challenges underscore the importance of robust security measures, data anonymization, and strict adherence to regulatory standards to protect patient privacy and maintain trust in the technology. Looking forward, the future of IoT processing in the cloud for healthcare is promising. It encompasses advanced applications such as remote patient monitoring, AI-powered diagnostics, telemedicine enhancements, and personalized medicine. Emerging technologies like 5G, edge computing, blockchain, and ethical AI will further shape the landscape of healthcare IoT, driving efficiency, accessibility, and innovation. In conclusion, IoT processing in the cloud for healthcare is poised to reshape the healthcare landscape, empowering healthcare providers, improving patient outcomes, and advancing medical research. While challenges persist, the potential for positive impact on healthcare delivery and patient well-being is substantial, making this an area of ongoing innovation and exploration in the healthcare sector. Use of MQTT [7](Message Queuing Telemetry Transport) and AWS IoT (Amazon Web Services Internet of Things) has paved the way for more efficient and reliable solutions.

KEYWORDS : *AWS IoT, MQTT, Cloud computing, HIPAA and GDPR, AI technologies.*

INTRODUCTION

The healthcare industry is witnessing a paradigm shift in patient monitoring and care, thanks to the convergence of Internet of Things (IoT) technology with cloud computing. In particular, the use of MQTT [7](Message Queuing Telemetry Transport) and AWS IoT (Amazon Web Services Internet of Things) has paved the way for more efficient and reliable bedside monitoring solutions in healthcare .Bedside monitors,

equipped with an array of sensors and data collection capabilities, play a pivotal role in the continuous assessment of a patient's vital signs and overall well-being. However, the true power of these monitors lies in their ability to seamlessly connect to the cloud, where sophisticated data processing and analytics take place. This paper explores the integration of MQTT and AWS IoT into healthcare bedside monitoring, shedding light on how this technology duo is revolutionizing patient care. Key Components of IoT Processing in the Cloud for Healthcare Bedside Monitoring using MQTT and AWS IoT: MQTT Protocol: MQTT serves as the communication bridge between IoT devices, such as bedside monitors, and cloud-based services. Its lightweight and efficient publish-subscribe messaging model enable real-time data transmission with minimal overhead. IoT Devices: Bedside monitors equipped with various sensors, including those for monitoring heart rate, blood pressure, oxygen levels, and more, are essential components of the system. Connectivity: MQTT ensures reliable and low-latency connectivity between IoT devices and AWS IoT Core, facilitating the seamless transfer of patient data to the cloud. AWS IoT Core: This is the core platform that manages the IoT devices, securely ingests data, and facilitates the routing of messages to the appropriate AWS services for further processing. Cloud-based Data Processing: AWS offers a suite of services, including Lambda, Kinesis, and S3, for data processing, storage, and analytics. This allows for real-time data processing, storage, and insights generation. Security and Compliance: Robust security measures, such as device authentication, encryption, and access controls, ensure the confidentiality and integrity of patient data, aligning with healthcare regulations like HIPAA.

Benefits of IoT Processing in the Cloud for Healthcare Bedside Monitoring using MQTT and AWS IoT:

Real-time Monitoring: MQTT and AWS IoT facilitate real-time data transfer, enabling healthcare providers to monitor patients continuously and respond promptly to critical changes in their condition.

Scalability: AWS IoT's scalable infrastructure ensures that healthcare facilities can accommodate a growing number of IoT devices and patients without compromising performance.

Data Insights: The AWS ecosystem provides powerful tools for data analysis and machine learning, allowing healthcare professionals to gain actionable insights into patient health trends and make data-driven decisions.

Remote Accessibility: Authorized healthcare personnel can securely access patient data from anywhere, improving collaboration and decision-making, especially in remote or critical care scenarios.

Cost-efficiency: By eliminating the need for on-premises hardware maintenance and reducing data center costs, cloud-based IoT solutions can lead to substantial cost savings for healthcare organizations.

Challenges and Considerations:

Data Security: Ensuring the security of patient data, including protection against potential breaches or unauthorized access, is of paramount importance.

Integration: Seamlessly integrating MQTT and AWS IoT[8] with existing healthcare systems and workflows requires careful planning and customization.

In conclusion, the integration of MQTT and AWS IoT into healthcare bedside monitoring is a transformative approach that enhances patient care by enabling real-time data insights, scalability, remote accessibility, and cost-efficiency. While challenges related to data security and integration exist, the benefits derived from this technology combination are propelling healthcare facilities towards a more connected and data-driven future, ultimately improving patient outcomes and healthcare efficiency. This paper will delve deeper into these components, benefits, and challenges to provide a comprehensive understanding of this innovative approach.

PROBLEM STATEMENT

In this project, building up on the IoT Core and DynamoDB lab. Device simulator will publish SpO2 (Oxygen Saturation) , Body Temperature values and Heart Rate periodically. Only need to channel that to the cloud (IOT Core → DynamoDB), and then aggregate data and detect anomalies.

ARCHITECTURE

Architectural Requirements ● Availability ○ Continuous data push to edge or cloud ○ Immediate local alerts

from mobile or traditional edge ○ Cloud scale for a large number of devices ● Device Monitoring ○ Ensure "on" state and correct functioning ○ Device hardware (battery, tampering) and software (updates, security) checks and alerts ● Stakeholder Updates ○ Push to family members and healthcare staff on multiple communication channels ● Data security ○ Sensitive healthcare data - Protection at rest and in transmission ● Data correlation ○ Correlation between health parameters and activity/location ● Pattern Analytics ○ Aggregate analytics for behavior modeling ○ Long term diagnosis and suggestions Types of Data ● Heart Rate - Electrode or Optical sensor ● ECG Electrical signal trace measurement sensor.

Figure 1. System architecture[17]

Figure 2. AWS IoTCore[22]

● Blood Pressure - Sphygmomanometer, Oscillometric sensor ● Oxygen Saturation (SpO2) - Pulse oximeter based on light absorption ● Respiratory Rate & Volume

- Piezoresistive& differential flow sensors ● Body temperature - Skin-touch wearable sensors ● Activity - Movement and acceleration sensors ● Location - GPS monitoring in wearable or mobile.

AWS IoT Core ● Virtual device configuration and mapping to real devices ● Shadow device service to maintain status, monitoring, updates, and upstream connections ● Device organization in various hierarchical categories ● Secure device communication - X.509 certificate and keys for authentication and authorization ● Communication protocols - MQTTS, MQTT over secure websockets, HTTPS, LoRaWAN ● On-the-fly data transformation ● Data streaming to various services - DynamoDB, S3, SNS, Lambda, Elasticsearch, Cloudwatch, IoT Analytics, IoT Events, Kinesis, SQS, Custom services ● Scalable to billions of devices.

Figure 3. AWS IoT Core-components[21]

AWS IoT - Components Device & Edge Services ● Greengrass - SDK for Edge Servers ● Free RTOS - Real-time OS for Devices ● Free RTOS BLE Mobile SDK - Low power communication via mobiles Cloud services ● IoT Core - Scalable and secure device connection and communication Device shadows, On-the-fly data transformation, post-collection seamless connection to various AWS services ● IoT Device Management - Registration, Organization, Monitoring, Update Management Analytics Services AWS IoT Analytics - Workflows, Time-series data storage, Queries, Transformations, ML ● IoT Events - Rule-based event processing and actions ● IoT Things Graph - Visual organization and workflow

METHODOLOGY

This methodology offers a structured approach to implementing IoT processing in the cloud specifically for bedside monitoring in healthcare. 1. It emphasizes the critical aspects of compliance, security, usability, and scalability to ensure the success of bedside monitoring project.2.Make sure , Python 3.6 or higher installed.At command prompt, run: $ python --version Python 3.7.3 .3.Ensure that the boto3 module is installed to interact with DynamoDBapis. 4. After the appropriate settings in IoT Core and DynamoDB, run the simulator code for at least an hour to create enough data in DynamoDB. 5. Please follow the account creation doc to get hold of the session key and secret key to perform the insert and fetch operation in DynamoDB using python program.

DynamoDB ● Fully Managed - No installation, upgrade, capacity planning, or manual provisioning needed ● NoSQL data model - Key-value and document models supported, in-build memory caching, support for multiple complex data types ● Access based optimization - Partition and Sort keys for efficient single or range pickup ● Scalable - Auto-scalable with simple rules based on size and read/write load ● Redundant - No single point of failure, multi-region ● Secure transmission, Encrypted at rest, Backup/Restore ● Ingress - Simple ingestion setup from IoT Core and other services ● Egress - Base for batch processing and analytics services, item-level change streaming to Kinesis.

IMPLEMENTATION

This project, building up on the IoT Core and DynamoDB lab. The device simulator will publish SpO2 (Oxygen Saturation) , Body Temperature values and Heart Rate, periodically, need to channel that to the cloud (Iot Core → DynamoDB), and then aggregate data and detect anomalies.

● In this example : ● focus is on the main flow, and not as much on error handling Similar to the lab, create Things, Certificates, Policy, DynamoDB table (bsm_ data) and IoT Core Rule , push the data created to the DynamoDB table. The simulator code is similar to the lab's simulator. And should create at least two devices/things.the simulator code to take deviceid as another parameter or run two copies in parallel with different hard-coded device ids. run them for at least an hour continuously to generate enough data. The data is being generated at 1, 15, and 20 second frequencies for the three different sensor types.

Aggregate the data in another table a. Create a new table (bsm_agg_data) using code or manually via the UI. Create model and database classes to access DynamoDB, the data aggregate from the three sensors individually, at the minute level. You should calculate and store the average, minimum and maximum values taking all values within a minute in account. Detect anomalies based on rules and store them.

Create a rules config file using any format that you see fit, including json. Also ability to define combination alert rules. One should be able to define an OR rule with min and max average values for any of the three data types. In addition to this one should be able to define a trigger count so that the values should be breached continuously that many times, before an alert should be raised.

Create a new table (bsm_alerts) using code or manually via the UI. Create the appropriate model to access it. Functionality - run the rule check for a specified time range. Also check all rules on all devices individually within that time period and raise alerts as appropriate. Alerts should be printed on the console, and saved to the bsm_alerts table with an appropriate format, specifying device id, data type, the timestamp of the first instance of breach, and the rule that was breached.

RESULT ANALYSIS

1. Screenshot of populated raw data in the table

2. Screenshot of populated aggregated data in the table

3. Screenshot of populated anomaly data in the table

FUTURE SCOPE

The future of IoT processing in the cloud for healthcare holds significant potential for transformative advancements in patient care, healthcare efficiency, and medical research. Here are several promising areas and trends that indicate the future scope of IoT processing in the cloud for healthcare: Advanced Remote Patient Monitoring, AI-Driven Predictive Healthcare, Telemedicine and Virtual Health, IoT-Enabled Medication Management, Blockchain for Data Security, Healthcare Robotics [11] etc.

CONCLUSION

In conclusion, IoT processing in the cloud for healthcare represents a transformative approach to revolutionize the healthcare industry. By seamlessly integrating Internet of Things (IoT) devices with cloud computing, this technology offers a wide range of benefits and opportunities to enhance patient care, streamline healthcare operations, and drive medical research.

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Battlefield Awareness using IoT in Network Centric Warfare : Soldiers Health Integration for Enhanced Location Deployment (SHIELD) System

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ABSTRACT

Data transmission during modern combat situations needs to be fast and reliable. At the same time, it should be able to support the rapidly changing requirements of Network Centric Warfare (NCW) and battlefield awareness. Battlefield awareness refers to the capability of military forces to collect, analyse, and comprehend real-time information on the battlefield which enables commanders to make well- informed decisions. Soldiers being the most critical element on the battlefield, their fighting potential needs to be enhanced and their ability to provide valuable information about the battlefield should be explored. This paper presents a reliable and scalable implementation of an Internet of Things (IoT) architecture, specifically designed for monitoring soldiers' health and acquiring real-time battlefield data. The system, named Soldiers Health Integration for Enhanced Location Deployment (SHIELD), integrates a comprehensive range of biometric and environmental sensors. These sensors monitor not only the physiological parameters of the soldier but also critical aspects of the battlefield environment. Portable and designed for long-range functionality with low power consumption, the SHIELD system incorporates key IoT technologies and biometric sensors in a wearable device. This device facilitates seamless communication and data exchange between the soldier and a centralised command centre.

KEYWORDS : *Battlefield awareness, Internet of Things (IoT), SHIELD, Real-time monitoring.*

INTRODUCTION

Battlefield awareness is a crucial aspect of all tactical military operations, demanding continuous acquisition, processing, and comprehension of real-time information. The ability to make informed decisions, adapt swiftly to evolving circumstances, and optimize resource utilization is paramount for military commanders. Recognizing the soldier as the linchpin in this dynamic environment, this paper introduces an innovative solution in the form of the Internet of Military Things (IoMT) based Soldier Wearable System. Focused on augmenting real-time battlefield awareness, the system presented in this paper seamlessly integrates an extensive range of biometric and environmental sensors with the soldier making him a potent weapon in himself.

Beyond monitoring the physiological parameters of the soldier, the system extends its scope to encompass crucial aspects of the surrounding battlefield environment. This wearable device harnesses IoMT technologies, facilitating seamless communication and data exchange between the soldier's wearable and a centralized command centre. Emphasizing the achievement of low-latency and high- reliability data transmission, the system is designed for real- time monitoring and decision-making, thereby ushering in a new era of enhanced military operational effectiveness.

The focus of this paper is to implement a novel architecture for a long-range low power portable system which can be worn by a soldier in the tactical battlefield. The system is expected to be robust and reliable and preferably have a very low latency for real time data

accessibility. The system is designed using Military Internet of Things technologies which is a subset of IoT.

The Internet of Things (IoT) is a system of interlinked physical devices which can be any vehicle, appliance, and various other objects that are equipped with sensors, software, and network connectivity. This empowers them to gather and share data. The core idea of IoT is to establish a seamless and intelligent link between the information sensing and decision making, facilitating continuous and uniform data transmission among devices. This makes decision-making based on reliable data and knowledge.

Internet of Military Things (IoMT) takes IoT a notch further. The plethora of sensors and actuators that exist on the modern battlefield are integrated into a single system with IoT based technologies giving rise to IoMT. The integrated system now acts a force multiplier on the battlefield making battlefield awareness and soldier health monitoring easier than never before.

LITERATURE REVIEW

The inception of the Internet of Things (IoT) dates back to the early 1980s. First demonstration of an IoT based system was a modified beverage vending machine at a leading American University which emerged as one of the earliest instances of a network of smart devices. This vending machine, connected to a local network, transmitted data regarding its stock level and the condition of the stored products. However, the contemporary concept of IoT took shape in the early 1990s with leading researchers working on IoT based technologies. This idea gained traction in academic forums due to its potential for plethora of applications. Since then, IoT has undergone substantial development, giving rise to various subsets with their own applications in military, agriculture and medical fields.

T. Yokotani in his paper [1] has discussed the application and technical issues of IoT in 2012. His research introduces the concept and definition of IoT, as well as its architecture, key technologies, and challenges. The paper reviews some of the existing and potential uses of IoT in different areas, such as domestic, urban, smart grid, smart medicine, and smart industry. He also identifies some of the technical issues and research directions for IoT, such as standardization,

interoperability, security, privacy, scalability, reliability, and energy efficiency.

Yushi et al. [2] in his paper explores the technical details and application modes pertaining to Military IoT (MIOT). The paper proposes a definition and an architecture of MIOT. The paper analyses three methods of MIOT, namely data detection, data communication, and data processing, and illustrates how they can be applied in various military domains, such as command and control, intelligence and reconnaissance, weapon control, logistics support, and training and simulation.

Jin, Gubbi et al. [3] have given an outline for forming an intelligent urban network using system of interconnected devices in 2014. They have given a comprehensive review of IoT technologies and proposed an architecture for an intelligent metropolitan using interconnected devices.

Aashoy Gondalic et al. [5] discuss a system that can detect the geographical position and sense the various parameters of the soldiers in real time with the help of positioning systems and various biometric sensors. Their paper also discusses the challenges and benefits of the system, such as enhancing the safety and performance of the soldiers, facilitating the medical decision making and intervention, and improving the command and control of the military operations. The paper presents a system architecture and a prototype implementation using Arduino, Node MCU, and various sensors.

In 2018, Afef Mdhaffar et al. [6] in their paper presented a system in which various sensors were used as an interconnected system for tracking the soldier's parameters using LoRaWAN and secure wireless communication technology. Their paper proposes a system that can collect and transmit biosensor data from patients to a cloud-based analysis module, where algorithms are used to detect abnormal situations and provide feedback. The paper also discusses the challenges and benefits of the system, such as reducing the cost and complexity of health monitoring, improving the quality of care and patient satisfaction, and enabling remote and preventive healthcare. The paper presents a system architecture and a prototype implementation using Arduino, Node MCU, LoRaWAN, and various sensors.

RELATED WORK

IoT and IoMT based technologies have seen rapid growth in the recent past owing to the plethora of applications they offer. There have been numerous implementations of IoT based systems in the field of defence and military applications. The aim of this research-based project is to propose and implement a novel framework architecture which may advance IoMT technology in a tangible way and contribute to further applications.

Maria Manoje et al. [7] have presented a model for combatant tracking system that detects the different physiological parameters. It is implemented using a programmable microcontroller and associated sensors. They have used Zigbee technology for transmission and reception of data.

Another implementation of such system is done by Shruthi Nikam et al. [8] in 2017. They have presented a system for the position tracking of a soldier and his navigation using GPS. The system has been implemented using an ARM based microcontroller.

SYSTEM ARCHITECTURE

The fundamental entity of battlefield is the soldier. In the SHIELD system, a wearable harness system is worn by the soldier. The system comprises of various sensors which capture soldier's physiological data and data from the surroundings. The graphical representation of the soldier with the SHIELD has been depicted in Figure 1.
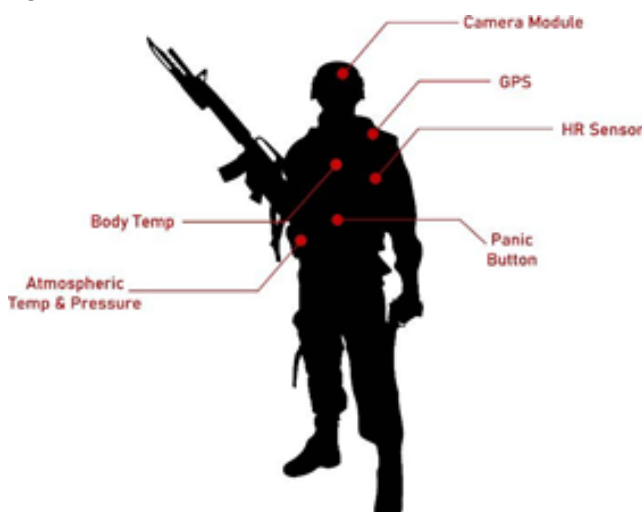
The framework for the Soldier Wearable SHIELD device has been shown in Figure 2. It is based on three entities i.e. a Command-Relay Network, a Field Command Post and a Squad. [15]
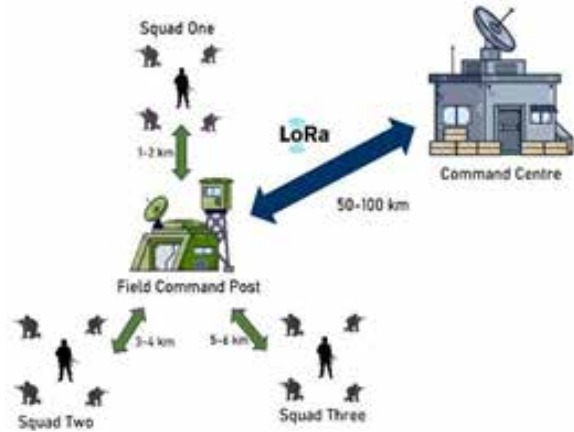
Fig. 2. System Architecture of the IoMT based SHIELD System

The system envisages the basic entity of a field unit as the Squad which consists of small team of 5 to 10 soldiers led by a team leader. The data from this squad flows to the Field Command Post. The collected data is collated and sorted here. It may be further sent to the Command Centre where higher computing resources are available for sorting and processing of data. Relevant decisions with respect to the battlefield are taken here and then are communicated down the chain.[18]

The consolidated architecture consists of the connection from each soldier to the Squad Leader and then further to the next command post or station. The Squad dynamics are illustrated in Fig. 3.
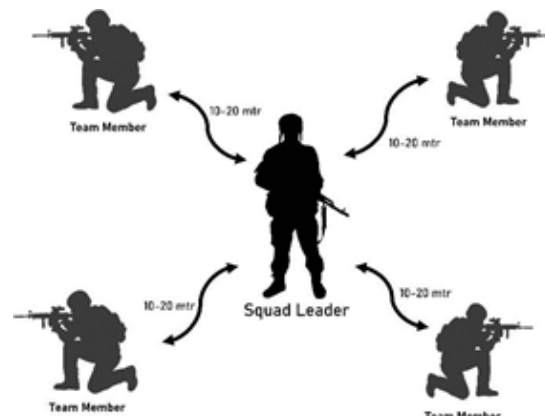
Fig. 3. Dynamics within a Squad

Fig. 1. System Architecture of the IoMT based System

IMPLEMENTATION DETAILS

The main objective of SHIELD device is to improve the accuracy of actions of the soldiers on the tactical battlefield. It comprises of various components, like biometric and bio- mechanic sensors and other sensors which detect other environmental parameters. Temperature and humidity of the surroundings is detected with an AHT-10 sensor, providing the reading in degrees and humidity in percentage. The system also includes a hazardous gas sensor which detects the presence of harmful gases which can be used in chemical or radiological warfare. For soldier tracking, the system integrates the GPS sensor, offering accurate position data. The global positioning system sensor is employed to access the satellites signals, determining the soldier's position information, which are then sent to the microcontroller.[19]

Fig. 4. SHIELD Transmitter Module

The programmable controller, equipped with integrated program for an IoT module on a programmable microcontroller, is designed to monitor and capture the physiological parameters of the soldiers. The in-built SHIELD device activates an alarm if the body parameters surpasses or declines as compared to a benchmark value, and it triggers various other mechanisms which can help the soldier to maintain their body parameters.Through a serial connection, the IoT module transmits and receives temperature, heart rate, and location data. The results are displayed in the base station. In emergency situations, an alert can be sent to the field command post or to the other unit by pressing an emergency switch. The receiver module continually monitors the status, presenting relevant information on an LCD display. The figures below show the actual system implementation.

Fig. 12 shows the transmitter module and Fig. 13 shows the receiver module. There can be many transmitter modules connected to a central receiver module.

Fig. 5. SHIELD Receiver Module at Base Station

RESULTS AND DISCUSSION

The system was rigorously tested in various environments and in varying weather conditions to simulate the battlefield environment.

Ranges Achieved

Typical range achieved was approximately 7 km. The range achieved remained unaffected by the presence of building and other structures.

Transmission and Reception of Data

The data from the sensors is constantly monitored, captured and transmitted to the base station by SHIELD transmitter. Parameter threshold can be set to alert the base station for various emergencies.

Upon successful transmission, an data frame containing GPS position information is dispatched to the command node or the nearest data processing node capable of taking decision. In case of the soldier's vital signs deviating from the set benchmarks, the command node promptly is alerted by the transmitter of the soldier and provides the accurate location. This allows for the collection and assessment of crucial physiological parameters and position of soldier.

There is provision of a 'panic' switch which can be manually activated by the soldier or automatically triggered in an event like the soldier taking a hit on the body. Upon activation, an emergency alert is sent to the

command node including the position. This could be used to request for emergency backup or for evacuation.

Additionally, the combatant is in a surrounding which is having adverse weather and the parameters fall below or go above the benchmarks, there is a provision for inclusion of heating or cooling system which can be switched on. Any abnormal pulse rate triggers an alert to the command node or squad leader as the case may be, providing the precise position.

The device, affixed to the soldier's tactical harness or harness utilizes location sensor for tracking both health status and current position.

Interface for Data Reception

The system status interface is available in dual mode. It is implemented as part of the receiver module as LCD screen. This is aimed to facilitate handheld usage in field conditions by the squad leader or field command post. In a more sophisticated setting, the data can also be captured and represented on a computer display. In this system, the data is displayed remotely using Adafruit utility.

Fig. 6. LCD display of SHIELD Receiver Module

Fig. 7. System interface on Adafruit IO

Fig. 8. Data received and displayed on System Interface

CONCLUSION AND FUTURE SCOPE

The objective of this paper has been to disseminate data about successful employment of SHIELD system in the simulated combat scenario. SHIELD has been proven to be successful in capturing and transmitting various parameters of the solider and more importantly capture battlefield data using sensors like gas sensors, pressure and ambient temperature sensor. In future, we envision enhancing the system by incorporating a solar panel for continued power accumulation during the day.

SHIELD system employs an innovative data transmission method for transmitting accurate sensor data. The seamless and rapid flow of information is achieved over large range using LoRaWAN communication technology. This allows the command node or another squad to assist in critical situations by tracking the sensor values, the surrounding battlefield situation, and the soldier's location. The system proves highly advantageous in wartime and rescue operations, offering unrestricted use, ensuring the protection of combatants in battle, and exhibiting high effectiveness due to integrated systems and sensors.

SHIELD is capable of effortless attachment to a soldier's hand or harness and can be made more potent by implementing an improved communication protocols to boost robustness and scalability.

ACKNOWLEDGMENT

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A Comparative Analysis of Convolutional Neural Networks for Accurate Brain Tumor Detection

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ABSTRACT

Brain tumours are a global health concern that re- quire prompt and precise diagnosis in order to initiate successful therapy. The potential of convolutional neural networks (CNNs) increasing precision of brain tumour diagnosis and classification is investigated in this paper. Using MRI images, we assessed the effectiveness of nine popular CNN models for the categorization of brain tumours. This comparison study assists in determining the most effective model for accurate brain tumour identification, allowing medical practitioners and researchers to make more informed judgements in the field. For better patient outcomes and efficient medical intervention, brain tumour detection accuracy is essential. In order to accurately detect brain tumours, this paper provides a thorough comparative review of convolutional neural networks (CNNs). Variety of CNN models, such as VGG16, VGG19, Inception V3, InceptionResNetV2, ResNet50, ResNet50V2, ResNet101V2, MobileNetV2, and EfficientNetV2L, are evaluated in terms of how well they classify MRI images that show various brain tumour types, including glioblastoma, meningioma, and pituitary tumours. The assessment measures provide a thorough insight of each model's capabilities and include accuracy, precision, recall, and F1-score. The results pro- vide insight on the advantages and disadvantages of various CNN topologies, which advances brain tumour detection techniques.

KEYWORDS : *Brain tumor classification, CNN, Machine learning MRI, Accuracy, Efficiency, Deep learning.*

INTRODUCTION

Abnormal cell grows in the brain that result in a mass or lump are called brain tumours. They can develop from a variety of brain cell types and can be benign (noncancerous) or malignant (cancerous) [2]. Depending on location, size, and type of tumour, symptoms such as headaches, seizures, difficulty speaking or understanding, weakness or numbness in the limbs, vision problems, and personality changes may indicate a brain tumour. With an estimated 700,000 new cases detected year, brain tumours are growing increasingly prevalent worldwide, necessitating increased need for accurate and timely diagnosis.

The detection along with categorization of brain tumours include use of trending medical imaging techniques, such as magnetic resonance imaging (MRI) scans. Traditionally, radiologists or other medical professionals have carried out this task by visually analysing the images and looking for features unique to the tumour. However, more impartial and trustworthy methods for diagnosis of brain tumours are needed as this procedure may be laborious and prone to human mistake. According to research conducted by the International Agency for Research on Cancer (Source: Globocan 2020), there would be 3,08,102 new instances of cancer in 2020 across all age groups and

both sexes, and 2,51,329 fatalities related to the brain and central nervous system.

Deep learning-based technologies have showed considerable promise in recent years for increasing accuracy of brain tumors identification. Convolutional neural networks (CNNs) are a sort of deep learning model that excels at image categorization tasks [1] [4]. CNNs may be trained on big datasets to reach great levels of accuracy in recognising patterns and features in pictures by analysing numerous layers of convolutional filters [4]. The use of CNNs for brain tumors identification has received a lot of attention in recent years [4]. One of the primary benefits of employing CNNs is that they can extract features from pictures automatically, eliminating the need for human feature engineering. This makes them especially valuable for medical imaging jobs, since the traits crucial to illness diagnosis may not be readily apparent to human specialists [4].
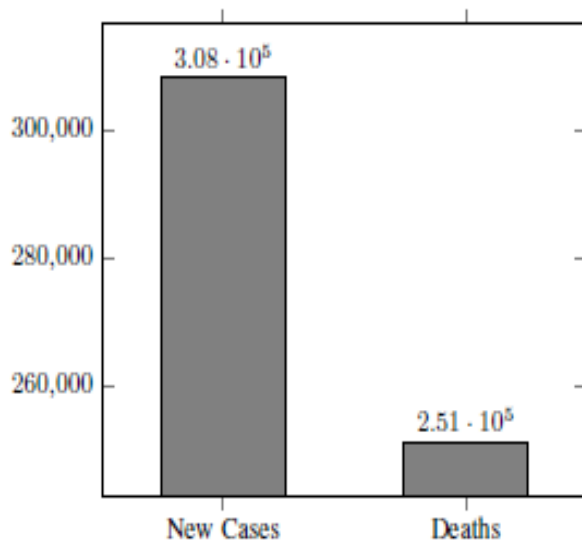
Several research have revealed promising outcomes when utilising CNNs to identify brain tumors. For example, a 2019 research published in the journal Radiology discovered that a CNN-based model had a 92% [11] accuracy rate in detecting glioblastoma, the most frequent and severe kind of brain tumors [4]. Another research published in the journal PLOS One in 2020 found that the identification of meningioma, a kind of tumors that comes from meninges, protective membranes that surround the brain and spinal cord, was

95.4% accurate.

Despite these encouraging findings, further study is needed to assess the effectiveness of alternative CNN models for brain tumors identification [2] [4]. The purpose of this work is to give a comparison of nine different CNN models for tumors classification by using MRI data. The research examines performance of each CNN model using several metrics like accuracy, precision, recall, and F1-score using dataset of brain MRI images from patients with glioblastoma, meningioma, and pituitary tumors.

Brain tumour detection is hampered by a lack of data, moral dilemmas, and trouble getting labelled pictures. In order to overcome these difficulties, this work investigates the advantages of transfer learning by using trained models on big datasets such as ImageNet. By adjusting to specific medical picture attributes, [2] transfer learning improves model accuracy by fine-tuning on a limited dataset of brain tumour images. Furthermore, transfer learning increases computing efficiency a critical component for timely and accurate medical diagnostics by lowering computational load and facilitating faster convergence. By encouraging improved generalisation to a variety of brain tumour pictures, the method reduces overfitting and guarantees reliable performance.

Criteria including accuracy, precision, recall, and F1-score, study analyses nine widely used CNN models: ResNet50, ResNet50V2, ResNet101V2, VGG16, VGG19, InceptionV3, InceptionResNetV2, MobileNetV2, and EfficientNetV2L. The results help comprehend how well CNN models function in the categorization of brain tumours, which helps with the creation of automated systems for precise and timely diagnosis and, eventually, better patient outcomes [4].

LITERATURE REVIEW

The detection and accurate diagnosis of brain tumors represent critical challenges in the field of medical imaging, prompting continuous advancements in methodologies to enhance precision and efficiency [1]. Over the past decade, researchers have delved into a spectrum of approaches, ranging from traditional techniques to sophisticated deep learning models [3].

Shiju et al. (2022) proposed a CNN model with UNet

and morphological operations, achieving accurate tumor segmen- tation through cross-validation [1]. C N Savithri et al. (2022) applied SVM with different kernel functions, yielding superior results with the Gaussian Kernel and employing Otsu segmen- tation [3]. Sunil Kumar et al. (2021) emphasized the accuracy of CNN methods in brain tumor detection [4]. Simarjeet Kaur et al. (2021) conducted a comparative study on denoising techniques, with the BM3D filter outperforming others on brain NCCT images [5]. Ankit Ghosh et al. (2021) explored machine learning algorithms, concluding that Gradient Boost- ing excelled in binary classification, and XGBoost performed best in multi-class classification [6]. Deepa P L et al. (2021) proposed a comparative analysis of ResNet variants, with ResNet-152 proving more accurate for brain tumor detection [7]. Alaa Ahmed Abbood et al. (2021) compared deep learning models, finding ResNet to have the highest accuracy, though slower than AlexNet [8]. Soukaina El Idrissi El kaitouni et al. (2020) conducted a comparative study between U-net and LBP-k-means methods, noting a slight superiority of the Markov approach in brain tumor segmentation [9]. Deipali Vikram Gore et al. (2020) presented a systematic review, identifying research gaps and highlighting CNN's advantages in learning complex features for brain tumor detection [10].

P.K. Bhagat et al. (2019) contributed a study on MRI image texture analysis, using various supervised algorithms (kNN, ANN, SVM) for detecting tumor images in MRI datasets [12]. Among these classifiers, SVM demonstrated superior results, underscoring its efficacy in brain tumor detection. This comprehensive review signifies the continual evolution towards more sophisticated and accurate brain tumor detection methodologies [3].

METHODOLOGY

The efficiency of nine alternative CNN models in identifying brain tumors was examined in this work, including VGG16, VGG19, Inception V3, InceptionResNetV2, ResNet50, ResNet50V2, ResNet101V2, MobileNetV2, and EfficientNetV2L. The purpose was to see which model performed the best in categorizing combined class of glioblastoma, meningioma, and pituitary tumors using Br35H Brain

Tumour Dataset from Kaggle. The models were trained and assessed using the same template code, which comprised setting up a checkpointer, halting early, compiling the model with a categorical cross- entropy loss, an Adam optimizer [2] with a learning rate of 1e-4, and accuracy measures. The code included fitting the model over training data with the help of fit generator() function and 32 steps per epoch, as well as testing the model on test data with a validation data parameter. The models were trained for 20 epochs using checkpointer and early stopping callbacks. Data augmentation methods like random rotation, zooming, flipping were employed to produce training dataset throughout the training phase. The pictures were normalised before being divided into training and validation sets. The validation data was utilised during training to evaluate the models and verify that they were not overfitting to the training data.

According to the findings, ResNet101V2 had best accuracy, followed by ResNet50V2. VGG16, InceptionV3, and InceptionResNetV2 also obtained great accuracy. EfficientNetV2L and MobileNetV2 showed lower accuracies than the other models assessed, which might be due to their smaller model sizes and lesser complexity.

The models were also evaluated using other measures including accuracy, recall, and F1- score. Findings indicated the ResNet consistently scored well on all assessment measures.

Fig. 1. ResNet 101v2 Architecture

One possible reason for the ResNet models' excellent accuracy is their use of skip connections, which allow for greater gradient propagation during training. This enables the model to learn more successfully while avoiding disappearing gradients. VGG models, on the other hand, attain excellent accuracy by using smaller kernels and deeper layers [10] . To capture characteristics at various scales, the Inception models use numerous branches with varying kernel sizes.

The findings of the study have a big impact on how deep learning methods for classifying tumours are developed. Use of ResNet models and other models examined in this work might help increasing precision and effectiveness of brain tumour identification and diagnosis. Subsequent investigations might include merging several models in order to improve precision and applicability.

If the validation loss did not improve after a predefined number of epochs, the early stopping callback function ended the training session. When performance improved, the model's weights were recorded via the checkpointer callback method. The model was developed using an Adam optimizer with learning rate of 1e-4, categorical cross-entropy loss function with accuracy as the evaluation measure. The fit generator() technique produced batches of pictures with data augmentation before to training the model on training set. Finally validation data option was used to compare model against the test data.

Table 1. Evaluating Metrices of 9 Different Models

Sr. No.	Model Name	Accuracy	Precision	Recall	F1 Score
1.	ResNet101V2	99.67%	0.9968	0.9967	0.9967
2.	VGG19	78.67%	0.7948	0.7866	0.7851
3.	VGG16	89.00%	0.8901	0.89	0.8899
4.	InceptionV3	91.00%	0.9101	0.91	0.9189
5.	InceptionResNetV2	96.16%	0.9617	0.9616	0.9616
6.	EfficientNetV2L	85.66%	0.8631	0.8566	0.8560
7.	MobileNetV2	75%	0.8333	0.75	0.7333
8.	ResNet50	88.33%	0.8917	0.8833	0.8827
9.	ResNet50V2	99.33%	0.9934	0.9933	0.9933

RESULTS AND DISCUSSION

With an amazing accuracy of 99.67%, F1 score of 0.9966, recall 0.9967, precision 0.9967 and ResNet101V2 model was shown to be the most successful in identifying brain

tumors. Skip connections are used in the ResNet101V2 model to increase gradient propagation during training, allowing for more effective learning and eliminating disappearing gradients. This, together with the model's deep design, allows it to extract features from photos with great accuracy.
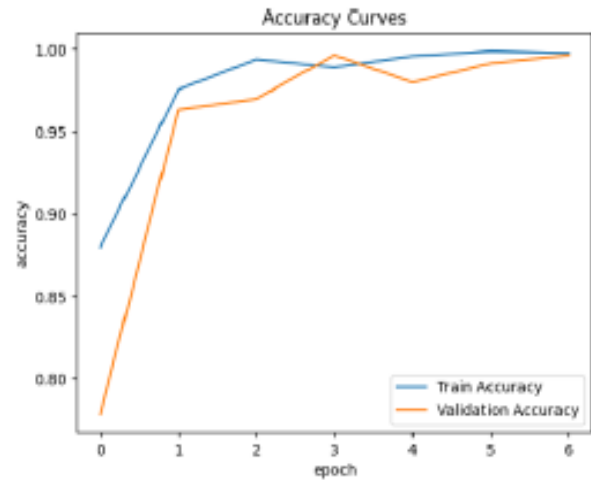
Fig. 2. Accuracy Curves Graph

According to the F1 score, recall, and accuracy measures, the ResNet101V2 model performed well in all areas of classification, including recognising false positives and false negatives. This implies that the model has a high level of resilience and generalizability, making it a viable contender for practical applications.
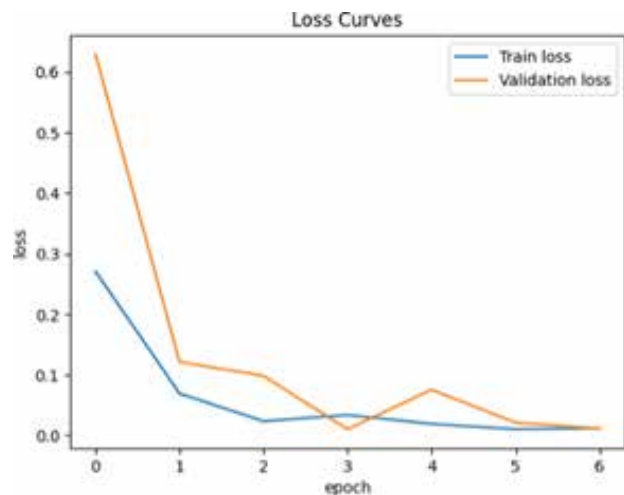
Fig. 3. Loss Curves Graph

The confusion matrix depicts the number of true positives, false positives, true negatives, and false

negatives to give supplementary information on the efficacy of a classification model. [13] True positives (TP), false negatives (FN), false positives (FP), and true negatives (TN) are represented by the values in a confusion matrix for a binary classification problem located in the top left, top right, and bottom left corners, respectively. [13]
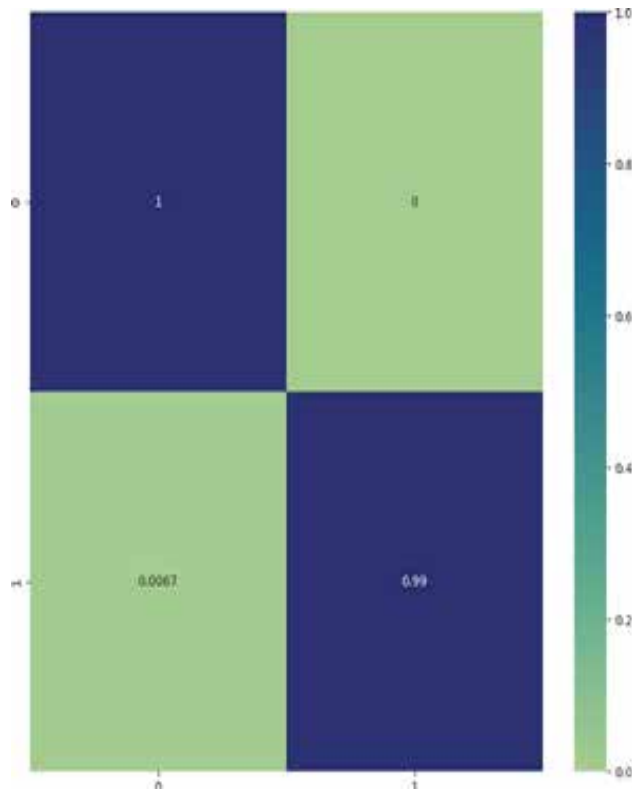
Fig. 4. Confusion Matrix

CONCLUSION

The outcomes of this research shows deep learning approaches have potential to improve accuracy of brain tumors identification, classification. Among the models examined, the ResNet101V2 model had the best accuracy and F1- score, suggesting that it may be the most effective model for this job. However, the other models worked good as well, indicating that there may be numerous useful models for brain tumors categorization.

Overall, the research emphasises the necessity of developing precise and timely approaches to detect and diagnose brain tumors. With worldwide prevalence, brain tumors on rise, fast and precise detection is critical

for improving patient outcomes. Deep learning-based algorithms, such as those used in this work, have the potential to greatly increase the accuracy and efficiency of brain tumors identification and classification, resulting in better patient outcomes. [4] The results of this work give useful insights in effectiveness of several models for brain tumors classification that may assist development of more efficient approaches for brain tumors detection and diagnosis.

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AI's Impact on India's EV Market

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ABSTRACT

Electric vehicles (EVs) have emerged as a promising and sustainable alternative to traditional internal combustion engine vehicles, addressing environmental concerns and reducing dependence on fossil fuels. This abstract explores the key aspects of electric vehicles, encompassing their technological advancements, environmental impact, market trends, and future prospects. The paper delves into the core components of electric vehicles, including batteries, electric motors, and power electronics, highlighting advancements in energy storage technologies and their impact on driving range, charging infrastructure, and overall performance.

Furthermore, the abstract examines the environmental benefits of electric vehicles, such as reduced greenhouse gas emissions and air pollution, contributing to global efforts to combat climate change and improve air quality in urban areas. Market trends and adoption rates are discussed, shedding light on the growing acceptance of electric vehicles across various regions and industries. The challenges facing the widespread adoption of electric vehicles, including infrastructure limitations and cost considerations, are also addressed.

Looking towards the future, the abstract discusses potential innovations and breakthroughs in electric vehicle technology, ranging from advancements in battery technology to the integration of smart grid systems. Additionally, it explores the role of policies, incentives, and public awareness in shaping the trajectory of electric vehicle adoption. In conclusion, this abstract provides a comprehensive overview of the current state of electric vehicles, offering insights into their transformative potential for the automotive industry and the broader sustainability landscape.

KEYWORDS : *Electric Vehicles, Market trends, Sustainibility.*

INTRODUCTION

In the automobile industry, electric vehicles (EVs) have become a revolutionary force, representing a paradigm change toward environmentally friendly and sustainable transportation. Electric vehicles run on electricity, which is usually stored in sophisticated rechargeable batteries, as opposed to conventional internal combustion engine vehicles, which are powered by fossil fuels. This revolutionary technology promises to completely redefine how we think about and use transportation in addition to addressing issues with air pollution and climate change.

An electric vehicle's electric motor, power electronics, and energy storage system—typically a lithium-ion battery—are its essential parts. The vehicle is propelled by the effective conversion of electrical energy from the battery into mechanical energy by the electric motor. The increasing viability of electric vehicles for daily use can be attributed to advancements in battery technology, which have played a crucial role in boosting overall performance, reducing charging times, and extending driving range.

Electric vehicles have a strong argument since they can cut down on air pollution and greenhouse gas emissions that come with using conventional combustion engines. Since EVs have no tailpipe emissions, they help to slow down global warming and enhance Urban air quality. Recognizing the environmental advantages of electric vehicles, governments and businesses around the world are increasing investments in, offering incentives for, and enacting policies to hasten the adoption of these vehicles.

Electric vehicles are becoming more popular in the market as the automotive landscape changes. Big automakers are pouring money into developing electric cars, while creative startups are emerging with cutting-edge technology. Consumers' concerns over range anxiety are being allayed by the growing infrastructure of charging stations and the developments in rapid charging capabilities. This makes electric vehicles more feasible.

Problems still exist despite the advancements. A few of the obstacles that industry players are actively tackling are the lack of adequate infrastructure, the high cost of electric vehicles, and the requirement for more technological breakthroughs. Through legislative frameworks, financial incentives, and the creation of charging infrastructure, governments are crucial in facilitating the shift to electric vehicles.

The invention and broad acceptance of electric vehicles represent a turning point in the history of transportation in this ever-changing environment. In addition to offering a more sustainable and clean future, this change also promotes economic growth, innovation, and a new era of mobility that places an emphasis on environmental stewardship. This introduction lays the groundwork for a more thorough investigation of electric vehicles, covering their technical nuances, effects on the environment, market dynamics, and future prospects and challenges.

LITERATURE REVIEW

A survey of the literature on electric cars (EVs) covers a wide range of topics, including technology, the influence on the environment, market dynamics, legislative issues, and consumer behavior. Here is a quick summary of the major ideas covered in the body of current literature:

Technological breakthroughs in electric vehicles, such as enhanced battery technology, electric motors, power electronics, and charging infrastructure, are frequently the subject of research. Research focuses on developments that improve EV efficiency, extend driving range, and shorten charging periods.

Environmental Impact: When comparing electric vehicles to conventional internal combustion engine vehicles, scholars look into the environmental effects of both. Commonly performed life cycle assessments and emissions evaluations take into account production processes, energy sources, and disposal of end-of-life materials. The overall ecological footprint of electric vehicles is the focus of this study.

Reviews of literature examine the state and difficulties around the infrastructure needed to charge electric cars. This includes talking about how to create public charging stations, how to use fast-changing technology, and how to include charging networks into city design. One of the most important variables impacting the adoption of EVs is the accessibility and availability of charging infrastructure.

Market Trends and Adoption: Researchers look at customer preferences, market trends, and variables affecting the uptake of electric vehicles. Research frequently examines how government regulations, rewards, and subsidies affect the adoption of electric vehicles. Additionally examined are market dynamics including the introduction of new competitors and changes in consumer perceptions.

The economic features of electric vehicles, such as production costs, total ownership costs, and possible economic benefits linked to the electric vehicle sector, are evaluated by literature evaluations. Economic models can also predict how the adoption of EVs will affect linked industries and employment generation in the long run.

Policy and Regulatory Frameworks: Researchers examine how well laws and regulations support the advancement of electric vehicles. This include infrastructural spending, emission standards, tax rebates for consumers, and incentives for manufacturers. It is essential to comprehend the function of government initiatives in order to forecast the adoption trajectory of electric vehicles.

Consumer Acceptance and Behavior: Studies examining how consumers feel and act in relation to electric vehicles are common. Adoption drivers and barriers are identified by analyzing factors that impact the decision-making process, including range anxiety, charging worries, and awareness campaigns.

Combination with Renewable Energy: A few evaluations of the literature look into how renewable energy sources and electric cars can work together. Talks on vehicle-

to-grid (V2G) integration, smart grid technology, and the possibility of EVs serving as energy storage devices and enhancing the sustainability and resilience of the energy ecosystem are all included in this.

In conclusion, the variety and multidisciplinary nature of the literature on electric vehicles reflects the complexity of the shift to sustainable transportation. Research will probably continue to address new opportunities and challenges in the electric car landscape as the technology develops.

RESEARCH GAP

In order to address areas where knowledge is currently lacking and to guide future research efforts, it is imperative to identify research gaps in the field of electric vehicles (EVs). In the area of electric cars, the following are some possible research gaps:

Technology Related to Batteries and Energy Storage

Recognizing how the production, recycling, and disposal of innovative battery technologies affect the environment and society over the long run, examining potential alternatives to lithium-ion batteries for energy storage and determining whether they may be widely used.

Infrastructure for charging: examining the best locations and layouts for charging stations to improve accessibility and user comfort, particularly in rural and urban settings, evaluating the efficiency and scalability of fast-changing technologies in order to shorten charging times and ease range anxiety.

Including Renewable Energy in Integration

Examining methods for improving grid reliability and encouraging sustainable energy behaviors, as well as the possible integration of electric vehicles with decentralized renewable energy sources.

Evaluating the effects of widespread EV adoption in combination with renewable energy production on the environment and the economy.

Customer Acceptance and Conduct

Recognizing the variables that affect consumers' decisions, especially those that affect their choices between conventional and electric cars. Looking at

ways to reduce or eliminate issues with infrastructure for charging, range anxiety, and upfront expenses in order to hasten the adoption of EVs.

Effects on the Economy

Evaluating the financial effects of extensive use of electric vehicles on government income, employment markets, and related businesses. Examining how new business models like energy-as-a-service and battery leasing might affect the profitability of electric vehicles.

Impacts on the Financial System

Calculating the financial impact of widespread electric car use on employment markets, government revenue, and other industries. Investigating the potential effects on electric car profitability of novel business models such as battery leasing and energy-as-a-service.

Vehicle-to-Grid (V2G) Integration and Smart Grid Technologies

Looking at the viability and scalability of V2G systems as well as any potential effects they might have on energy management and grid stability. Evaluating the effects of grid-connected electric vehicles and bidirectional energy flow on society and the economy.

Battery Usage in a Second Life

Examining the potential uses and difficulties of recycling spent batteries from electric vehicles for stationary energy storage systems. Evaluating second-life use's financial and environmental benefits in order to increase the overall sustainability of electric car systems.

Consumer Experience and Human Elements

Looking at how electric cars are made and how to use them while taking comfort, happiness, and user preferences into account. Investigating the effects of new technology on the General Electric car user experience, including as connectivity and autonomous features.

EV INDUSTRY IN INDIA

With a number of programs and regulations, the Indian government has been aggressively supporting electric mobility. With financial incentives for both manufacturers and consumers, the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME)

program was expanded in 2019 to promote the use of electric and hybrid vehicles.

India now has a number of manufacturers producing a variety of electric bikes, scooters, and vehicles in the electric vehicle industry. MG Motor, Tata Motors, Hyundai, Mahindra Electric, and Ather Energy are a few of the leading manufacturers. Additionally, domestic businesses like Hero Electric and Ola Electric have grown in importance.

Since firms like Ather Energy and Hero Electric introduced electric scooters, the market for electric two-wheelers has grown significantly. Electric two-wheelers are becoming more and more popular, especially in cities, because to their cost and ease. India's electric vehicle market has gradually seen a rise in available models. MG ZS EV, Hyundai Kona Electric, and Tata Nexon EV are a few of the electric vehicle models that are offered. Electric buses have also been introduced as a result of government efforts to electrify public transit.

Adoption of electric vehicles still heavily depends on the development of the infrastructure needed for charging them. Urban charging network expansion is being pursued by companies such as Tata Power, Ather Energy, and EV charging startups. A number of electric vehicle startups with an emphasis on creative solutions have emerged in India. For instance, Ola Electric has been constructing a Hypercharger Network and developing electric scooters. The electric bike market is being bolstered by startups such as Revolt Motors.

There is an increasing focus on battery manufacturing because batteries account for a large amount of the cost of an electric car. In order to set up battery manufacturing facilities in India, businesses are looking into joint ventures and investments. Notwithstanding the encouraging developments, there are still issues facing the Indian market for electric vehicles, including the requirement for a more robust infrastructure for charging, consumer apprehension, and upfront cost concerns. For electric vehicles to be widely adopted, these issues must be resolved.

CONCLUSION

For electric vehicles to be widely accepted, the development and growth of the infrastructure necessary for charging them is essential. Various organizations'

efforts to provide an extensive network of charging stations in cities and along major thoroughfares point in the right direction for reducing range anxiety and improving the convenience of owning an electric vehicle overall.

Technology breakthroughs and a wider range of products have been made possible by innovation and entrepreneurship, especially from electric car companies. Businesses such as Ather Energy and Ola Electric, among others, have demonstrated the potential for homegrown innovation and created the conditions for a vibrant and competitive market.

These are encouraging tendencies, yet problems still exist. Barriers that must be methodically addressed include consumer awareness, worries about the infrastructure for charging, and the initial expense of electric vehicles. In order to overcome these obstacles and promote the steady expansion of the electric car market in India, ongoing research, development, and policymaking are important.

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Data Mining Process and Algorithms

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ABSTRACT

This review paper shows the various steps performed during the progress of data mining and data algorithms used to discover knowledge. Data mining is the process of extract hidden and useful patterns and information from data. It is a newest technology that helps businesses to predict future trends and behaviors, allowing them to make proactive, knowledge-driven decisions. The purpose of this paper is to explain the methods and algorithms of data mining and how it can help decision makers to made determination resolutions.

KEYWORDS : Data mining, Knowledge discovery process, Data mining algorithms, Data mining applications.

INTRODUCTION

As information technology has advanced, vast databases and volumes of data in several fields have been produced. The internet has made it possible to create vast amounts of textual, online, and social media data. Database research has led to the development of a method for manipulating and storing data so that it may be used for future decision-making. The practice of gleaning important patterns and information from massive amounts of data is called data mining. It is also known as data analysis, knowledge extraction, knowledge mining from data, and knowledge discovery in database process.

Figure 1. Knowledge discovery Process

The manor objective of the KDD process is to extract information from data in the frame of reference of huge databases. It does this by using Data Mining algorithms to identifies what is considered knowledge. KDD are the organized procedure of recognizing valid, useful, and understand small patterns from huge and complex data sets. The foundation of the KDD process is data mining, which involves developing algorithms to analyze the data, build models, and identify patterns that were previously unidentified. The model evaluates and forecasts data in addition to deriving information from it. To accurately extract information from the data, the KDD process is iterative and necessitates several repetitions of earlier processes [1].

The following steps are included in KDD knowledge discovery in databases process:

Data Cleaning

Data cleaning is defining as removal of noisy and irrelevant data from collections. Cleaning in cases of Missing values, noisy data, where noise is a random or variance error.

Data Integration

Heterogeneous data from several sources merged

in a single source is known as data integration (data warehouse).

Data Selection

The act of identifying and recapturing from the data collection the pertinent data for the analysis is known as data selection. Methods like neural networks, decision trees, naive Bayes, clustering, and regression can be used for this.

Data Transformation

Data transformation is the process of Transformationing of data into applicable form necessitate by mining procedure. Data. Data Mapping and code generation are the two processes of transformation.

Data Mining

Data mining is defined as technique of analyzing and searching of raw data to identifying patterns and extract useful data. With the help of classification or characterization techniques of data mining, relevant data is transforms into patterns, and decides the purpose of model.

Pattern Evaluation

Pattern evaluation is the process of identifying interesting patterns in the data, however, it also interacts with servers of a database to produce the results of the user requests.

Knowledge Representation

This involves presenting the results in a way that is meaningful and can be to used to make decisions. It uses summarization and Visualization to make data understandable by users.

DATA MINING ALGORITHMS AND TECHNIQUES

Based on their respective roles, data mining algorithms may be classified as descriptive or predictive [2]. Descriptive analysis serves as a helpful bridge between the final analysis and predictive analysis. A wide range of algorithms and techniques, such as nearest neighbor methods, artificial intelligence, neural networks, decision trees, association rules, classification, clustering, regression, and so on, are used to extract knowledge from databases.

Classification

Classification is the data mining approach most frequently used, which utilizes agroup of already-classified instances to development a model. Applications for credit risk and fraud detection are especially well suited for this kind of study. Classification algorithms based on decision trees or neural networks are primarily used in this technique. Data is examined using a categorization system. This approach estimates the accuracy of the classification rules using test data. If the accuracy is good enough, the rules can be applied to fresh data tuples. These pre-classified samples are used by the classifier-training method to identify the sets of parameters needed for accurate discriminations [3]. These parameters are subsequently encoded by the algorithm into a model known as a classifier.

Types of classification models

- Neural Networks
- Decision tree induction
- Bayesian Classification
- Association-based classification.
- Support Vector Machines (SVM)

Clustering

Clustering is also known as clusters of related object types. We may find general distributed patterns and correlations among data variables, as well as further identify dense and sparse locations in object spaces, with the use of clustering tools. Although classification techniques are also useful for effectively separating different object types, clustering can be utilized as a preprocessing technique for attribute subset choices and classifications because they might be costly. For example, E-commerce companies uses this technique on the basis of their buying patterns to segment customers.

Types of clustering methods

- Partitioning Methods
- Density based methods
- Hierarchical Agglomerative (divisive) methods
- Model-based methods
- Grid-based methods

Predication

Regression techniques can be adapted for predication.

Modeling the links between one or more independent variables and dependent variables is possible with regression analysis. In data mining, response variables are what we wish to predict, while independent variables are attributes that are previously known. To predict future values, more sophisticated methods (such as logistic regression, decision trees, or neural networks) would be required. Regression and classification may frequently be performed with the same model types. For examples, the classifications and regressions trees which is also known as CART, the decision tree algorithm is capable of constructing regression trees for the purpose of forecasting continuous response variables as well as classification trees for the purpose of classifying categorical response variables. Neural networks may be used to create regression models as well as classification models [4].

Types of regression methods

• Linear Regression

• Multivariate Linear Regression

• Nonlinear Regression

• Multivariate Nonlinear Regression

Association rule

In huge data sets, association and correlations are typically used to establish frequent items set discoveries. These kinds of discoveries are beneficial in business to certain decisions, such as catalogue designs, cross marketing, and customer shopping behavior analysis. For analyzed and predict customer's behaviors association rules are very helpful. Association rule techniques shows how often data appears which is helpful for market and customer analysis.

 Types of association rule

• Generalized association rule

• Quantitative association rule

• Multi relational association rule

• Interval information association rule

Neural Networks

Combinations of related input and output units make up neural networks, and each association has a weight assigned to it. Neural network techniques modify weights in order to anticipate the right class labels of input tuples throughout the learning stages. Neural networks are particularly good at extracting meaning from imprecise or complicated data [5]. They can also be used to spot trends and patterns that are too intricate for humans or other computer programs to pick up on. Neural nets operate effectively with continuous valued inputs and outputs.

DATA MINING APPLICATIONS

Data mining technology has important role with popular with businesses intelligence as it allows different organizations to learns more about their customers and make better marketing decision. By using this strategy, marketers may better understand the behavior and preferences of their customers and develop advertising and marketing campaigns that are specifically targeted to them. There are plenty of organizations which are already using data mining, Retail establishments, healthcare facilities, banks, and insurance providers are a few of these entities [6]. To help them make better judgments, these firms combine data mining with statistical analysis, pattern identification, and other crucial technologies.

CONCLUSION

Data mining is used to better categorize markets and examine ever-larger databases. For prediction and forecasting, data mining techniques plays a crucial role with the help of different machine learning techniques. To improve market segmentation by exploring large databases data mining plays vital role.

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A Study on Open Source Server Technologies

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ABSTRACT

Open source technology (OST) is an often-misused term; too often, users often think open source is synonymous with free. With the relatively recent rise of the Internet's influence on production and development of software, open source has become a popular vehicle to gain widespread use and support of some very popular software titles. This study paper is to put forward 10 new technologies for open source servers that will compile a diverse list of projects and applications for developers to discover and explore. Many of these products are free of cost or close to it.

KEYWORDS : *Open source, Open source technologies, Zenoss, Mono, Apache, Drupal, OpenSolaris.*

INTRODUCTION

The term "open source" refers to something people can adapt and share because its design is publicly accessible.

The term arises in the context of software development to designate a specific approach to construct computer programs. Today, however, "open source" nominates a broader set of values—what we call "the open source way." Open source projects, products, or initiatives grasp and celebrate principles of open exchange, transparency, rapid prototyping, collaborative participation, meritocracy, and community- oriented development.

This paper discussed a definition of open source technology and new upcoming open source technologies. Although these software projects pair well with Linux, it isn't an integral part of any of the 10 listed. Software for open source servers do not refer to Linux-only environments for long. In fact, open source servers now cross all operating system boundaries, so much so, that Microsoft launched its own open source laboratory called Port 25, and it is a platinum-level sponsor of the Open Source Business Conference in San Francisco.

DEFINITION OF OST

Open source technology is defined as development philosophy and the production of allowing developers and end users to not only see the source code of software, but modify it as well. One of the best-known examples of open source software technology is the Linux operating system.

Unlike Linux, Windows is built on a closed source paradigm that does not grant the end user the ability to see or edit the code that makes up the operating system.

BUSINESS CHALLENGES

A backbone of today's dynamic service delivery infrastructures are servers, and therefore one of the most vital components in any monitoring solution.

Availability of hardware and operating system components and visualizing the performance, as well as the virtualization technologies that run on top of these platforms, is principal to delivering end-to-end service reliability.

NEW OPEN SOURCE SERVER TECHNOLOGIES

Zenoss

Technology for open source servers is about more than Linux. Here are 10 must-evaluate projects for open source servers in any enterprises considering making the leap. Zenoss is an open source IT Management suite. One can monitor and observe the entire network using Zenoss. It is composed of network discovery, an alert console, service monitoring , performance monitoring, and inventory modules. It is enterprise-ready, free, easy to install and maintain, and modular through ZenPacks.

Mono

Mono is the open source implementation of Microsoft's

.NET technologies. When first hearing about Mono Project, it' s difficult to put Microsoft technology into the open source world category, but it has captured the attention of developers and businesses on a worldwide scale. Sponsored by Novell, this technology combines two incompatible worlds (*nix and Microsoft) into a single agile, open source and stable realm. Mono allows developing powerful and advanced server-side applications on Linux, Mac OS X and Windows.

Apache

The Apache Web Server is the Internet's most popular Web server, and the project everyone associates with apache.org. However, it might surprise to know that there are more than 70 other projects under the Apache umbrella. Enterprise-level projects include ActiveMQ, Geronimo, SpamAssassin and Tomcat. While many Apache projects (like Geronimo and Tomcat) are related to Java, some are stand-alone projects (like OFBiz), and some improve Apache directly (like mod_perl). The decentralized open source group of developers is called the Apache Software Foundation. Their software is released as free and open source (FOSS) under the provisions of the Apache License. A cooperative, consensus-based development method and an open, practical software license define the Apache projects. A self-selected group of technical professionals who actively participate in the project oversees each one. Over time, Apache.org has evolved into more than just a URL that allows you to download the world's most potent open source software, the Apache Web Server.

SugarCRM

SugarCRM is the term for using a customer relationship management (CRM) software suite with a disruptive engineering and marketing model. The SugarCRM team has a distinct strategy for marketing enterprise software: users can use the product here and then engage SugarCRM for a business partnership when they require the additional capability. Instead of spending money on marketing or sales, the corporation puts all of its resources into developing the product. Thanks to this strategy, "Sugar" has become the most popular open-source CRM product globally.

Drupal

For business websites, social networking sites, community portals, intranets, e-commerce applications, and discussion sites, content management systems (CMSs) create a collaborative environment. Communities may exchange, publish, and administer a range of material on a Web server with Drupal, a content management system. User numbers in communities vary from a few to tens of thousands. Numerous add-ons, including forums, images, blogs, podcasts, newsletters, file uploading and downloading, collaborative authoring, and e-commerce, enhance Drupal's usefulness and attractiveness. Drupal is modular.

OpenSolaris

OpenSolaris is the x86 version of Sun's Solaris operating system. The two most exciting aspects of this operating system are that it contains all of the built-in enterprise components (virtualization and ZFS) as the standard Solaris offering and it runs on inexpensive x86 hardware. OpenSolaris hands over next-generation computing technology, commercial support and a worldwide development community. OpenSolaris uses a network-aware package management system called the Image Packaging System (also known as pkg(5)) to remove, add and manage installed software and to update to newer releases. Packages for development releases of OpenSolaris are disclosed by Oracle typically every two weeks to the /dev repository.

MySQL

The most widely used open source database software in

the world is called MySQL, and it was once owned by Oracle. It works with practically any operating system and can be moved from one platform to another using drag and drop. MySQL provides power to Internet sites, business applications and enterprise tools, such as Zenoss. It is in running with the most- expensive commercial relational database systems. Oracle shall continue to elaborate MySQL and make subsequent versions of MySQL, including Version 6, which are available under the GPL. Oracle will not release any new, enhanced version of MySQL Enterprise Edition without collectively releasing a new, also enhanced version of MySQL Community Edition licensed under the GPL. Oracle shall continue to make the source code of all versions of MySQL Community Edition publicly available at no charge.

Pentaho

A commercial company called Pentaho offers an open source business intelligence software in a community version that is free to use, investigate, and modify as needed. Data integration, data mining, dashboards, querying, reporting, and interactive analysis are all included in all editions. The business intelligence industry's economics are altered by Pentaho's approach, which offers its commercial version for an annual subscription fee that is less than one-third that of its rivals. Customer testimonials from satisfied clients speak loudly about the company's ability to reduce business intelligence software total cost of ownership.

Magento

The Magento eCommerce suite, specifically the Community Edition, offers a complimentary and open source solution for propelling one's business towards the vast online market that has been widely discussed. On the other hand, the Magento Enterprise Edition is also open source, but it requires a commercial license in order to access advanced support and functionality. The Community Edition encompasses a comprehensive range of e-commerce features, including catalog browsing, marketing tools, search engine optimization, analytics and reporting, mobile commerce, checkout, shipping, customer service modules, and checkout capabilities.

Java

Java technologies have had effective enterprise applications since 1995. Java currently powers more than 2 billion handheld devices and 800 million PCs, and 3.5 billion smart cards as well as a host of set-top boxes, games, Webcams, medical devices and much more. With uptake by major companies such as Oracle (Java's new owner) and IBM, Java is a technology to watch and grasp for all levels of enterprise use. Java is open source because it has a version in which you could download its compiler source code. The best example would be Oracle NetBeans and Eclipse IDEs. Eclipse IDE is open source since its code writers openly post its entire source code for anyone to download, copy, redistribute them, which is usually part of the GPL (General Public License, the license that usually comes with open source software). On the other hand, Oracle NetBeans IDE is not open source (although it is still free), since it does not disclose its source code publicly. Some may also refer to such software as closed-source software.

CONCLUSION

Although open source servers are often free to download and use, open source licenses rarely transfer any ownership of the software to the end user or developer. Open source is not limited to server or software. Open source philosophies can be applied to everything over the Internet. The result is higher commitment and even cult status among the developers and users of open source technologies. This paper discussed ten new technologies of open source server which explained the new open source technologies. Ultimately in the long run, the end user is the ultimate judge of which is a better solution. Without support from the user, developers and open source projects cannot continue except as a hobby or personal challenge for the developers.

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PATAPAY : Online Secure Payment Addressing System

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ABSTRACT

A ground-breaking initiative called PataPay has the potential to completely transform online shopping. With e-commerce becoming more and more popular, accurate address entry at checkout is essential. In order to meet this requirement, PataPay streamlines the procedure and makes it quicker, safer, and easier to use.

Fundamentally, PataPay gives customers a special and practical way to submit their address information when they shop online. Users can submit their phone number in place of tediously typing out their entire address. It guarantees that shipping information is quickly and accurately populated and is connected to their entire address.

In addition to saving time, this lowers the possibility of data entering errors. In the digital world, security is crucial. PataPay uses cutting-edge technology, like blockchain, to protect user data. User information is kept private and secure at all times thanks to encrypted transactions and strict security measures.

KEYWORDS : E-commerce, Automated address retrieval, Security, Block chain, Direct payment integration.

INTRODUCTION

The process of shopping online ought to be easy and fun. But adding address details is a lengthy process that frequently leads to conflict. The goal of PataPay is to streamline this process and make it more efficient and approachable. In our ideal scenario, users will be able to execute transactions quickly and easily. We aim to improve data security, remove errors, and streamline the address entry procedure.

Our goal is to make online buying easy for people and to give them a sense of security and confidence. Because we value inclusion, we provide our service to companies of all sizes. Our objective is to establish a digital marketplace that is more user-centered and efficient by means of proactive community engagement and constant adaptation to evolving trends. Our goal is to continuously innovate and enhance the online buying and payment experience for all users. Boosting Small Businesses: It can be difficult for small and medium-sized companies to compete with larger companies. The goal of PataPay is to level the playing field for smaller businesses by providing affordable alternatives. The core driving force behind the PataPay initiative is the goal of advancing innovation and advancement in the e-commerce and digital payment space. Our goal is to be a driving force behind positive change in the digital marketplace by streamlining, securing, and improving the online purchasing and payment experience

OBJECTIVE

Efficient Checkout Procedure: PataPay aims to streamline address entry with phone numbers in order to speed up the checkout process and decrease the time it takes for consumers to complete transactions.

Reduced Cart Abandonment: Ensuring users finish their purchases by offering an address entry mechanism that is both user-friendly and efficient is a crucial step in reducing cart abandonment rates.

Adaptive Technology: PataPay is dedicated to maintaining a leading position in technical

advancements. To deliver the best user experience, our goal is to continuously adapt and integrate evolving technology.

Customer Satisfaction: By providing a fluid and reliable online buying and payment experience, the initiative seeks to increase overall customer satisfaction.

Global Expansion: PataPay is driven to make its services available to customers and businesses worldwide in order to promote diversity and economic progress in many places.

PROBLEM STATEMENT

There are a lot of difficulties in the modern online payment and purchasing environment. Users frequently lose a significant amount of time due to drawn-out and annoying address entering processes. Customers frequently abandon their shopping carts due to this inefficiency, which lowers conversion rates. In addition, the system's widespread inefficiencies raise operating expenses for companies while simultaneously degrading customer experience.

Consequently, this adversely impacts their productivity and financial gain. The ever-present risk of data breaches and privacy issues also presents a big obstacle for the e-commerce industry. A seamless and reliable online buying experience is hampered by the absence of a streamlined and secure address entering method.

By using a phone number-based method to streamline address entry, guarantee data quality, and offer strong security features, PataPay seeks to overcome these problems. The main goal is to solve the time-consuming nature, inefficiency, and low conversion rates that now afflict the digital marketplace by creating a safer, efficient, and user-friendly environment.

SCOPE

Multiple Payment Options: PataPay may expand its reach to support other payment methods, such as cryptocurrencies, in addition to addressing details, to provide users more flexibility when completing transactions.

Geographic Localization: To make the process even more user-friendly, the project might incorporate geolocation technologies to automatically detect and populate address information. Integration with E-commerce Platforms: In order to provide consumers

and companies with a wider reach and accessibility, PataPay may look at forming partnerships and integrations with well-known e-commerce platforms.

Mobile Application Development: To broaden its reach, PataPaymay want to think about creating a specific mobile application that would provide a more practical and approachable user interface for tablets and smartphones.

Address Validation Services: PataPay may offer businesses address validation services to make sure that addresses entered are deliverable and accurate.

Smooth Integration with External Services: PataPay may investigate interfaces with external services like GPS and mapping programs, improving location precision when entering addresses.

A decentralized strategy would increase trust and security by reducing reliance on a central authority. Blockchain-based smart contracts have the potential to further improve efficiency and transparency by automating address verification and payment processing.

REVIEW OF LITERATURE

NAME OF THE PAPER	AUTHOR/WEB	PUBLISHER	YEAR	SUMMARY
An overview of Ethereum and solidity vulnerabilities[4]	AichaBouichou, SoufianeMezroui, Ahmed El Oualkadi	IEEE	2021	It highlights that Ethereum Smart contracts constitutes the most important step toward securing the whole blockchain
Blockchain Technology and Cryptocurrenices [5]	Siddharth Rajput, Archana Singh, SmitiKhurana, TusharBansal, SanyuktaShreshtha	IEEE	2020	This paper covers the history of Bitcoin, literature reviews, blockchain's functioning, and its applications. In blockchain once data is recordd, it can't be altered. It's used for cryptocurrencies like Bitcoin and Ethereum.
Improving conversion rates for fashion e-commerce with A/B Testing [6]	Reza Rahutomo, Yulius Lie, AnzaludinSamsingaPerbangsa, Bens Pardamean	IEEE	2020	In this paper learnt about conversion rate and how effective it is for website building. A/B testing is also used to optimize conversion rates

PROPOSED SYSTEM

Automated Address Retrieval: PataPay presents a cutting-edge technology that automatically extracts user addresses, doing away with the necessity for accurate manual entry. Direct Payment Integration: By enabling users to make direct payments, intermediate services are not required, and the payment process is streamlined for ease and efficiency. Decreased Checkout Time: The suggested solution considerably shortens the checkout process, giving customers a quick and easy experience that immediately boosts conversion rates. Enhanced Profitability: PataPay intends to reduce cart abandonment rates and operational costs for businesses by streamlining the process and improving user experience. Quick and Safe Transactions: PataPay uses cutting-edge technologies to safeguard user information and privacy while guaranteeing transactions are both quick and safe. User-Focused Design: PataPay's user-centric design philosophy guarantees that consumers' preferences are catered to during their online purchase journey, offering a smooth and enjoyable experience that promotes higher conversion rates.

BUSINESS MODEL

1. API Access Fees: Businesses and developers looking to include the PataPay address retrieval system into their e-commerce platforms are charged API access fees by PataPay, which provides a flexible income source. Because these costs are based on use tiers, companies of various sizes can access them. PataPay is able to maintain and enhance its services because to this revenue stream.

2. $9 Fee for Each Address Retrieval Transaction: PataPay levies a $9 minimal fee for each address retrieval transaction that is successful. This fee is intended for online retailers and companies that use the automatic address retrieval system offered by PataPay to expedite their checkout procedures. The charge makes sure PataPay gets paid for the convenience and accuracy it offers to users and businesses.

3. Affiliate Partnerships: In the e-commerce sector, PataPay works with affiliate partners. Through these collaborations, affiliate partners and PataPay establish a win-win relationship that draws new customers and companies to the platform. Affiliates receive commissions in exchange depending on the revenue that is brought in by the customers they suggest. Partners are encouraged to actively market PataPay's services through this technique.

4. 2% Transaction Fees for Using Pata-Pay's Cryptocurrency Payment Gateway: Businesses and individuals who wish to conduct transactions with digital currencies can utilize PataPay's secure cryptocurrency payment gateway. A 2% transaction fee is charged for each transaction made over the Pata-Pay cryptocurrency gateway. This cost structure is competitive, promotes the use of digital currencies by companies, and increases PataPay's revenue stream.

TECHNOLOGY USED

Web Development (Front End):

HTML and CSS: They are used in front-end web development to style and develop the PataPay platform's user interface.

Figma: Used to develop and prototype user interfaces to guarantee user experience that is both aesthetically pleasing and intuitive.

React: It is a JavaScript package that provides responsive and dynamic user interactions. It was utilized in the construction of the PataPay web application's front end.

(Back End):

Truffle: Used for Solidity smart contract development and testing for the Polygon/Maticblockchain.

Ganache: A blockchain for development that is used to safely test and implement smart contracts. Integrated for SMS services,

Fast2SMS API allows for user notifications and communication.

Solidity (Polygon/Matic): The computer language Solidity (Polygon/Matic) is used to create the smart contracts that run PataPay's services on the Polygon/Maticblockchain. The PataPay platform's backend runtime environment

Node.js: It makes server-side logic and scripting easier to implement.

CONCLUSION

In the ever-evolving landscape of e-commerce, PataPay stands as a beacon of innovation and progress, redefining how users interact with online shopping and payment processes. This transformative project has set its sights on addressing the challenges faced by the existing systems and has charted a course toward a future where efficiency, security, and user-centric design reignsupreme. PataPay's core objectives of automated address retrieval, direct payment processing, and reduced checkout times reflect a commitment to user convenience and efficiency.

The platform is engineered to streamline the shopping journey, ensuring that users can complete transactions swiftly, accurately,and securely. By significantly reducing checkout times and simplifying the payment process, PataPay directly contributes to higher conversion rates, promising increased profitability for e-commerce businesses.

In summary, PataPay is more than just a solution; it's a promise to reshape the digital marketplace,making online shopping and payments more accessible, efficient, and secure for all. It's a journey toward a future where users can shop with peace of mind and businesses can thrive with enhanced profitability. PataPay is not just a platform; it's a testament to the power of innovation and pursuit of progress in the world of e-commerce.

FUTURE SCOPE

UPI Link-Up: In order to expand its payment choices, PataPay plans to integrate with India's Unified Payments Interface (UPI) system. With this integration, customers will be able to pay straight from their UPI accounts, giving Indian users more convenient and varied payment options.

Collaborating with Payment Gateways: Through establishing alliances with different payment gateways, PataPay hopes to broaden its scope.Through these collaborations, consumers will have additional alternatives for paying, easier payment experiences, and integration with a wider range of online companies and e-commerce platforms.

Business Insights: The project's main goal is to improve analytics and data insights. PataPay seeks to give companies even deeper insights on the habits, preferences, and behavior of its users. Businesses will be able to optimize marketing tactics, make data-driven decisions, and further enhance their services with the use of advanced data analytics.

Utility Token: PataPay intends to launch a utility token that users will be able to obtain or utilize on the network. There will be other applications for this coin, such as loyalty benefits, lower transaction costs, and incentives for user participation. The utility token's adoption will boost user interaction even further and provide incentives for users to stick around on the site.

Global Reach: PataPay wants to make sure that individuals and companies anywhere may take advantage of its cutting-edge solutions by bringing its services to a worldwide audience. By expanding its reach geographically, PataPay will aid in the global expansion of e-commerce.

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foodE - Culinary Tech Companion

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ABSTRACT

foodE – Culinary Tech Companion is a cutting- edge recipe suggestion application that is designed to transform the way users discover and prepare meals. Homemakers often face the recurring challenge of deciding what to cook, while youngsters seek variety and new culinary experiences. Our app serves as a comprehensive solution to these common problems. This app leverages advanced machine learning algorithms and a vast database of recipes to offer personalized culinary recommendations based on individual preferences, dietary restrictions, and available ingredients. The main objective of the app is to simplify the cooking experience for users, regardless of their culinary expertise. The app's intuitive interface ensures a seamless user experience, making it accessible to both novice cooks and seasoned chefs. By understanding each user's unique taste preferences, dietary needs, and cooking proficiency, the app generates tailored recipe suggestions that cater to a wide range of palates and lifestyles. Users can purchase ingredients directly through the app, saving time and effort in meal preparation. The proposed solution provides daily notifications featuring carefully curated meal recommendations, and culinary exploration for those seeking novel culinary experiences, the app ensures a fresh dining adventure every day, and the app simplifies the cooking process with step-by-step instructions, ensuring that even novice cooks can confidently prepare gourmet meals with ease and other features include Integrated Ingredient Purchase and Personalized Recommendations by using collaborative filtering, content- based filtering, matrix factorization and deep learning models.

KEYWORDS : *Collaborative filtering, Content-based filtering, Matrix factorization, Deep learning.*

INTRODUCTION

Homemakers often face the recurring challenge of deciding what to cook for dinner, while youngsters seek variety and new culinary experiences. Our app serves as a comprehensive solution to these common problems. Food recommendation systems are rising as a new field to resolve these concerns. These systems play a vital role across a wide range of online technology-based lifestyle applications, and they have become an integral part of various lifestyle services. This can be used to motivate people to adopt a healthy lifestyle. These systems find relevant food products that accommodate users' daily diet preferences while enabling these people to satisfy their basic needs and optimally perform their daily chores. Daily notifications provide timely and practical meal suggestions, simplifying the meal planning process. Our app offers a curated selection of delicious and nutritious dishes from around the world, ensuring each meal is a delightful culinary adventure. Users can conveniently purchase all necessary ingredients directly through the app's interface, streamlining the cooking process.

EXISTING WORK

Many food recommendation systems have been proposed earlier to predict people's preferences and/or to guide their choices based on some predetermined criteria. Despite the relative success of previous food recommender systems, these systems still suffer from several limitations such as:

Recommendations: Many previous food recommender systems cannot guarantee that the recommended foods are personalized according to the users.

Ingredients: Most previously published food recommendation models are based primarily on historical ratings. This approach uses the method of collaborative filtering that mostly ignores ingredients. Because individuals usually prefer foods that contain enjoyable ingredients, previous models may overlook some essential parts of the recommendation. As a result, traditional collaborative filtering models may not be able to consider all the preferences and tastes of different users.

Data sparsity problem: Most users have only rated a few foods, so standard recommendation models have problems identifying active users' preferences or similar items. As a result, users can only receive food recommendations from standard recommender systems if the particular food has been rated enough. Moreover, there are instances where an item has not yet received enough user ratings and is, therefore, called a "cold start food". As a result, this food item usually gets ignored by such a standard model.

Controllability: In previous food recommender systems, end-users did not participate in the final recommendation process directly. As a result, these models did not allow users to affect the system by interacting with the system with different kinds of inputs and/or parameters.

RELATED WORKS

Many experts have studied various methods for recommending a list of recipes based on the ingredients at hand. These published research works propose the use of different approaches to offer substantial improvements to the problems discussed earlier.

An innovative approach to e-commerce is introduced. It provides an exceptional and enhanced shopping experience for consumers. Usually, people have a hard time figuring out what food to cook throughout the day. Therefore, to solve this issue, the application will also have a Recipe Recommendation System which will give the user numerous recipe options to select from, based on the food items in the cart. It uses Natural Language Processing algorithms. There will be an Admin Portal to keep track of the items that are available in the mart or that are currently being purchased and a statement of all the payments by the customers. Finally, with the implementation of this system, the customer will save their precious time and shopping and cooking will become much easier [1].

This paper proposes a combination of image recognition and CNNs (convolutional neural networks). It simplifies the process of finding recipes and also speeds up the process. Food is an essential aspect of human survival, and people always enjoy trying out different types of delicious recipes. Many a time, people choose food ingredients without even knowing their names or pick up some food ingredients that they aren't familiar with from a grocery store. It is important to know which ingredients can be combined to create a delicious recipe. It can be quite challenging for a beginner cook to select the right recipe by choosing a list of ingredients. Machine learning (ML) is a technology that we use frequently in our everyday lives. For example, recognizing objects through image processing is an active use of ML. Though this process is complex due to different food ingredients, traditional approaches lead to a higher inaccuracy rate. In this paper, a model is implemented for food ingredient recognition, and an algorithm is designed for recommending recipes based on recognized ingredients. The Convolution Neural Network (CNN) model was used to identify food ingredients, and machine learning for recipe recommendations. The model achieved an impressive accuracy rate of 94 percent [2].

Creating a recipe is a challenging task as there are countless possibilities of recipe combinations to determine which additional ingredient goes well with others. In this work, RecipeBowl is proposed. It is a cooking recommendation system that takes a set of ingredients and cooking tags as input and suggests possible ingredient and recipe choices. RecipeBowl

is trained on the constructed dataset where the model predicts a target ingredient previously eliminated from the original recipe. This system carries out the prediction process by using a set encoder and a two-way decoder. For the set encoder, it utilizes the Set Transformer which helps in building meaningful set representations. The model creates a set representation of a leave-one-out recipe and maps it to the ingredient and recipe embedding space. Experimental results demonstrate the effectiveness of this approach. Additionally, analysis of model predictions and interpretations reveals interesting insights related to cooking knowledge [3].

As the living standards improve, there is an increasing demand for personalized recipes. Therefore, this paper aims at designing and implementing a beneficial recipe recommendation system that is based on dietary knowledge mapping. The system's front end uses Vue. js to build the user interface while its back end uses the Spring MVC framework to implement it. The recommendation technology based on the knowledge graph is studied, and the recipe recommendation method is improved by incorporating the knowledge graph. The proposed system crawls the recipe knowledge through crawlers and builds a dietary knowledge graph, integrating multi-domain information using the rich semantics of the knowledge graph. Furthermore, the knowledge graph is combined with the collaborative filtering algorithm implemented by Mahout to improve the effectiveness of recommendations. Lastly, an intelligent Q&A module based on the knowledge graph is developed for the system to provide accurate and effective recipes for individuals and patients with dietary choice difficulties [4].

According to this paper, Graph databases can replace traditional Relational databases. This enables relationships for faster querying and retrieval of data through Neo4j. Relational databases compute relationships at runtime whereas graph databases persist relationships for quick querying and data retrieval [5].

Since there are a lot of options available on the internet, choosing the best one manually can be a challenge. Hence, a recommendation system is quite helpful in solving this problem. This paper proposes to develop a system using the K-nearest method and Python programming language. It uses content-based and collaborative filtering methods for recommending the food [6].

This paper proposes to use Web-scraping in order to develop a collection of a variety of recipes and employ the content-based method for recommending the recipes in real-time. This method recommends recipes based on the availability of the ingredients. It also uses Natural Language Processing to extract data [7].

This paper explores a recipe recommendation system, named RecipiMate. that aims to suggest recipes based on user input about ingredients. It uses NLP along with other machine learning techniques to pre-process and analyze the dataset. This system is developed with the help of Python libraries. The accuracy of this system is pretty impressive. It is a web application that is developed using Flask [8].

This research paper analyses the dataset from Zomato in order to locate the restaurants near the users. It proposes to develop a website where the user can enter their basic information to develop a system that is personalized for them. Furthermore, they can select their current mood from the options provided. Based on inputs received from the users, this system recommends the user with food and/or respective restaurants. This model is designed with the help of PyCharm and the KNN algorithm [9].

This paper discusses personalized suggestions. It uses the Fuzzy Inference System (FIS) for recommending food. It also uses various other techniques like Rule Base, Database, Decision-making Unit, etc. [10].

PROPOSED SYSTEM

Introducing the innovative "foodE – Culinary Tech Companion" app, a singular and uncomplicated remedy designed to solve all the mealtime dilemmas faced by both housewives and young individuals.

In this section, we propose a novel food recommender system, which incorporates a collaborative filtering model and a content-based model. The developed model, called foodE – Culinary Tech Companion (foodE for short), is grouped as a hybrid recommender system that utilizes the advantages of both collaborative filtering and content-based models. FoodE suggests a list of favorite foods by utilizing user similarities and food groups.

FoodE consists of mainly two phases: (1) collaborative filtering and (2) the food recommendation. In the first phase, the user-to-user similarity matrix is calculated. The user sends the request to the server which in turn interacts with the database that is developed using MongoDB. The server then fetches the required data from the database and displays it to the user. Next.js and react are used to build the frontend whereas node and express are used to build the backend of our system. We have employed Tailwind for our user interface and Passport.js for authentication and authorization. GraphQL is the query language that handles the requests and responses between the client and the server. Finally, considering the users' similarities and historical ratings, recipes are predicted using the collaborative filtering-based model. Collaborative filtering is used to discover the similarities between different users and predict the taste of one user based on the similar choices made by other users. In the second phase, content-based filtering is used so as to find similarities between the dishes and the user preferences based on the food items or recipes liked by the users previously. Overall, the proposed model provides the following features:

- Daily Notifications: Users will receive daily notifications featuring meal recommendations that are curated carefully.

- Culinary Exploration: For those who seek new culinary experiences, this app ensures a fresh dining adventure every day.

- Simple and Convenient: The application simplifies the cooking process with step-by-step instructions, ensuring that even novice cooks can confidently prepare gourmet meals.

Aim and objectives

The main aim of the app is to simplify the cooking experience for users, regardless of their culinary expertise. The app's interface ensures a seamless experience for the users, making it accessible to both novice cooks and seasoned chefs. By understanding each user's unique taste preferences, and cooking proficiency, the app provides tailored recipe suggestions that cater to a wide range of lifestyle choices.

The objectives for developing this application are:

1) Encouraging Healthier Lifestyle: Our app provides daily nutritious meal suggestions, thereby, promoting a balanced and healthier lifestyle.

2) Simplified Cooking: Our application aims to offer user-friendly recipes for all skill levels, from novices to experienced cooks.

3) Convenience: Users can prepare meals by following the easy-to-understand steps provided by the app, thus, saving time and effort in meal preparation.

4) Tailored Suggestions: The app analyzes user preferences for providing personalized recipe recommendations, thereby, ensuring a delightful culinary experience.

Block Diagram

The user first enters the application. After successful initiation, the home page shows recommended recipes based on the user's past behavior and preferences which are stored in the database. Or else, the user can search for their required recipes as well. The recipes are extracted by using various data mining and machine learning techniques. The result i.e., the recipe is sent to the front end of the application which is viewed by the user. The user can either follow this recipe or continue searching for other recipes. Figure 1 represents the working of the system.
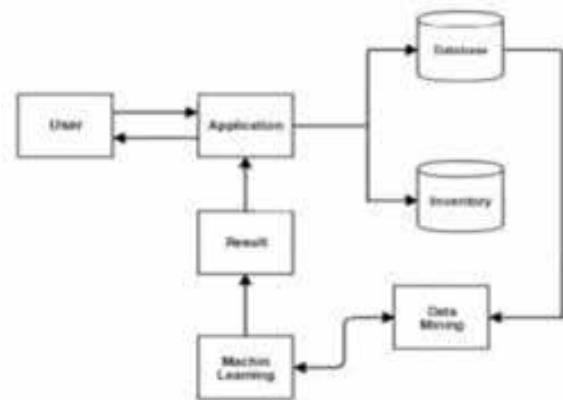
Fig.1: Block Diagram of foodE - Culinary Tech Companion

Control Flow Diagram

FoodE uses the modules of Recipe Recommendation. To begin, the user needs to create an account by filling

up necessary details like name, email, date of birth, gender, etc, and set a password. Unique token IDs will be generated to differentiate users and easily access a specified user's information. After the Sign-Up process, the user needs to log in again to his account by using the proper credentials (i.e. Email Address and Password). Proper validations would also be implemented to make the process error-free.

Once logged in, the user would remain in the same session until the user logs out. Further, the user can search for various recipes with the help of the search box or go with the recipes recommended on the home page. The search results would contain the necessary information like the Recipe Name, ingredients, etc. During this, the user can view various recipes in the application. Once the user is satisfied with the recommended recipe, the search and extraction process come to an end and the user can either stay on the application or log out.

Fig.2: Control Flow Diagram of foodE - Culinary Tech Companion

REQUIREMENT ANALYSIS

Functional Analysis

• Data Storage: The system must efficiently store and manage data, ensuring the integrity, availability, and security of stored information.

• User Interface: Develop an intuitive and user-friendly interface for data management and interaction.

• Scalability: Ensure the system can scale to accommodate growing data storage needs effectively.

• Data Backup: Regularly backup data to prevent data loss in case of unforeseen events.

• Performance Optimization: Optimize system performance to ensure efficient data retrieval and storage operations.

• Compliance: Ensure compliance with relevant data protection and privacy regulations to protect user data and maintain legal and ethical standards.

User Interface

• Home Screen: Recipe recommendations from the client and server components are shown on the home screen.

• Data Handling: Through an intuitive user interface, users can easily browse, download, and manage their data files.

• User-Friendly Access: Users can effortlessly access and manage recipes while on the go thanks to the dynamic and customizable interface.

Non-Functional Requirements

Performance:

• Upload, download, and data retrieval speeds.

• Capacity to increase data needs.

• Resource efficiency and network performance.

• A responsive UI to improve the user's experience.

• Recoverability and backup speed of data.

• Minimal system downtime and high availability.

• Managing loads from several concurrent users.

Usability

The comfort and adaptability of the user is the focus of usability, which also includes an approachable interface, straightforward access control, effective search and retrieval, support resources, customization, handling of errors, feedback choices, and user training. User input and ongoing usability testing guide interface improvements for a user- centered design methodology.

Reliability

The concept of "reliability" refers to a variety of factors, including routine maintenance, data validation, a disaster recovery plan, user education, compliance, resilience, backup and recovery procedures, security measures, and monitoring systems. Together, these elements protect against disruptions and data loss by ensuring continuous access to data and system functionality.

FEASIBILITY STUDY

Operational Feasibility

Evaluating resource availability, data transfer, user acceptance, compatibility, legal compliance, data security, cost-benefit analysis, user assistance, and business continuity are all part of the process of determining operational feasibility. For a project to be successful, alignment with operational requirements must be guaranteed.

- Resource Availability: To enable the creation, implementation, and continuous operation of the project, sufficient hardware, software, and trained workers must be available.

- Data Migration: It is important to think about the benefits of moving current data to the new system, as well as the procedures and tools needed to make the move go smoothly.

- Training and User Adoption: It's critical to make sure users can quickly become accustomed to the new system. It is crucial to determine whether it is feasible to offer the assistance and training required for user adoption.

- Compatibility: It is important to ensure that the software and systems are compatible with current user or organizational systems. Integration with modern technology must be seamless.

- Legal and Regulatory Compliance: The project needs to follow all applicable rules and regulations, such as those about data protection and industry-specific guidelines.

- Data Security and Privacy: It's critical to determine whether putting strong security measures in place to protect data, like encryption and access limits, is feasible.

Technical Feasibility

Technical viability assesses how feasible it is to use a certain set of technologies and makes sure the required technical components are available and attainable.

- Technology Availability: Verify that the necessary technologies are available, validated, and kept up to date.

- Integration Complexity: Assess the degree of difficulty involved in integrating cutting-edge technology and make sure the required protocols and APIs are accessible to enable a smooth integration.

- Scalability: Verify that the technology selected can accommodate rising user traffic and data storage needs.

- Data Security Measures: Confirm that the technology you've selected can successfully integrate data security features including data integrity checks, access controls, and encryption.

- Performance and Efficiency: Evaluate a technology's capacity for performance to guarantee effective data storage and retrieval processes.

- Interoperability: Verify that a chosen technology can work in harmony with current user and organizational applications and systems.

Economical Feasibility

Economic feasibility assesses the project's financial sustainability through cost analysis, prospective savings, ROI, budget alignment, funding sources, financial forecasting, and cost-benefit analysis. This ensures that the project is financially sustainable and generates a solid return on investment.

IMPLEMENTATION

Overview

The Proposed System is implemented using a web application developed using Visual Studio. Each Customer has to register to access the functionalities. The backend of this application will be a local server setup using the MongoDB framework. This server would accept the ingredient information given as input by the user via the interface and carry out the necessary

calculations and search process. Once, the computation is done, the server-side program will return the results to the application providing for easier and faster networking.

Requirements

Hardware Requirements

- Processor: - Pentium IV 2.6GHZ or above

- Ram: - 2GB or above

- Hard disk Space: - 256GB

Software Requirements

- Operating System: - Windows 7 or above

- Languages used are: - HTML, CSS, Python, RASA framework, Node, Express, Next.js, React, Passport.js, and GraphQL.

Software used: Visual Studio Code.

RESULTS

Recipes are recommended based on the users' preferences shown in Figure 3. Recipes would be listed according to the ingredients in the search box. This search box can be altered to suit the needs of the user. Various parameters are considered to sort and filter the recipes list. The recipes recommended by the Deep Learning Models are sorted in descending order of the matched ingredients. The User can also like certain recipes.
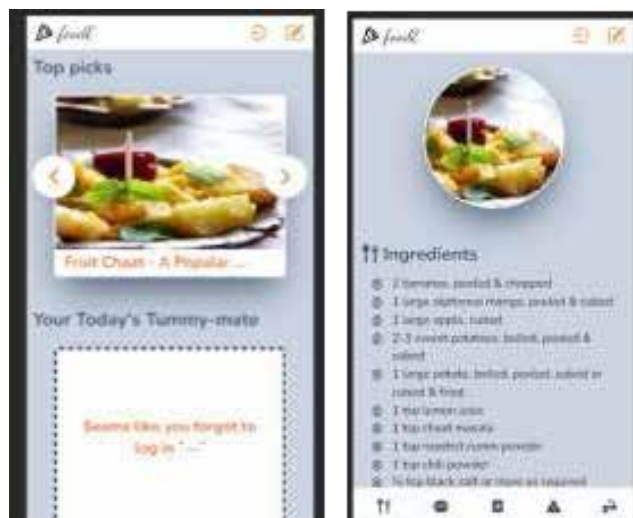
Fig.3: Recipe Recommendation Page

CONCLUSION

Food plays a significant role in people's lives. Many hail it as a means of motivating people to adopt a healthier lifestyle. Therefore, food recommendation systems play an important role in a wide variety of lifestyle services. In order to build an effective food recommendation system, it is very important to efficiently understand a user's preferences. Such systems are typically generated through machine learning and deep learning algorithms. Some previous and existing food recommendation systems are not able to guarantee user preferences regarding the foods they recommend. Therefore, our app helps in solving this problem and giving the user preference more importance. The app also provides a user- friendly interface that would interactively receive information from the system and give optimal solutions for the end user.

ACKNOWLEDGMENT

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Smart E-Health Card System for Hospital

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ABSTRACT

Nowadays, In response to the evolving healthcare landscape, this paper presents our project on a Smart E-Health card system developed during our Computer Engineering program. Focused on applying programming skills, the project created a web application to streamline hospital management, reducing patient wait times, enhancing report traceability, and centralizing patient history data.

The Smart E-Health card system serves as a vital tool, contributing to the modernization of patient experiences and providing healthcare professionals with efficient access to essential information. The project aimed to address critical challenges in healthcare and align with the industry's evolving needs.

The web application, powered by innovative technologies, facilitates seamless data collection and management in hospitals, marking a significant advancement in healthcare processes. The project not only deepened our practical skills but also nurtured teamwork, management proficiency, and leadership abilities among project team members.

This paper delves into the technical aspects of our Smart E-Health card system, detailing its architecture, functionalities, and positive impact on hospital management. It reflects on our experiential journey, emphasizing the project's role in enhancing our understanding of software development challenges in healthcare.

KEYWORDS : Healthcare efficiency, Streamlining processes, Data centralization, Evolution of hospital management systems, Report traceability.

INTRODUCTION

More In the ever-evolving landscape of healthcare, the integration of innovative technologies is paramount to enhance efficiency, reduce waiting times, and improve patient care. This research paper explores the implementation and impact of a Smart E-Health card system designed to enhance hospital management in the evolving healthcare landscape. The system provides authorized users, including the chairman, branch manager, doctors, and receptionists, with restricted access to corporate information and hospital statistics through the internet. Patients are offered one-year, two-year, and ten-year smart cards (gold, silver, or platinum) with corresponding discounts on medical bills, tailoring services to individual needs.

The proposed system revolutionizes traditional hospital procedures by eliminating upfront financial transactions for patients with Smart E-Health cards. Initial examinations by doctors can take place without immediate payments, and patient details are securely stored in the hospital's database. This allows doctors to access previous medical records through a user-friendly website, streamlining the process and eliminating the need for patients to carry prescriptions at every visit.

Furthermore, the Smart E-Health card system promotes global information exchange among the

hospital group's branches, facilitating a cohesive and comprehensive healthcare approach. Subscribers of the smart card also benefit from initial treatment without consultancy charges during periods of ill health, fostering a proactive and patient-centric healthcare model. The paper delves into the intricacies of the system, discussing its objectives, methodology, results, and analysis, emphasizing its transformative impact on modern hospital management.

LITERATURE SURVEY

Developing Effective Hospital Management Information Systems (Dr. Christopher Bain MBBS, 2019):

Approach: Technology Ecosystem Perspective

This study adopts a Technology Ecosystem Perspective to address the needs of hospital managers and understand the impact of Environmental Shaping Factors (ESF's) on daily activities. By examining the technological landscape in the healthcare domain, the research aims to develop effective Hospital Management Information Systems (HMIS). This approach recognizes the interconnectedness of various technologies within the hospital environment.

A Hospital Resource and Patient Management System (Musa, A., Lancashire, UK, 2015):

Approach: Real-time Data Capture

Focused on real-time data capture, this research proposes a solution using Radio-Frequency Identification (RFID) and wireless sensor technology for tracking hospital assets and patient movement. RFID technology allows for the identification and tracking of assets, while wireless sensors enable real-time monitoring of patient movements within the hospital. The integration of these technologies contributes to a more streamlined and responsive hospital management system.

Smart Healthcare System: A Primer (Dr. Jackson Akpojaro, University of Africa, 2014):

Focus: IoT-based Healthcare

Examining the landscape of IoT-based healthcare, this research primer explores a paradigm shift for digital natives, emphasizing the importance of Internet of Things (IoT) and cloud-based healthcare services. By incorporating IoT, the system aims to provide real-

time monitoring of patient health, improve diagnostic capabilities, and enable remote healthcare services. This approach reflects a forward-looking perspective on healthcare management, embracing the potential of emerging technologies.

PROPOSED SYSTEM

The overview of our proposed system is shown in the below figure. The E-health smart card system's components and interactions are represented in a block diagram. Usually, it is made up of blocks that stand in for important system components, such as "User Interface, " "Database," "Search Engine," and so on.

This visual aid makes it easy to quickly understand how the platform works and the primary roles that each block plays by providing a high-level perspective of the system's architecture and component interactions. It is beneficial to comprehend the data flow and control inside the platform as well as its structure.

Fig. 1: System Overview

A Block Diagram, as shown in Figure 1, visually represents the interaction between these system components. This diagram illustrates the flow of data and control within the system, offering a high-level view of the architecture. This architectural design ensures a cohesive and efficient system that streamlines hospital management, addresses the identified gaps in existing research, and aligns with the objectives of enhancing patient care and accessibility.

Methodology

The research design employed in this study is a combination of descriptive and experimental approaches. Descriptive research provides an in-depth understanding of the existing E-Health card systems and healthcare management practices, while the experimental approach involves the development and

implementation of the Smart E-Health card system to assess its effectiveness.

Data collection methods include a comprehensive review of existing literature, surveys, and interviews with healthcare professionals and potential users. The selection of this methodology is justified by the need to gather insights into current healthcare practices, identify user needs, and assess the feasibility and usability of the proposed system.

Limitations of the study include potential biases in survey responses and the dynamic nature of healthcare systems, which may evolve post-implementation.

System Architecture

The architectural design of the Smart E-Health card system is characterized by a robust framework that seamlessly integrates various components for efficient hospital management. The system comprises key elements such as the "User Interface," "Search Engine," and "Database."

The User Interface serves as the front-end interaction point, providing users with a user-friendly experience for accessing and managing health information. The Search Engine facilitates quick and accurate retrieval of patient records and relevant medical data. The Database serves as the centralized repository for storing and managing patient information, ensuring data integrity and accessibility.

PROPOSED APPROACH

Discover the Smart E-Health card system's successful implementation and its consequential impact. From feasibility to Agile Methodology, our approach ensured a seamless integration. Results, presented succinctly through visuals, highlight the system's transformative effects on user satisfaction and healthcare efficiency. Further sections delve into a concise analysis of these outcomes.

Implementation

The implementation of the Smart E-Health card system involved a carefully planned approach, considering economic, technical, and operational feasibility.

Feasibility Study

The feasibility study focused on economic, technical, and operational aspects. Economic feasibility involved

evaluating benefits against costs, ensuring that the expected savings and advantages justified the project. Technical feasibility examined the compatibility of existing systems with the proposed addition, while operational feasibility addressed the need to educate and train staff for seamless adoption.

Implementation Plan

The hardware/software interface specified minimum requirements for efficient system operation. Front-end software was developed using ASP .net, while the back-end utilized the Microsoft SQL Database. Client devices with modern web browsers and smartphones/tablets supporting the mobile application were essential components.

The Agile Methodology was employed for system development, facilitating parallel development and continuous testing throughout the project life cycle. The methodology allowed small teams to produce regular updates, enabling real-time adjustments based on user feedback.

Different Stages of Agile Methodology

1. Requirements Phase:

Gathering and understanding employee/patient requirements, with flexibility for mid-way changes.

2. Design Phase:

Visual design and web architectural structure development, including software and UI/UX design.

3. Development and Coding Phase:

Creation of the actual software using coding, aligning with the gathered requirements.

4. Integration and Testing Phase:

Testing for software bugs, compatibility, and conditions across different environments.

5. Implementation and Deployment Phase:

Installation on web servers for demonstration or actual use, with subsequent iterations for updates.

6. Review Phase:

Obtaining user feedback for continuous improvement, considering changes for future versions.

The overview of our Implementation Flow is shown in the below figure.2
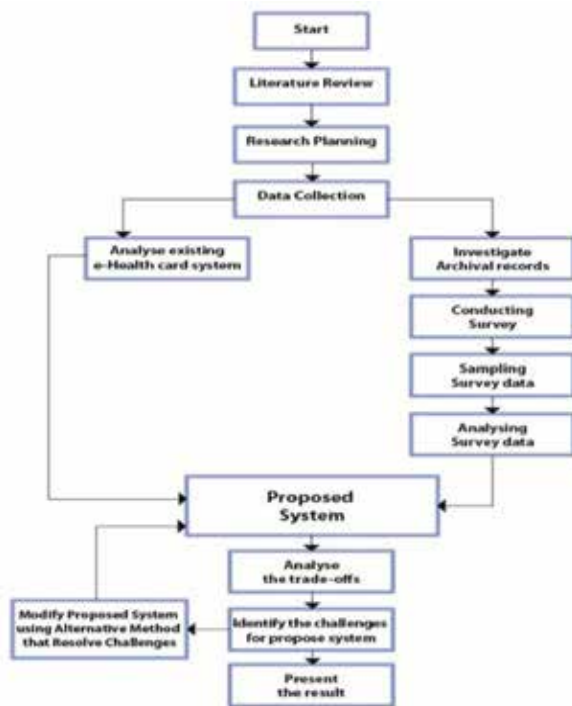
Fig. 2: Implementation Flow

Challenges encountered during implementation included staff resistance to change and the need for comprehensive training. These challenges were addressed through targeted educational initiatives and user feedback mechanisms to ensure a smooth transition.

RESULTS AND ANALYSIS

Results Obtained

The implementation of the Smart E-Health card system yielded promising results. Tables, charts, and graphs presented in the following sections provide a comprehensive overview of the outcomes, including user satisfaction, system efficiency, and improvements in patient care.

Analysis

The results showcase a positive impact on hospital management, with notable enhancements in data accessibility, patient care efficiency, and overall system performance. The system's effectiveness is evident in the reduction of waiting times, streamlined patient Information retrieval, and improved communication among healthcare professionals.

The implications of these results underscore the transformative potential of the Smart E-Health card system in advancing healthcare services. The following sections delve into a detailed analysis of the obtained results, emphasizing their significance in the context of the broader HealthCare landscape.

A well-orchestrated workflow within hospital settings. It commences with the seamless enrollment of patients, wherein their pertinent information is securely recorded in the system database. Subsequently, patients are issued Smart E-Health cards, encapsulating their unique identification details and comprehensive medical history. Healthcare professionals actively contribute to the system by inputting and updating patient data, ensuring real-time accuracy and completeness. Patients, in turn, benefit from features such as appointment scheduling, enabling efficient management and reduced waiting times.

The overview of our different states of implementation is shown in the below figure.3

We can also say it as State Transition Diagram.

Fig. 3: State Transition Diagram

The state transition diagram of the Smart E-Health card system visually illustrates the dynamic flow of operations. Initiated at the patient enrollment state, individuals transition to Smart Card Issuance, receiving personalized cards with unique identification and medical history. The diagram delineates pathways, including Data Input and Updates for real-time information maintenance and Appointment Scheduling for efficient patient management.

Additionally, the Smart E-Health card system serves as a comprehensive platform for medication management, billing, and insurance integration, streamlining financial transactions and reducing administrative complexities. Serving as a centralized communication hub, it fosters collaboration among healthcare professionals, enhancing overall coordination.

CONCLUSION

In conclusion, the Smart E-Health card system emerges as a transformative solution, fostering enhanced communication and swift access to accurate health data. Our findings underscore its potential to revolutionize hospital management, addressing key challenges and providing valuable insights for future advancements in healthcare technology.

Discussion

Interpreting the findings within the context of our research objectives, the Smart E-Health card system has demonstrated significant advancements in hospital management. Comparing our results with prior studies underscores the efficiency and reliability achieved through our system. Notable strengths include improved communication and swift access to accurate reports, addressing challenges associated with manual processes. However, it is essential to acknowledge the limitations, particularly the need for organizational flexibility during implementation.

Conclusion

In summary, the creation of the E-SMART HEALTH CARD project marks a pivotal contribution to hospital management. The project's success lies in its ability to enhance communication, efficiency, and accessibility of health data. The implications of our findings underscore the transformative potential of the Smart E-Health card system in streamlining healthcare processes. The successful implementation in developed countries highlights its relevance, showcasing time and cost savings for citizens.

Recommendations

Looking ahead, future research should explore ongoing system improvements and adaptations for diverse healthcare settings. Emphasizing flexibility and cooperation during implementation will be crucial for the sustained success of similar projects. The significance of our research extends beyond this study, influencing the trajectory of digital healthcare management globally.

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ABSTRACT

In an era defined by digital communication, WhatsApp stands out as the predominant and effective means of communication in contemporary times. WhatsApp stands as one of the most ubiquitous messaging platforms, facilitating countless conversations daily. Within these chats lie a treasure trove of insights, sentiments, and patterns waiting to be discovered. WhatsApp chat analyser is the application which provide analysis of WhatsApp chats. This project is a combination of machine learning and NLP. This WhatsApp chat analyser takes a chat file which is imported from Whatsapp from user and analyses it and gives different visualizations as a result. This tool aims to offer a thoroughout study of the information that WhatsApp provides. Regardless of the subject around which the conversation is centred, our generated code may be used to improve comprehension of the data. These modules are employed to generate data frames, and the resulting graphs are displayed within the web application. Because this approach is effective and resource-conserving, it can be readily applied to the largest dataset. Real-time analysis adds a crucial dimension to this project, enabling users to glean instant insights from ongoing chats, whether for enhancing customer support, understanding market trends, or improving personal productivity. Privacy and ethical considerations are at the forefront, ensuring data security and user confidentiality. Ultimately, the WhatsApp Chat Analyser project embodies the fusion of cutting-edge technology and practical utility, offering a gateway to harness the latent potential within our digital conversations.

KEYWORDS : Pandas, Seaborn, Matplotlib, Sentiment analysis, Streamlit, NLTK, and data from WhatsApp chats are some examples.

INTRODUCTION

WhatsApp, recognized as a proprietary instant messaging app for smartphones, enables users to exchange text messages, share media files, and communicate across various platforms like Android, Apple, and Windows iOS. Apart from text messaging, users have the ability to effortlessly exchange images, videos, audio messages, as well as documents and applications within the application. The versatile software operates on different Internet Operating Systems (iOS), providing a comprehensive and cross-platform communication experience. WhatsApp, a messaging application, allows users to instantly share messages, images, videos, and make voice calls over the internet. It simplifies communication through text or voice messages, fostering easy interaction among two or more individuals. It facilitates connections among individuals, making WhatsApp an appealing application. Upon installing the application, the exchange of messages is free, distinguishing it from the conventional text message feature on mobile phones.

The designation of WhatsApp as cost-free distinctly contributes to its success. Additionally, its compatibility with various smartphone platforms, including Apple and Android, along with its international functionality, further contributes significantly to its widespread popularity.

This project is a response to this burgeoning challenge, born from the necessity to unlock the latent information embedded in our digital dialogues. Equipped with cutting-edge machine learning and natural language processing methods, this project aims to thoroughly automate the analysis of WhatsApp conversations. From sentiment analysis that deciphers emotional nuances to topic modelling that unveils recurring themes, and user profiling that illuminates distinct communication patterns, our endeavour is to render these insights accessible and actionable.

Research Objective

The project to develop a robust and effective system for analysing and extracting meaningful insights from WhatsApp chat conversations. This involves implementing various natural language processing (NLP) techniquesand machine learning concepts. The aim is to create a tool that not only accurately captures sentiment dynamics and prevalent topics within chats but also provides valuable user behaviour insights. Additionally, the research seeks to ensure the tool's scalability, real-time analysis capabilities, and ethical considerations in handling user data, contributing to a comprehensive and versatile WhatsApp chat analysis solution.

- To leverage machine learning techniques for real-time analysis of WhatsApp chats.

- To conduct a thorough exploratory data analysis on diverse categories of WhatsApp conversations.

- To enable users to make timely decisions, improve customer support, monitor brand reputation, enhance personal productivity, facilitate community moderation, and conduct market research.

LITERATURE SURVEY

Dr. T. Siva Ratna Sai, T. Naga Nandini, et al [1] present an overview of "WhatsApp Chat Analyzer" project. It is a platform designed for users to analyse their WhatsApp conversations conveniently. A user can upload WhatsApp chat file in .txt format, and the analyser processes this file to provide valuable insights. The analysis includes sentiment analysis, categorizing chats as positive, negative, or neutral.

In this paper [2], they have used an algorithm named LSTM (long short term memory). In this paper, sentiment analysis is employed on messages exported from the chat using the built-in export feature in the WhatsApp application. The exported chat undergoes preprocessing for improved computation, with all messages being individually separated and subjected to sentiment analysis.

In [3], in-depth exploration of WhatsApp chat analysis, offering a comprehensive guide to the entire data analysis process. It includes insights on data preprocessing, sentiment analysis, and user profiling using Python programming, culminating in a deployment-ready project, making it a valuable resource for data enthusiasts and analysts.

Also, in [4], The article delves into analysing WhatsApp usage data while omitting message content. It explores patterns and behaviour to develop prediction models. Published on arXiv, it sheds light on understanding user interactions and predicting engagement without invading message privacy.

In [5], the examination of WhatsApp chat data is done. This research explores techniques and tools for chat analysis, shedding light on the growing relevance of data-driven insights in the digital communication landscape. [6] explores a comprehensive framework and methodology for analyzing WhatsApp chat data. It delves into data analytics techniques to extract meaningful insights from WhatsApp conversations, enhancing the understanding of user behaviour and interaction patterns. Published in December 2016, it contributes to the field of computational intelligence and data analytics.

METHODOLOGY

Problem Statement

In the age of digital communication, WhatsApp has become a ubiquitous platform for conversations. However, the sheer volume and complexity of chat data pose challenges in extracting valuable insights

and patterns. Manual analysis of WhatsApp chats is impractical due to the sheer volume and complexity of the data, making it essential to automate the process. Users and businesses struggle to extract valuable insights, including sentiment trends, key topics, and user behaviour, from their WhatsApp conversations. Understanding user behavior and communication styles requires an in-depth analysis of the chat data. Identifying key topics and themes discussed in the chat is complex due to diverse conversation patterns.

Modules Used

This project is composed of five main modules which also include sub modules:

1. Data extraction: Data is extracted from WhatsApp by clicking on export button. After exporting, a text file is created which includes raw data. The raw data is given to WhatsApp chat analyser to perform preprocessing.

2. Data Collection: Utilize the "Export Chat" feature to transmit the complete conversation in text format to your email ID, then retrieve and download the exported chat from your email inbox.

3. Data Preprocessing: In this module, data preprocessing is done by removing all the unwanted content from the raw data. Only the data required for analysis is taken into consideration.

4. Importing Data into website: Users can choose between overall group analysis and a specific user analysis. The user then clicks the display analysis option to analyse the imported file after choosing the user. Analysis of an imported WhatsApp text file is displayed.

5. Statistical Representation: It involves employing a variety of graphical techniques to visually present. Graphical representations could include charts, graphs, histograms, or other visual aids, enhancing the accessibility and interpretability of the preprocessed data.

Technologies Used

Python

o   Python is chosen as the main programming language due to its versatility, user-friendly nature, and a comprehensive array of libraries in its ecosystem.

Natural Language Processing (NLP) Libraries

o   Libraries like NLTK (Natural Language Toolkit) and spaCy are employed for text analysis, including tokenization, stemming, and sentiment analysis.

NumPy and Pandas

o   NumPy and Pandas are essential for data manipulation and analysis, facilitating tasks like data cleaning, aggregation, and transformation.

Matplotlib and Seaborn

o   Matplotlib and Seaborn are data visualization libraries used to create insightful charts and graphs representing sentiment trends, topic distributions, and user participation.

Streamlit

o   Streamlit, a Python library, simplifies the creation of interactive, web-based applications for machine learning projects with minimal coding effort. It is particularly useful for user interfaces (UIs) that allow users to interact with data visualizations and analysis.

Latent Dirichlet Allocation (LDA)

o   LDA is a common algorithm for topic modeling, helping identify key themes within the chat data.

WhatsApp Business API

o   If dealing with larger datasets or real-time analysis, the WhatsApp Business API may be used for data collection.

Jupyter Notebooks

o   Jupyter Notebooks provide an interactive environment for code development and testing, making it easier to visualize and analyse data.

PyCharm

o   PyCharm, created by JetBrains, is an Integrated Development Environment (IDE) meticulously crafted for Python development. It furnishes a robust and feature-laden space for Python code composition, debugging, and testing, showcasing its dedication to enhancing the Python development experience.
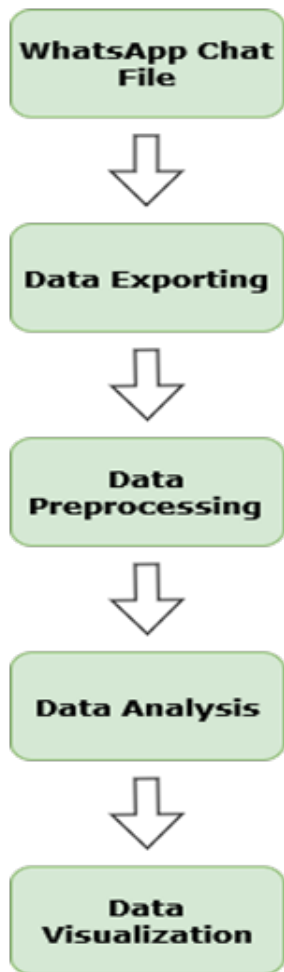
Fig 1 : DFD Diagram

These technologies collectively contribute to the successful implementation of this project, offering a robust and scalable solution for analysing chat data.
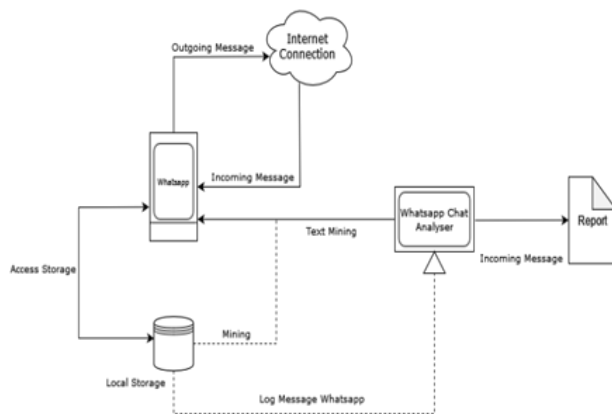
Fig 2: System Architecture

FUTURE SCOPE

• The current project can be further modified by incorporating more advanced Natural Language Processing (NLP) techniques for topic modeling, and user profiling to improve accuracy.

• Expanding the analyser's capabilities to include analysis of chat data from other messaging platforms like Facebook Messenger, Slack, or Telegram can be done.

• In this project, we can further integrate capabilities to analyze multimedia content, such as images and videos, within WhatsApp chats for a more comprehensive understanding.

• Predictive analytics models can be developed to anticipate trends in chat behaviour and provide proactive insights for users, enabling them to better understand and respond to chat dynamics.

• Features that offer personalized insights to individual users based on their specific communication patterns and preferences can be added to make the insights more personalized.

CONCLUSION

This project represents a milestone in chat data analysis, providing a comprehensive and user-friendly solution. It has successfully combined technical feasibility, operational efficiency, and economic viability to empower users with valuable insights from WhatsApp conversations. As we look ahead, this tool promises to play a pivotal role in enhancing decision-making processes, improving user experiences, and deepening our understanding of digital communication dynamics. Its continuous evolution and user-centric approach will further solidify its position as an indispensable resource for chat data analysis. Python was utilized for the system, incorporating libraries such as NumPy, Pandas, Matplotlib, and Seaborn. Upon completion, the anticipated outcomes were achieved, revealing the extent of participation by different individuals in the designated WhatsApp chat. In a more formal tone, this system possesses the capability to analyze WhatsApp group data inputted into it.

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Raspberry PI and Arduino based Open Source 3D Laser Scanner

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ABSTRACT

A 3D Scanner refers to creating a generalized and simplified representation of the functionality, data output and operation of 3D Scanner. It is often used in engineering, computer programs and various applications. The proposal of this project is to construct a scanner for scanning of smaller objects and visualizing them in a computer. 3D Scanners are commercially available using techniques like image processing, laser, etc. These techniques are high-resolution webcams and high end equipment like laser sources. They have good accuracy, but it is equally expensive. To optimize between price and accuracy, a distance sensor can be used for plotting points in 3D space. Algorithm which is used to create a mesh for the concept of point cloud, this mesh is written in the format '.STP file' which is done by python coding language. In domains of CAD modeling'. STP file' is a widely used format. Thus the object can either be viewed in any 3D printed or any CAD software.

KEYWORDS : Scanners, Arduino, IR sensor, Three dimensional image acquisition, LCD display.

INTRODUCTION

A common technology called 3D scanning is the process which is used to visualize a real-world object or collect data from the surroundings on its possible appearance and shape. Digital 3D models can be constructed by using collected data. It makes it possible to record an object in three dimensional geometry, which may be used for many purposes, including product creation, quality assurance, etc. To build a 3D scanner model, we will use an open source microcontroller board called Arduino and Raspberry Pi. The objective of this project is to design a low-cost, simple-to-assemble 3D scanner that a public may copy and modify. A camera or photodiode will be used to observe any scatter light or reflected object and a structured light or a laser source will be used by the 3D scanner to scan the item. To obtain a 3D shape of a component whose physical attributes are difficult to measure, after scanning, the data is in the form of point cloud data. CAD software is used to create the 3D model with the use of point cloud. As this model involves cameras, sensors whose output may vary depending upon external conditions. The purpose of this paper is to help to grasp an understanding of the state-of-the-art in the field of 3D scanning.

The objective of this 3D scanner is to create a 3D model on the basis of real-world objects. It consists of geometric samples of a point cloud on the surface of the object. After that, these points can be used to understand the shape of the object and this process is called reconstruction. If colour information is collected from the object at each point, then information about the colour and textures can also be determined. This 3D scanner can give several traits with the help of cameras.

3D scanning permits us to scan and generate the digital 3D models of the same. This digital model can be used for historical artifacts and many more.

LITERATURE REVIEW

3D scanners are not new technology, but they are becoming more booming and ordinary every day. These 3D scanners are popularly used for overlooking the features of products which assist the process of reverse engineering and reduction of cost highly, especially for geometrics with complex characteristics. 3D scanning technologies were created in the 1960s. To execute the task, initial scanners use projectors, cameras and lights. Then, due to limited equipment, it took a lot of time and effort to scan the object precisely. After 1985, this equipment was replaced with lasers, white light and shadowing to capture a given surface.[1-3].

For 3D scanning, surface based measurement techniques, which can result in a large quantity of points in an organized pattern. By the accumulation of 3D scans we can obtain Computer-Aided Design (CAD) models, line drawings, 3D surface models or video animations. 3D scanners can be used for the formation of a CAD model from an existing object for implementation such as numerical analysis, industry simulation and mechanical modeling. It provides many advanced features in various industries, like medicine, automotive and aerospace, where measurement is the crucial thing.

1) Reverse Engineering: This is a process of reconstructing an existing product. The recreation is done in several aspects, like size, design and shape. The important part of this process is to recreate an existing product for great results. This process starts with a CAD model, which requires dimensions from a physical model that are measured from the original model. In CAD software, sometimes it's difficult to redraw some features. For this reason, 3D scanning is a solution to be used for some cases like this. [4-7].

2) Computer Vision: A process which is proceeding with image processing of real-world images for better quality. For this one of the techniques, 3D scanners are used for 2D images. For example, Photogrammetry is a process in which you basically remove 3D information by integrating some 2D photographs. In 2D, pictures depth is lost, but in Photogrammetry, reverses this loss of pictures from at least two angles at each point.[8]

3) White Light Scanning: White light scanning is also called light scanning in a structured way. This methodology is projecting towards a structure of light like black and white lines and for capturing the images, sensors are used with patterns projected on them. Multiple sensors or multiple patterns can be used to capture 3D information.[1-3]

4) Cyber-Physical-System: Cyber physical system determined as transformative technologies to manage computational and system's physical domains. It can be developed to manage Big Data applications and implement Industry 4.0 factories. [9]

5) Laser Scanning: Laser scanning is a non-contact technique that leads the industry. But even if they are more popular, laser scanning systems have difficulties with transparent surfaces or reflective and small-scale models[10]. The main three techniques of laser scanning are; Laser Triangulation, Time of Flight Laser Scanning and Phase Shift Laser Scanning.[1-4]

Table 1. Main Laser Scanning Techniques

Laser Scanning Technique	Details
Laser Triangulation	Laser triangulation predicts a laser point or laser line is used to scan the surface, then, with the help of a sensor, it captures the reflection that is located at a specific distance.
Time of Flight Laser Scanners	It calculated the distance by projecting towards a laser light and measuring the consumed time for the laser to reflect from the object on the sensor. If the speed of the laser was known, then calculate the distance.
Phase Shift Laser Scanners	Phase-based scanning releases a constant laser beam into multiple phases. To find the distance, the laser scanner uses phase-shift properties.

Zhang(2000) proposed a flexible new technique for 3D scanning i.e for camera calibration. This technique utilizes the checkerboard pattern. Calibrating the 2D points with the help of a camera plane with the 3D points of the real world. In this method, a planer checkerboard pattern works to rotate for maximum orientations and these orientations are noted by the camera. This proposed calibration technique is flexible and easy [10].

Yao(2005) paper proposed the application of reverse engineering and 3D scanning quality control. The differentiation of an original CAD design and fabrication parts is time-consuming. This paper uses an integration of three techniques: rapid prototyping for rapid producing products, reverse engineering and 3D scanning[11].

Wang & Feng(2016) paper proposed the consequence of scanning the orientation on the basis of outlier evolution in 3D laser scanning of consequences of surfaces that are reflective. This orientation greatly acts on the quality of scanning of the reflection of the surfaces. By selecting the proper scanning path the quality of scan can be more enhanced to a great effect [12].

Jurado et al.(2016) paper put forward the projector system and multiple cameras which can simultaneously scan the whole subject without being oriented. This paper studied the method to automatically calibrate parameters of the various cameras as well as the projector without requiring any certain equipment. In this method the structured light sequence is projected by the multiple projector one by one in a well defined sequence and simultaneously multiple cameras are used to capture [13].

HARDWARE SPECIFICATIONS

Raspberry PI

It is a "credit-card sized computer" that connects into a computer or TV and it works with a normal mouse and keyboard. It is a small device that is useful for any person for exploring computing or learning about programming, like python. It is a programmable device and it has inbuilt all features of the motherboard, all the internal storage and peripherals. To start with a Raspberry computer, an SD card is inserted into a given space. It is adaptable with Linux OS.

Fig. 1 Raspberry PI

Arduino UNO

The Arduino Uno is an ATmega328 microcontroller. It consists of two pins, i.e. digital and analog pins(I/O). It has a 6 number of analog input pins and 14 number of digital output pins, a USB type connector and a power jack. Programmed based on the Integrated Development Environment(IDE) and it can run on both platforms, like online and offline.

Fig. 2 Arduino Uno

Stepper Motor

It is a motor that is synchronous that simultaneously splits a full rotation into a number of steps. It is a brushless motor. It works on the principle of electro mechanism and it has a magnetic rotor or soft iron and this is surrounded by electromagnetic stators.

Fig. 3 Stepper Motor

Line Laser

It is a device that uses an optical lens and laser to direct towards the laser beam as a form of line instead of a point. This is possible due to passing the beam through a power lens and cylindrical lens.

Fig. 4 Line Laser

KEY FEATURES

- Digital Physical Object: The 3D scanner provides a higher quality solution for digitizing physical objects. This allows users to scan various geometries for molds, sets and many more.

- Reverse Engineering: Reverse Engineering is the procedure of reconstructing a current product. The recreation is done through different aspects like design, shape and size. The important part of this process is to recreate an existing product for great results. This process starts with a CAD model, which requires dimensions from a physical model that are measured from the original model.

- Verify the accuracy of products: Accuracy is a crucial part for many industries, like automation, medical or aerospace, where measurement is the crucial part. When products are manufactured, verification of accuracy is commonly done.

- Education: A scanner is a crucial thing for learners as it helps to develop and generate new ideas and helps to visualize things better. It constructs a 3D model which provides a better understanding of every point.

METHODOLOGY

A 3D scanner is a process that collects all the data from surface data to find out the shape. It permits the user to either copy the part by reverse engineering or scan

it through dimensional analysis. To reach up to this scanner, they use lasers, light and sensors to detect the surface of the object being scanned and allocate data points to the surface. With the help of these data points, we recreate the object. In this project we have used Raspberry Pi, Arduino, Raspberry Pi Camera Module, Laser Light, Power Supply and Stepper Motor.
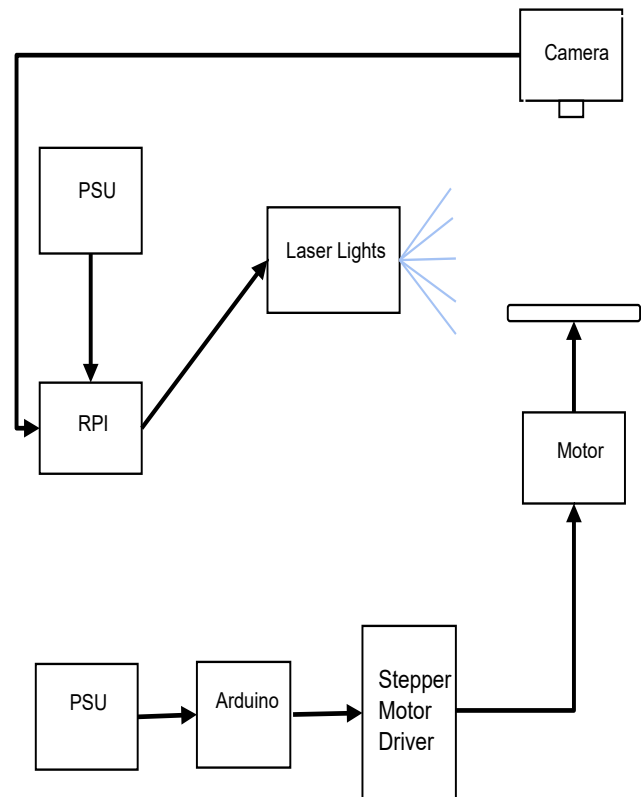
Fig. 5 3D Scanner Block Diagram

The methodology of creating a 3D scanner with features like wifi-module because of raspberry pi which is used as a mini computer. The scanning process starts with precise line laser positioning, casting light onto the object while the Raspberry Pi's camera captures illuminated images. A stepper motor, under Raspberry Pi control, rotates the object incrementally, capturing new images after each turn. This repetition accumulates data slices from all angles for a complete 360-degree scan. These images are 2D slices, each offering a unique perspective, reflecting variations in the laser line due to the object's shape, stored digitally on the Raspberry

Pi. Next, data processing occurs, with specialized software analyzing the images. It interprets laser line shifts and calculates the intricate 3D shape of the object, geared for structured light 3D scanning. Power supplies vary based on configuration, with dedicated supplies for the Arduino, stepper motor, and Raspberry Pi. Enclosure secures components, ensuring proper alignment. Hardware includes screws, nuts, springs, Etc. Calibration is essential for accuracy, addressing potential distortions. Upon completion, the system generates a 3D model, easily saved or exported for diverse applications[14].

RESULT

In the domain of 3D scanning, the implementation of this project emerges as a cutting-edge and cost-effective solution, showcasing exceptional proficiency in capturing precise three-dimensional models of tangible objects. The technology's transformative impact is underlined by its user-friendly interfaces, ensuring not only accessibility but also instrumental versatility across various applications. The ultimate result of the scanning process is the generation of a meticulously detailed 3D mesh that vividly encapsulates the intricate details and contours of the scanned object. This outcome signifies a remarkable stride in democratizing 3D scanning technology, making it widely accessible, independent, and user-friendly across diverse domains. Deployment of this project is a major step towards making 3D scanning technology more accessible, user-friendly, and independent across various domains.

CONCLUSION

From this research we conclude that the 3D scanner is an appropriate and useful tool to create a 3D model from the real world. It is extensively used for reverse engineering purposes. Objects are difficult to measure their physical attributes, so the 3D scanner helps to provide an exact size and shape of the object by using data points and it is also efficient for checking the quality of the product. Normally, it takes more time to check the quality, but a 3D scanner gives us a solution in much less time. 3D scanners provide accurate and precise objects without being interrupted. It is very useful for many purposes.

For example, historical monument models, medical, automotive and many more.

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IOT based Advances in Healthcare: A Survey

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ABSTRACT

The integration of Internet of Things (IoT) technology in the healthcare sector has emerged as a transformative force, revolutionizing the way patient care is delivered and managed. This paper explores the manifold applications of IoT in healthcare, highlighting its potential to optimize medical processes, improve patient outcomes, and enhance overall efficiency within the healthcare ecosystem.

KEYWORDS : IOT, Security Issues, Healthcare, MIot.

INTRODUCTION

The IoT-enabled healthcare system involves the interconnectivity of devices, sensors, and healthcare infrastructure, creating a dynamic network capable of real-time data collection, analysis, and communication. Through wearable devices, smart medical equipment, and remote monitoring systems, healthcare providers can gather continuous and personalized patient data, enabling proactive and preventive care strategies.

Furthermore, IoT facilitates seamless communication among healthcare professionals, patients, and medical devices, fostering a collaborative and integrated approach to healthcare delivery. Remote patient monitoring, telemedicine, and smart healthcare facilities contribute to the accessibility of healthcare services, particularly in remote or underserved areas.

Data security and privacy concerns are critical aspects of implementing IoT in healthcare, and this paper addresses the various challenges associated with safeguarding sensitive medical information. Robust cybersecurity measures, encryption protocols, and compliance with healthcare regulations are imperative to ensure the confidentiality and integrity of patient data.

The paper also delves into the potential cost savings and operational efficiencies that IoT implementation brings to healthcare organizations. Streamlined workflows, predictive analytics, and improved resource allocation contribute to a more sustainable and economically viable healthcare system.

RELATED WORK

Several studies and research efforts have explored the integration of the Internet of Things (IoT) in healthcare systems, showcasing the diverse applications, benefits, and challenges associated with this technology. Here are summaries of some notable related works:

Chevi Herli Sumerli et. al.[1] presented a comprehensive review on the various IoT applications in healthcare, including remote patient monitoring, smart healthcare systems, and wearable devices. The paper emphasizes the potential for improved patient outcomes and the challenges related to data security and interoperability.

Zulfiqar Ali Solangi et. al.[2] focuses on security and privacy concerns, this survey provides insights into the challenges associated with the implementation of IoT in healthcare. It discusses the need for robust security measures to protect patient data and maintain the trust of both healthcare providers and patients.

Kiran Dewangan et. al. [3] presents a review paper where it explores IoT applications in healthcare, emphasizing the role of sensors, devices, and

communication technologies. It discusses challenges such as standardization, interoperability, and scalability while providing an overview of the potential benefits in terms of patient care and healthcare system efficiency.

Mostafa Haghi et. al.[4] provides an overview of wearable devices in the context of the Medical Internet of Things (MIoT). It reviews commercially available wearable devices, their capabilities, and their impact on healthcare, highlighting their potential in continuous patient monitoring and disease management.

Alkeya et. al.[5] focuses on smart healthcare systems, this review discusses the integration of IoT technologies to enhance healthcare services. The paper explores the potential of IoT in supporting real-time monitoring, disease prediction, and personalized medicine, while addressing challenges like data privacy and system scalability.

Bikash K. Pradhan et. al. provides case study which explores the implementation of IoT in a smart hospital setting. It discusses the integration of IoT for patient monitoring, asset tracking, and energy management, showcasing practical applications and benefits within a healthcare facility.

CONCLUSION

These works collectively contribute to the growing body of knowledge on IoT in healthcare, covering aspects such as applications, security, privacy, and future directions for research and development. Researchers and practitioners can leverage these insights to further

advance the integration of IoT technologies in healthcare systems.

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IoT based Mobile Charging using Solar Power

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ABSTRACT

In today's rapidly evolving technological landscape, the fusion of the Internet of Things (IoT) and renewable energy sources has paved the way for innovative and sustainable solutions. One such groundbreaking application is the "IoT-based Mobile Charging with Solar Energy." This cutting-edge system harnesses the power of solar energy to revolutionize the way we charge our mobile devices, offering not only convenience but also a significant step towards reducing our carbon footprint. Imagine a world where your mobile device is seamlessly charged by the sun's rays, regardless of your location. This revolutionary concept leverages IoT technology to intelligently manage and optimize the charging process, ensuring efficient energy utilization and a seamless user experience. By integrating solar panels, energy storage solutions, and smart charging algorithms, our system aims to provide a sustainable and eco-friendly solution for our ever-growing energy needs. Our system offers a decentralized and scalable solution, providing energy access to a wider population while maximizing the efficient use of available resources. System Integrates solar energy with IoT technology which helps alleviate the strain on existing energy infrastructure, reducing the risk of power shortages and grid instability during peak demand. Our system uses RFID to authenticate users and show the charging balance period of charging.

KEYWORDS : *Internet of Things, Solar power, Environmental sustainability, Radio frequency Identification (RFID), Eco-friendly, Data gathering.*

INTRODUCTION

Today mobile phones have a very important value, as well as the mobile phone having become a great communication medium for public use and industry use [1]. Most of the people in each of the 11 emerging and developing nations that were polled either own or share a mobile phone, and owning a phone is far more common than sharing one with someone in each of these nations [2]. The increasing number of individuals utilizing mobile phones in their daily lives has increased demand for these devices, as the mobile phone and electronic gadget industries have expanded into both rural and urban regions for communication purposes [3].

Electricity plays a pivotal role in our life. It forms the backbone of every electronic gadget. One such gadget is the mobile phone. However, most of the mobile phones come with a very poor battery life. Not everyone always carries portable power banks with themselves and thus can often be left with no battery [4].

The market for solar photovoltaics (PV) is still expanding and shows no signs of slowing down. By the end of 2018, there were 509 GW of PV installed globally; by 2022, that amount is predicted to have doubled. 10.7 GW of PV systems were installed in the US alone in 2018 [7][8]. These gave rise to the need for sustainable and ecofriendly infrastructure for charging mobile devices.

LITERATURE SURVEY

RFID Integration offers a wireless and efficient charging experience by just tapping in RFID to authenticate ourselves and attach our phone to a USB cable. Users can conveniently recharge their mobile phones in public places, ensuring that they can stay connected and productive while on the go [1]. A mobile charging

system that uses solar energy to charge mobile phones is designed to be used in public locations where access to electricity is limited. Solar energy is transformed into electrical energy by the solar module and is subsequently stored in a battery for later use. By aligning a solar panel with the sun on a single axis, the system's coin sensor module and sun-tracking technology maximize the amount of sunlight available for charging [2][8].

According to the end user's requirements, the suggested module can be configured with either a coin or an RFID system. The user has the choice of an RFID-based transaction or a coin-based transaction. A blue LED signals the start of the charging process when a coin is inserted, and another LED lets you know when the charge is finished. The module can display the remaining charging time and the amount of money in the user valet [3][4][7]. Vision system check for authentication of quality of industry automation for detection of system parts using Raspberry Pi document discusses the use of a vision system for authenticating the quality of industry automation in detecting system parts using Raspberry Pi The paper [9], also presents the development of the process through software, the features of the vision system using OpenCV and Raspberry Pi, and the integration of the system on the shop floor. Results and interpretation highlight the successful testing and the need for improvements in the graphical user interface and processing time.

The Modeling of cantilever-based power harvester as an innovative power source for RFID Tag explores the concept of using a cantilever-based power harvester as an innovative way to generate power, for RFID tags. It focuses on the limitations of battery powered RFID tags. Highlights the importance of finding energy sources particularly in situations where it is impractical to replace batteries. The proposed model employs lead zirconium titanate as a material to capture energy from random vibrations. The design consists of plates, a voltage multiplier circuit, and a supercapacitor, for storing energy [6][10].

IMPLEMENTATION

In this research study, we proposed "IoT-based Mobile Charging System using Solar Power" that presents an innovative solution to address the escalating demand for sustainable mobile charging solutions. This system

leverages RFID technology for user authentication, allowing individuals to charge their phones based on the available balance on their RFID cards. Upon scanning their RFID cards, users gain access to charging facilities, with the allotted time contingent on the card's remaining balance.
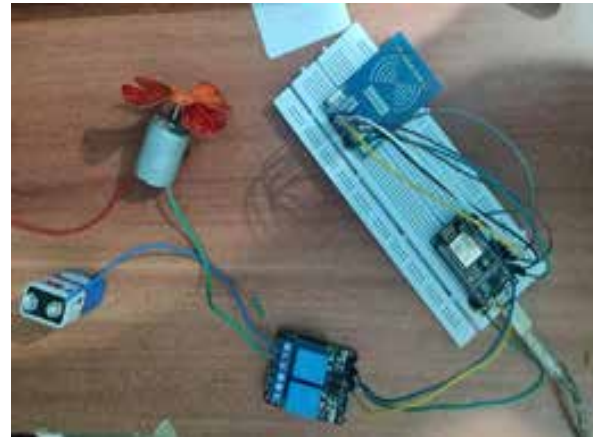
Fig. 1. Charging System implementation

Administrators have oversight through a dedicated web application, granting them insight into user logins and charging activities. Data transmission occurs seamlessly via Wi-Fi connectivity, facilitating real-time updates to a Firebase system. Moreover, users possess the flexibility to manually halt charging by rescanning their RFID cards, ensuring a convenient and user-friendly experience.

The system integrates solar panels to harness renewable energy, emphasizing sustainability in its core functionality. With a meticulous combination of hardware components, including solar panels, RFID readers, and microcontrollers, coupled with intricate software development encompassing RFID authentication, charging control logic, and seamless Firebase integration, this system embodies a holistic approach towards efficient and eco-conscious mobile charging solutions.

Steps/ Workflow of the system

1. The user begins by placing their RFID card or mobile device near the RFID module for authentication.

2. RFID module reads the user's RFID card or mobile device to authenticate their access to the mobile charging service.

3.   On the website user check-in will be shown with date and time as a valid user with RFID card taps on the RFID module.

4.   The user connects their mobile device to one of the charging slots on the multiplug charger.

5.   The user interacts with their mobile device to initiate the charging process. This can be done by pressing a button on their device or through a mobile app.

6.   The user's charging request is transmitted to the microcontroller using IoT communication. The microcontroller coordinates the charging process.

7.   The microcontroller activates a relay to connect the mobile device to the power source.

8.   The relay allows electrical power from the power bank or solar energy (based on availability) to flow to the mobile device, initiating the charging process.

9.   When the mobile device reaches a full charge or the user manually stops charging, the relay disconnects the power source, completing the charging process.

10.   The user receives a notification through the mobile app, indicating that their device is fully charged and ready for use.

11.   Power bank is integrated as the energy source to ensure uninterrupted charging.

12.   The user can disconnect their mobile device and remove their RFID card to end the charging session.

METHODOLOGY

IoT technology and renewable energy sources have converged to create innovative and eco-friendly applications in the era of connected devices and sustainable energy solutions. we introduce a groundbreaking mobile charging system based on the Internet of Things that integrates solar power with RFID card authentication. With the demand for ubiquitous mobile charging solutions growing, our system stands out due to its emphasis on user security, energy efficiency, and cloud-based administration.

Whenever the RFID card ID is inserted into the reader or swapped between the reader and the individual. An alert is sent to the controller or microcontroller when a disturbance is detected when hearing a signal.

Until microcontrollers receive a signal or command from RFID modules, they remain inactive. The controller begins to send an ON/OFF command signal on a transfer button. The work is innovative in that it builds a solar power public station in areas without access to energy by combining NodeMCU ESP8266, RFID, and solar panels. Work is beneficial to society and areas without electricity as well.
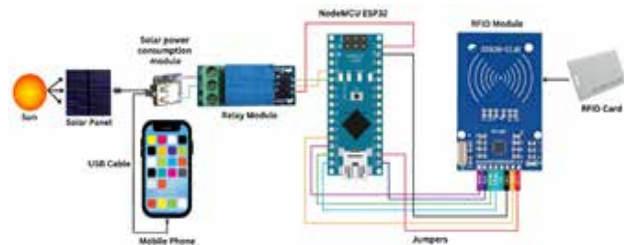
Fig. 2. System Architecture

These can be explained by following hardware description points:

1.   User Authentication: Users initiate the charging process by tapping their RFID card on the RFID module. The RFID module reads the card and verifies user authorization from the stored database. If authorized, the system allows the user to proceed.

2.   Power Activation: Upon successful authentication, the RFID module triggers a relay connected to the power supply via NodeMCU ESP8266 Microcontroller.

3.   Charging Process: Power is supplied to the mobile device through a USB port, providing a 5V output for charging.

4.   User Disconnection: To disconnect from the system, the user taps their RFID card again. The RFID module deactivates the relay, cutting off power supply to the device.

5.   Data Storage on Cloud: User login/logout timestamps and system usage information are stored on the cloud. This information is crucial for system monitoring and user activity tracking.

6.   Administrator Interface: The cloud-stored data is accessible through an HTML interface for the

administrator. Real-time user activity, login/logout history, and system usage statistics are displayed.
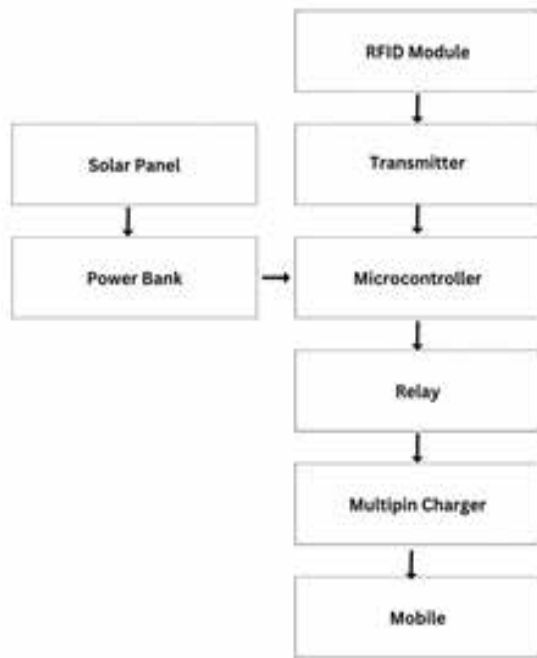
Fig. 2. Block diagram of the implemented system

The block diagram shown in Fig. 4 is the RFID Tag based on a mobile charger with the use of a solar panel. The power supply has a solar system installed to provide authorized users with electricity via the microcontroller. Thus, a 5V rechargeable battery receives DC electricity, and Grid Deliver's DC provides a 5V DC charging battery.

The Proposed Design of mobile solar powered public station using RFID contains:

1. RFID Card and RFID Module: RFID card serves as the user's identification token. RFID module reads the card's data, authenticates the user, and interfaces with the system.

2. Relay: The relay controls the power supply to the mobile device based on RFID authentication. It acts as a switch, enabling or disabling the charging process.

3. Solar Panel: Solar panels harness sunlight to generate electrical power. This renewable energy source ensures sustainable and eco-friendly mobile charging.

4. Solar Power Consumption Module: Monitors and optimizes the power consumption from the solar panel. Regulates the power output to ensure efficient and stable charging.

5. NodeMCU ESP8266 Microcontroller: The Arduino NodeMCU ESP8266 serves as the central control unit. Manages communication between RFID module, relay, solar power module, and cloud storage. Facilitates the execution of the charging process and data transmission to the cloud.

6. Firebase: Cloud storage on Firebase securely stores user login/logout timestamps and system usage information. Reliable data retrieval for monitoring user activity.

7. User Interface using HTML and JavaScript: The HTML interface provides a user-friendly dashboard for administrators. Real-time updates on user activity, login/logout history, and system usage statistics are presented effectively.

RESULTS

The implementation of the IoT-based mobile charging system using solar power and RFID card authentication has yielded positive outcomes, demonstrating its feasibility and utility in addressing the challenges of providing mobile charging solutions in rural and remote areas without access to grid electricity. The following results highlight the key achievements and implications of the proposed work:

Fig. 3. Users' check-in and check-out summary

Fig. 4. Users' Live Activity Status

- Portable Solar-Powered Mobile Charging: The designed system successfully provides a transportable solution for mobile phone charging in areas where grid electricity is unavailable. Solar panels efficiently harness sunlight, converting it into electrical power to charge mobile devices.

- User Authentication and Authorization: RFID cards serve as secure authentication tokens for users. The RFID module reads and verifies the user's identity, ensuring that only authorized individuals can access the charging system.

- Cloud-Based Data Storage: The system records user activity, including login and logout timestamps, and stores this information on the cloud. Cloud storage enhances data accessibility, allowing for real-time monitoring and historical analysis of user interactions with the charging system.

- User Interface for Administrator: The User interface provides an intuitive platform for administrators to monitor the system's status. Information regarding active users, login/logout history, and overall system usage is displayed in a user-friendly manner.

- Societal Impact: The system contributes to societal well-being by ensuring that people can perform their daily tasks even in areas lacking conventional charging infrastructure. It offers a sustainable and eco-friendly solution, aligning with the growing demand for clean energy technologies.

FUTURE SCOPE

The envisioned "IoT-based Mobile Charging using Solar Power" system holds considerable potential for future development and expansion. One promising avenue is the refinement of the user interface, possibly through the creation of a dedicated mobile application. This app could empower users with features such as seamless account management, real-time balance tracking, and access to comprehensive charging histories. Furthermore, integrating secure payment gateways within the application would facilitate direct credit replenishment to RFID cards, augmenting user convenience. By incorporating smart charging algorithms, the system could dynamically adjust energy distribution based on factors like weather conditions, user preferences, and device specifications, optimizing both efficiency and user experience. Additionally, future iterations might focus on fine-tuning energy storage solutions, potentially incorporating advanced batteries or capacitors to ensure uninterrupted charging, even in periods of limited sunlight. Exploring integration with the power grid could offer further opportunities for sustainability and grid-balancing initiative.

CONCLUSION

In conclusion, the IoT-Based Mobile Charging with Solar Energy project not only addresses the immediate need for sustainable and environmentally friendly mobile device charging but also anticipates the future of clean energy solutions. By combining technology, renewable energy, and user-centric design, this project exemplifies innovation in the field of mobile device charging, contributing to a greener and more accessible future for all. The potential for grid integration, battery swapping stations, and smart grid technology opens new doors, making the system even more versatile and attractive for diverse applications.

The project's emphasis on user convenience and accessibility makes it suitable for a wide range of locations, including remote and underdeveloped areas with limited access to traditional power sources. It provides cost-effective charging, thereby reducing the financial burden for low-income communities and enhancing equity in mobile device usage.

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Optimizing Production through Total Productive Maintenance: A Comprehensive Study

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ABSTRACT

This study aims to explore the competitive advantages that manufacturers derive from the effective implementation of Total Productive Maintenance (TPM) methodologies. The primary focus of this study is the effects of strategically applying Total Product Quality Management (TPM), particularly the Keikaku-Hozen (KH) Pillar actions, to address breakdown concerns in an Indian manufacturing firm. The paper carefully examines the challenges that India's manufacturing industry faces, particularly with regard to processing specialized machining processes and minimizing downtime caused by maintenance issues. The study employs a scientific approach, applying Root Cause Analysis (RCA) to discover and address the underlying causes of maintenance issues that result in prolonged downtime in Indian enterprises

KEYWORDS : Comprehensive productive maintenance (TPM) Planned maintenance (Keikaku-Hozen) Root cause investigation (RCA), Organizational effectiveness.

INTRODUCTION

Employee participation in maintenance activities is given priority by Total Productive Maintenance (TPM), which is a radical change in the maintenance paradigm. This strategy approach encourages proactive engagement from operators and all staff members in an effort to reduce disruptions and breakdowns. The principal objective is to enhance production efficiency by means of cooperative involvement in maintenance tasks. Dependability and well-maintained machinery play a critical role in meeting industrial goals such as cost-effectiveness, high-quality production, on-time delivery, and operational flexibility in the fiercely competitive manufacturing scene.

Several studies in the body of current literature highlight the need for more research in the field of operations and maintenance management. To close this gap, this study explores how V&l is implementing Total Productive Maintenance (TPM) techniques. The primary objectives of this study are to explore the correlation between TPM (Total Productive Maintenance) practices and manufacturing performance. Additionally, the study aims to assess the impact of technical complexity within the production process as a moderating factor on this relationship.

Over 60% of industries in India belong to the Small and Medium Enterprises (SMEs) category, playing a crucial role in the contemporary economy by supplying components to larger industries. The heightened competition among SMEs has led to continued existence of those who can manufacture superior goods at fair prices. It is possible to accomplish this by implementing contemporary technology such as RCM (Reliability-Centered Maintenance) and TPM (Total Productive Maintenance). The foundations of TPM implementation are critical to its success, and implementing particular

pillars customized to given SME's demands is easier to handle than applying TPM across big sectors.

LITERATURE REVIEW

Whole-Sustained Productivity Without a doubt, manufacturing companies must focus more on modern technology and high-tech machinery, particularly in the face of high customer demands. As a result, manufacturing organizations need to respond swiftly to maintain seamless daily operations and handle shifts in market uncertainty. For example, lean production demands highly competent workers who can overcome a variety of obstacles in order to manufacture goods. It is possible to prevent significant losses from flaws and malfunctions by using appropriate maintenance procedures. Despite the fact that these maintenance plans are pricey, the cost of not doing maintenance will be higher. Any TPM program seeks to improve quality and productivity while also boosting employee morale and work satisfaction. TPM's increasing acceptance is due to its focus on potential of human capital resources to improve performance. Recent years have seen a large number of international TPM research projects (including case studies and surveys).

METHODOLOGY

We conducted a comprehensive analysis in the manufacturing sector, focusing on V&L cosmetics a manufacturer of professional beauty goods. Strict scientific methodology was followed in the conduct of our study, and several manufacturing techniques were employed to manufacture the sampling frame. The metrics used in the study were derived following a thorough examination of relevant literature on the subject.

A systematic approach was employed to select sample, ensuring representative and unbiased data collection. This study's main goal was to investigate how manufacturing performance and Total Productive Maintenance (TPM) procedures relate to degree of technical complexity in the production process. Hierarchical regression analysis was then employed to test the study's hypotheses.

DESCRIPTIVE ANALYSIS

variable	Mean Time (min)	Std. Deviation
Time for loading	15	1.5
Cutting and embossing	10	0.85
unloading	3	0.76
Fixturing	4	0.72

Production costs, including labor costs, overhead costs, material costs. Were all considered in the observed reduction in manufacturing expenses. The study employed a three-step hierarchical regression methodology to examine the presented hypotheses. Many scholars endorse hierarchical regression in research focused on identifying moderator variables, and assessing moderating effects can be accomplished through multiple regression analysis.

In the initial phase, the dependent variable was regressed using the four independent factors. In the second stage, the moderator was introduced, and the dependent variable was regressed against the technical difficulty of the production process. Finally, the dependent variable was regressed using the independent factors, incorporating the moderator and its relationship with technical difficulty of the production process.

Before delving into further analysis, several tests were conducted to ensure adherence to multiple regression assumptions. Homoscedasticity, linearity, independence of residuals, and normality were examined in sequence. The scrutiny of these assumptions is crucial, as the validity of multiple regressions depends on their fulfillment. The hierarchical regression analysis revealed the adoption of the TPM strategy.
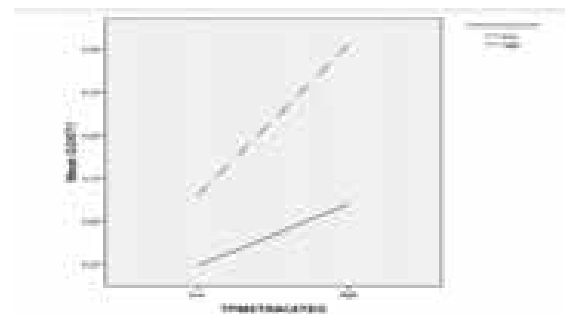
Fig. 1. The moderating effect of technical complexity on the relationship between Total Productive Maintenance (TPM) strategy and cost
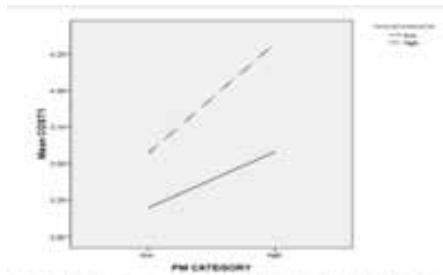
Fig. 2. The moderating effect of technical complexity in the relationship between Planned Maintenance and Cost.

CONCLUSION AND RECOMMENDATION

Total Productive Maintenance is strategic approach aimed at minimizing losses related to equipment and enhancing efforts to reduce defects. It plays a vital role in mitigating equipment deterioration, leading to improved performance, as emphasized by researchers in the cited references. This proactive strategy ensures the optimal functionality of equipment, thereby contributing to overall operational efficiency. Despite the apparent limited use of TPM teams in the plant, as indicated by the standardized beta value of -0.05 for cost, it is noteworthy that vicariate analysis uncovered a modest positive correlation have been robust enough to withstand scrutiny in a multivariate analysis.

A case study suggests that the morale of TPM team development can be influenced by work habits and communication, especially within the context of production lines and different shifts. There appears to be a lack of clarity in communication and leadership within the TPM team, particularly between operators and other departments. The study implies that the TPM team's ability to formulate cost-reducing strategies is perceived as inadequate. The TPM method, focusing on overall equipment effectiveness (OEE), aims to demonstrate how maintenance staff and operators can effectively collaborate using comprehensive information and real-time production line data. This collaboration generates more improvement ideas, ensuring optimal equipment availability, performance, and utility. Achieving world-class performance, defined as reaching an OEE of 85%, requires approaching 95% in performance efficiency, availability, and 99% in quality.

The findings underscore a connection between planned maintenance, cost, and the Total Productive Maintenance (TPM) strategy. Future studies could expand their focus by examining other variables influencing production efficiency, such as product characteristics, vertical integration, model diversity, and market needs.

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Blockchain based Anonymity

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ABSTRACT

Blockchain technology has revolutionized various industries by offering transparency, immutability, and decentralization. However, the inherent transparency of most blockchain systems poses significant challenges to user privacy. This paper presents an in-depth exploration of anonymity-based blockchain systems, which aim to address these privacy concerns while preserving the core benefits of distributed ledger technology. The paper begins by providing a comprehensive overview of the fundamental principles of blockchain technology and the importance of privacy in blockchain networks. It then delves into the various privacy-preserving techniques employed in anonymity-based blockchain systems, including cryptographic primitives such as zero-knowledge proofs, ring signatures, and confidential transactions.

Furthermore, the paper discusses the key advantages and limitations of anonymity-based blockchain systems, considering aspects like scalability, efficiency, and usability. It also presents a comparative analysis of prominent anonymity-focused blockchain projects, highlighting their unique features and use cases. It discusses the potential impact of these systems on enhancing user privacy, reducing fraud, and fostering trust in various domains. By striking a balance between privacy and transparency, anonymity-based blockchain systems offer a promising avenue for the future of secure and private decentralized applications.

KEYWORDS : *Anonymity, Blockchain, Hash function, e-voting.*

INTRODUCTION

An Blockchain based Anonymity system is a digital system that utilizes blockchain technology as the underlying infrastructure to facilitate secure, transparent, and tamper- resistant electronic voting processes. It leverages the decentralized and immutable nature of blockchain to enhance the integrity, transparency, and efficiency of the voting system. This system will also able to provide a post-election analysis and report that will help the verify and validate the outcome.

E-contracts are contracts that are not paper-based and are electronic in nature. They are digital versions of traditional paper contracts, created and signed electronically. The e-contract makes it easier to filter out fraudulent and repeater in voters list . It also makes sure that voters who are going to vote and eligible and haven't voted yet.

BACKGROUND AND RELATED WORK

Blockchain based anonymity gives rise to something much more important and brings innovation to existing models in terms of the organisation, security, integrity and storage of information. Blockchain-based anonymity refers to the use of blockchain technology to enhance privacy and anonymity in various online transactions,

voting systems and interactions. Blockchain, the underlying technology behind cryptocurrencies like Bitcoin, is a decentralized or centralized distributed ledger that keeps record of transactions across a network of computers with the help of private and public key. While blockchain provides transparency and security, it also has implications for privacy, and various projects aim to leverage its features to enhance anonymity. The application of blockchain in voting targets various challenges associated with traditional voting systems, i.e., lack of transparency and data breaches. Blockchain operates on a network of computers, known as nodes which may be centralized or decentralized. Each node in the network maintains a copy of the ledger, ensuring that there is no central point of control. This fundamental makes it difficult for a attackers to infiltrate the network. Once a block is added to the blockchain, it is virtually impossible to alter, tamper or extract the information within it. This empowers the integrity of the voting records. Blockchain-based voting systems is designed to provide the anonymity to the users while allowing verification of individual votes. Smart contracts are utilized to automate the aspects of the voting process. They can enforce rules, verify identities, and trigger actions based on predefined conditions, reducing the need for intermediaries and manual oversight. Blockchain based voting systems inhibit potential to increase accessibility by allowing voters to cast their votes remotely using any of their local and handy devices. This can be particularly beneficial for individuals who may face challenges in physically accessing polling stations. Each user has a private key for signing transactions, and the integrity of the system relies on the strength of cryptographic algorithms. This helps protect against unauthorized access and tampering. While blockchain-based voting systems offer potential benefits, there are also challenges and considerations. The blockchain system is still in its early stages of development this makes the development of any application based on blockchain incomplete but there is a lot to discover and many different types of consensus algorithm to discover.

SYSTEM ARCHITECTURE

In the system, were are applying anonymity concept of blockchain and introducing voting system integration to carry out voting from anywhere in the world.so the platform will provide various encryption levels to make the system more secure and breaking the anonymity chain could be preserved and voter can easily process their vote without any trouble. Blockchain working are for the integrity purpose and confidentiality is maintained via anonymous token system which will yield random token to a voter while his registration via entity email as authentication parameter. Here our system provides various for election commission and candidates to track the whole process without effecting integrity of the whole process, Some of the main highlighted features are identity and verification secrecy, secure and resilient infrastructure parameters tracking , immutable and transparent live tracking audit trails , Post-election analysis and reporting. Even after voters vote , they can track if vote is successfully registered in blockchain or not via the same token initially issued to them.

This whole system work on the blockchain technology and anonymizing network strategy which separates whole architecture from each other and form a sensitive architecture design where crucial voting activity are done.

The following diagram explains the system architecture of the web application system.

Here the web application uses the local storage provided by the browser which is provided by the local device. This is system makes use of the local storage to sync all the chains across the different systems to make sure there is no tampering of the data inside the chain. The hash functions make sure the there is a certain effort made by the miner while creating a block. This effort of making a block which miner puts in is called Proof of Work

Here is a more detailed explanation about it:

Proof of Work (PoW) is a consensus algorithm used in blockchain networks to achieve agreement on the state of the blockchain. In the context of Ethereum (ETH), which is a blockchain platform that supports smart contracts, PoW is used to secure the network and validate transactions.
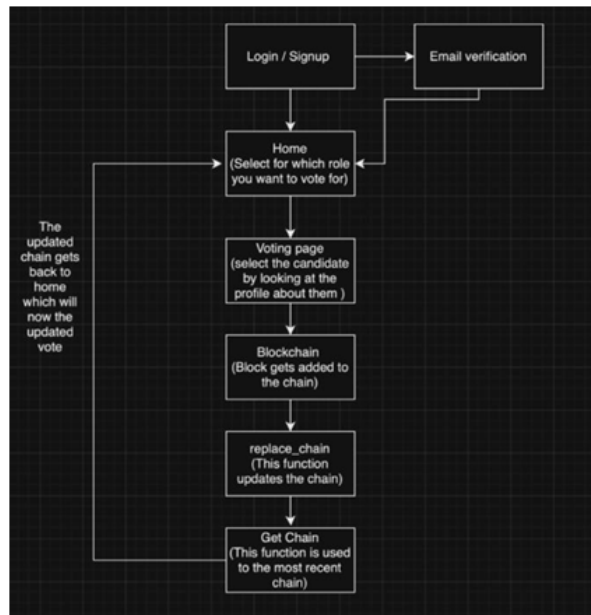
The above diagram is control flow diagram about the system which has been implemented.

The system proposed works on authentication based upon unique email id which work as a primary key in the database. These username are also stored inside the blockchain for verifying if the given voter has voted or not.

This application is mainly made for organizational election process where the environment is more controlled and the voter can be trusted.

In this system whenever a voter vote's the length of the blockchain increases for the following candidate and also at the same time the data about the voter which has already voted also gets updated.

While showing the results and maintaining the record regarding the elections the length of the chain where all the data is stored gets accessed. The number of votes for the particular candidate is calculated by the length of the chain.

The tampering is made practically impossible as the blockchain hinders with the outside access of the attackers.

To maintaining the consensus the same chain when gets updated is broadcasted along the network of nodes to make sure that every node has the newest and the most recent chain.

CONCLUSIONS

Anonymity is one of the most features in the recent system like e voting system and working with blockchain technology is one of the most interesting topic a developer can work on these days. It really helps the users and candidates as they can now trust the platform more than ever.

There technology used and the logic used resemble the best industry used platform and while developing this system we have made sure that we can add more and more features while remaining up to date with the recent technology so that there is limited chances of intrusion and vote tampering. This system can be used as template for other system like data security and communication management.

This Paper is written based on the framework and programming languages used in making the system. This paper also is a written statement about the requirements of the system and challenges faced while making a system to support public need. One of the

main challenges where to decentralize the system and making it open for all of view but not to tamper the system.

The E contract made in solidity makes it easier for us to control the accessibility of the voters and not offering the candidates any control on what their voting count should be.

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Cyclone Intensity Estimation

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ABSTRACT

Tropical cyclone intensity estimation is critical for disaster forecasting and severe weather warning. In recent years, the performance of various TC intensity estimation models has been gradually enhanced, but the accuracy still needs to be improved. In this, we explore the application of Convolutional Neural Networks (CNNs) to estimate cyclone intensity using half-hourly INSAT-3D IR images. The aim is to create an automated system that can reliably predict cyclone intensity and by focusing on deep learning, the goal is to revolutionize cyclone intensity estimation, enabling timely and accurate predictions. The impact of climate change on cyclone intensity has been a significant scientific concern for several decades. Despite theoretical frameworks and models indicating a potential increase in the strength of tropical cyclones in a warming climate, uncertainties persist in both assessing and projecting the responses of tropical cyclone intensity to climate change. While some comprehensive reviews have previously addressed the overall influence of climate change on tropical cyclone activity, encompassing aspects such as intensity, this particular review is focused on deepening our understanding of the effect of climate change on basin-wide tropical cyclone intensity. It specifically delves into the examination of indices relevant to basin-wide tropical cyclone intensity, explores historical datasets utilized for detecting intensity trends, and involves simulations to better comprehend the dynamics of tropical cyclone intensity changes in response to climate variations.

KEYWORDS : *CNN, INSAT-3D IR images, Deep learning, Historical dataset.*

INTRODUCTION

Tropical cyclones pose significant threats to coastal regions and require Accurate intensity estimation for timely preparedness and response. Deep Learning, a subset of artificial intelligence, has shown promise in automating cyclone intensity estimation by learning complex patterns from large datasets. In this study, we explore the application of Convolutional Neural Networks (CNNs) to estimate cyclone intensity using half-hourly INSAT-3D IR images. The system aims to predict cyclone intensity based on satellite imagery, enhancing the accuracy and efficiency of intensity estimation in meteorology. Tropical cyclones pose a significant threat to coastal regions, demanding accurate intensity estimation for timely and effective disaster management. Tropical cyclones are among the most catastrophic of high-impact weather events, causing substantial mortality and huge economic damage in many tropical and subtropical countries [2]. Traditional methods have limitations, and there is a need for advanced techniques that can harness the wealth of information available in high- frequency satellite imagery. This research addresses this need by leveraging the power of CNNs in image-based tasks for cyclone intensity prediction.

LITERATURE SURVEY

Wang, Chong, Gang Zheng, et al[1] Tropical cyclone intensity estimation from geostationary satellite imagery using deep convolutional neural networks." IEEE Transactions on Geoscience and Remote Sensing 60 (2021): In this study, a set of deep convolutional neural networks (CNNs) was designed for estimating the intensity of tropical cyclones (TCs) over the Northwest Pacific Ocean from the brightness temperature data observed by the Advanced Himawari Imager on board the Himawari-8 geostationary satellite.

Wu, Liguang, Haikun Zhao, et al[2] Understanding of the effect of climate change on tropical cyclone intensity: a review." Advances in Atmospheric Sciences 39, no. 2 (2022): 205-221. This review focuses mainly on the understanding of the effect of climate change on basin-wide tropical cyclone intensity, including indices for basin-wide tropical cyclone intensity, historical datasets used for intensity trend detection, environmental control of tropical cyclone intensity, detection and simulation of tropical cyclone intensity change, and some issues on the assessment of the effect of climate change on tropical cyclone intensity.

Wang, Pingping, Ping Wang, et al[3]. A Conformal Regressor With Random Forests for Tropical Cyclone Intensity Estimation. "IEEE Transactions on Geoscience and Remote Sensing 60 (2021): In this article, 71 intensity- related features are extracted from satellite infrared images of TCs. These features are grouped by eye features, circle features, texture features, and time-series features. Using the random forest model as the underlying algorithm of conformal prediction (CP), an intensity applicable CP framework is proposed.

Zhang, Chang-Jiang, et al[4] Tropical cyclone intensity classification and estimation using infrared satellite images with deep learning." IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing. A novel tropical cyclone (TC) intensity classification and estimation model (TCICENet) is proposed using infrared geostationary satellite images from the northwest Pacific Ocean basin in combination with a cascading deep convolutional neural network

(CNN). The proposed model consists of two CNN network modules: a TC intensity classification (TCIC) module and a TC intensity estimation (TCIE) module.

DATASET

Insat-3D IR Images

The dataset used in this study comprises high-resolution Infrared (IR) images captured by the Indian National Satellite System (INSAT-3D). INSAT-3D, launched by the Indian Space Research Organisation (ISRO), is equipped with an advanced imager that provides critical information about Earth's atmosphere, including cloud cover and temperature distribution. The dataset used in this research is derived from INSAT-3D(Indian National Satellite) Infrared (IR) imagery, which provides cloud top temperature (CTT) measurements at a resolution of 4 km. The data set comprises of labeled images of tropical cyclones in the Indian Ocean region, collected during the period of 2012- 2022.

The categorization of images is determined by their maximum wind speed, serving as the ground truth label. The intensity classifications encompass five categories: depression ($\leq$33 knots), deep depression (34-47 knots), cyclonic storm (48-63 knots), severe cyclonic storm (64-89 knots), and very severe cyclonic storm ($\geq$90 knots). The dataset comprises a total of 1184 images, each category being equally represented for a balanced distribution.

The dataset available at https://mosdac.gov.in/cyclone-genesis/archive/is a satellite observation dataset of tropical cyclones (TCs). The dataset contains data on the intensity, size, minimum sea-level pressure, and center location of TCs in six regions (Atlantic Ocean, Eastern North Pacific, Western North Pacific, Central Pacific, Indian Ocean, and Southern Hemisphere). Information was gathered from two openly available sources to compile a dataset featuring a frame size of 201 x 201 data points. The spacing between each data point is 4 kilometers. The center of the tropical cyclone is situated at the midpoint, surrounded by a radiusof7 degrees in both latitude and longitude. The resolution is set at 7/100degreefor both latitude and longitude, and some missing values have been addressed by filling

them with NaN. Notably, the original resolution of the PMW (Passive Microwave) channel is 1/4 degree for both latitude and longitude, but a linear interpolation was applied to increase it approximately fourfold, ensuring uniformity across all four channels.

Image Characteristics

The INSAT-3D IR images utilized in this research offer valuable insights into the thermal structure of tropical cyclones. These images are captured at half-hourly intervals, providing a temporal sequence that allows for the observation of dynamic changes in cyclone intensity over time. The spatial resolution,ensuring fine-grained details are preserved for analysis. TC intensity usually refers to the maximum wind speed near the TC center [3].

Spectral Information

The IR images are particularly useful for cyclone intensity estimation due to their ability to detect thermal radiation emitted by clouds. The spectral bands used in the IR imagery capture variations in cloud-top temperatures, enabling the identification of regions with intense convection associated with tropical cyclones.

Temporal Coverage

The dataset covers a specific time range, allowing for the analysis of cyclone evolution during critical phases. The temporal frequency of half-hourly images facilitates the tracking of rapid changes in cyclone intensity, which is vital for accurate predictions and timely disaster response.

Fig. 1. Database

Fig. 2. Rawand Infrared Images

OBJECTIVE

The primary objective of this research is to leverage the capabilities of deep learning, specifically Convolutional Neural Networks (CNNs), to develop a robust model for cyclone intensity estimation using half-hourly INSAT-3D Infrared (IR) images.

The aim is to create an automated system that can reliably predict cyclone intensity, irrespective of accurate center determination, and provide valuable insights into the evolving dynamics of cyclones.

By focusing on deep learning, the goal is to revolutionize cyclone intensity estimation, enabling timely and accurate predictions that enhance disaster management strategies.

Cyclone intensity estimation is vital for public safety and disaster preparedness. Traditional methods rely on satellite imagery analysis and other data sources. Utilizing deep learning techniques, such as CNNs, can provide a more automated and accurate way of estimating cyclone intensity. Develop and refine mathematical models and algorithms that use the extracted features to estimate cyclone intensity. Validate the intensity estimation models using historical cyclone data and observed ground-truth intensity values. Implement a real-time monitoring system to continuously update cyclone intensity estimates and provide accuracy.

PROPOSED SYSTEM

The proposed solution involves harnessing the power of deep learning, specifically Convolutional Neural Networks (CNNs), to develop an advanced model for cyclone intensity estimation using INSAT-3D Infrared (IR) images.

The INSAT-3D satellite captures high-resolution IR images at frequent intervals, offering a rich source of temporal and spatial information. The deep learning model will be designed to extract meaningful features from these images, learning complex patterns associated with cyclone intensity changes. A simple CNN model contains various combinations of convolutional, pooling, and fully connected (FC) layers. The convolutional layer extracts image features[1].

Step 1

Satellite Imagery:

Meteorological satellites provide continuous images of the cyclone's cloud patterns estimation using half-hourly INSAT-3D Infrared (IR) images, and other characteristics.

Step 2

Convolutional Neural Network(CNN) three layers: Convolutional Layer- 1:

The filters are responsible for capturing specific features in the input data. In the case of image data, these features could be edges, corners, or more complex patterns.

Step 3

Convolutional Layer-2:

Repeat Convolution: The process of applying filters and activation functions to the feature maps is repeated in the second convolutional layer. This layer further extracts higher-level features by processing the down sampled feature maps from the previous layer.

Step4

Convolutional Layer-3:

Final Feature Extraction: The third convolutional layer continues to extract higher-level features from the down sampled feature maps.

Step 5

Intensity Prediction:

To make intensity predictions for a new cyclone, The model will produce an intensity estimate as a numerical value and Convert the predicted numerical value into a meaningful cyclone intensity category based on the relevant scale.

Step6

Deep analysis:

The system continuously monitors the cyclone's parameters and updates intensity estimates as new data becomes available. provide valuable insights into cyclone behavior.

Step7:

Visualization of finding on dashboard on interactive dashboard:

A visual indicator of the current estimated intensity level based on CNN predictions.
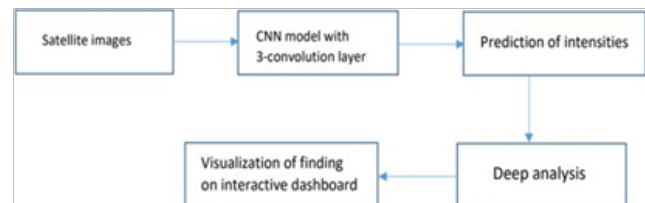
Fig. 3. Flow Diagram

CONCLUSION

Mitigating the severe consequences of cyclones necessitates early prediction of their occurrence. Historical data underscores the profound impact of cyclones, with predictive measures significantly reducing the loss of human lives. The precision of cyclone forecasts hinges on the incorporation of various parameters and the efficacy of the forecasting model. Upon examining the outcomes of the proposed model's experiments, it becomes apparent that the model has demonstrated a 70% accuracy rate, showcasing an improvement over the current existing model. The proposed solution presents a promising approach for cyclone intensity estimation by harnessing the capabilities of deep learning, particularly Convolutional Neural Networks (CNNs), in conjunction with INSAT-

3D Infrared (IR)images.TheutilizationofINSAT-3D'shigh-resolution IR images, which are captured at frequent intervals, provides a valuable resource for studying cyclone dynamics. By designing a deep learning model that can extract meaningful features and learn complex patterns from these images, we aim to significantly enhance our ability to predict and monitor cyclone intensity changes.

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Web Based Salary Census Prediction using Efficient Supervised Machine Learning Algorithms

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ABSTRACT

The starting point of this article is to find a suitable method of salary prediction to find a job. Firstly, this paper will introduce the content and usage of different regression models in machine learning. After understanding the methodology that will be used, it is pointed out that the goal of this study is to find the correlation between the salaries of employees and different influencing factors, and this paper investigates the predictive capabilities of Random Forest and Logistic Regression models in the context of salary censuses. In today's dynamic workforce, understanding and predicting salary levels are crucial for effective human resource management. Leveraging traditional statistical methods like Logistic Regression and ensemble learning techniques with Random Forest and XgBoost, our study employs a diverse dataset encompassing various industries and occupations. The objective is to compare the performance, strengths, and weaknesses of these models for predicting salary levels. This research contributes valuable insights to the field of salary prediction, aiding organizations in making informed decisions about compensation structures and navigating the intricacies of a competitive job market.

KEYWORDS : *Machine learning, Linear regression, Random forest algorithm, Salary prediction, XgBoost algorithm.*

INTRODUCTION

In contemporary workforce dynamics, understanding the factors that influence salary levels is imperative for both employees and employers. Predicting salary censuses has become a focal point in human resource management, aiding organizations in making informed decisions about compensation structures and facilitating individuals in negotiating equitable remuneration. In this paper, we delve into the realm of salary prediction using machine learning techniques, specifically focusing on the application of Random Forest and Logistic Regression and XgBoost models. Other statistical methods like Bayesian ML and ANN are also studied for better selection of algorithms[1].

Supervised machine learning algorithms are much more efficient to solve problems of salary prediction and is used more often[7]. The task of predicting salary censuses involves analyzing a multitude of variables, such as education, years of experience, industry, and geographical location, to discern patterns and relationships that contribute to salary disparities[2]. Traditional statistical methods, like Logistic Regression, have been widely employed for binary classification tasks, making them a natural choice for predicting salary levels based on categorical and numerical features. On the other hand, Random Forest, an ensemble learning algorithm, has gained popularity for its ability to handle complex relationships and non-linearities in the data. This paper aims to explore the effectiveness of Random

Forest, XgBoost and Logistic Regression models in predicting salary censuses, comparing their strengths, weaknesses, and overall performance. The prediction can also be done by using Linear Regression and then later optimizing it using polynomial transformation or different methods[2]. After prediction of salary the algorithms can be optimized to improve their scores or efficiency leading to better prediction by the models[5]. By employing a comprehensive dataset sourced from diverse industries and occupations, we seek to uncover insights into the predictive capabilities of these models and their applicability in real-world scenarios. The structure of this paper is organized as follows: Section 2 provides a review of related literature, highlighting previous attempts to predict salary levels and the methodologies employed. Section 3 details the dataset used in our study, presenting an overview of the features and their significance in the context of salary prediction. Subsequently, Section 5 outlines the methodology, explaining the process followed to build the models. We are also studying about regression algorithms and in their effectiveness on predicting the best values, so we may use other techniques in order to improve the efficiency of the model[3]. In conclusion, this research aims to contribute to the growing body of knowledge in the field of salary prediction, shedding light on the comparative performance of Random Forest, XgBoost and Logistic Regression models. As organizations strive to make informed decisions in a competitive job market, understanding the nuances of predictive modeling becomes paramount. The paper we referred[9] also shows more linear regression, means how it can be used for this predictor web application. As organizations strive to make informed decisions in a competitive job market, understanding the nuances of predictive modeling becomes paramount.

RELATED WORK

Analysis on Employee Salaries

Research in the analysis of employee salaries encompasses a diverse range of factors that contribute to compensation structures within organizations. Numerous studies have explored the impact of educational qualifications, years of experience, job roles, and industry sectors on employee salaries[3]. Studies regarding salaries of certain qualification like computer engineering are also available out there giving insight into factors affecting the salaries having computer science degree[4]. Analysing salary distribution patterns and identifying key determinants provide valuable insights for human resource professionals and organizational decision-makers. Furthermore, advancements in data visualization techniques have facilitated a more comprehensive understanding of salary structures[8]. Visualization tools help stakeholders interpret complex salary data, enabling them to identify trends, outliers, and potential areas for adjustment in compensation policies.

Prediction of Employee Salaries

Prediction of Employee Salaries: The predictive modeling of employee salaries has been a focal point in recent research. Traditional statistical methods like Linear Regression have been widely employed to model the relationship between various factors and salary outcomes. Studies by Lokesh Kumar and Ajay Kumar [5] showcase the use of regression analysis for predicting salary levels based on quantifiable variables such as education, experience, and job responsibilities. Machine learning techniques, including Random Forest and Neural Networks, have also gained attention for their ability to capture intricate patterns in salary data. Research by Gomez-Cravioto[7], Daniela A demonstrates the application of ensemble methods and deep learning to enhance the accuracy of salary prediction models. These advanced techniques take into account non-linear relationships and interactions among multiple variables, providing a more nuanced understanding of salary determinants. Simple regression model[8] as well as multiple regression models[3] can be used for prediction purposes giving varying results. In summary, the analysis and prediction of employee salaries involve a multifaceted exploration of various factors impacting compensation structures. The integration of traditional statistical methods with advanced machine learning techniques contributes to a holistic understanding of salary dynamics, aiding organizations in making informed decisions related to employee compensation[1].

METHODOLOGY

We are going to follow the standard approach of building a machine learning model for prediction. This is done

using three models to test out which has better accuracy while also studying different regression models to get the most optimal model. By studying the comparison of models[6] while also comparing the performance of the models we train to understand which may be more suitable for the salary prediction problem. After which the aim will be trying to optimize our algorithms to get the best results.

Our methodology involves :

1. Gathering a proper dataset which is suitable for our needs.

2. To study and understand which machine learning algorithms are the most effective and suitable to achieve our objectives.

3. Create make a model on these algorithms and see which algorithm performs the best.

4. Creating a website in order to give users a easy to use interface.

5. To host the chosen machine learning model on the website so that it can be accessed directly from the website itself.

6. The prediction process then can be done from the website which is easy to use from a user perspective.

Figure 1. Flow Chart

Figure 2. Block Diagram

OBJECTIVE

Understanding the dataset

The first and most important objective is to find a dataset that is suitable for our needs. It should have all the features that can affect the salaries of a person. A proper dataset will help in getting better performance out of the machine learning models. Here understanding a dataset plays a huge role since everything getting online these days. You can also consider the salary ratio in the USA by exploiting the benefits of data science to collect a 20,000+ dataset of salaries in the USA [11].

Using Machine Learning Algorithm

Our main objective is to use a machine learning algorithm to predict an employee's salary. This task will be performed using multiple algorithms and the best, most optimally performing model will be selected. Ensemble methods like random forest use features like bagging which leads to better prediction[7]. We are going to prepare our data and then train our model on that data. Optimization of the model will be performed in order to better improve the predictions. Creating a proper predictor can help us to solve the problem of predicting salary for job advertisements where the salary is not already mentioned which then help fresher to predict possible salary for different companies but the location can vary [10].

EXPERIMENTS

Here we discuss about our dataset and the process involved in preparing the data to make it suitable for training the machine learning model.

Dataset

The selection of the dataset is very important as only the right and useful data will give us better results. The dataset should have different features which will be helpful for the machine learning model to understand from these different factors and give prediction with higher accuracy. The dataset consists of 15 different features which are age, workclass, fnlwgt, education, education-number, marital-status, occupation, relationship, race, sex, capital-gain, capital-loss, hours-per-week, country and salary. This dataset is downloaded from Kaggle and has over approximately around 32000 rows making it an ideal dataset for proper training.

Data Preparation

We take a look at our dataset and understand our data and its features. The dataset contains both categorical and numerical values. For example, age is a numerical value, while marital status is a categorical value. Out of the 15 features, 6 of them have numerical values. The rest have categorical values which must be converted into numerical values.

Table 1. Sample of Dataset

Sr. No.	age	education	hours-per-week	country
1	39	Bachelors	40	United-States
2	50	Bachelors	13	United-States
3	38	HS-grad	40	United-States
4	53	11th	40	United-States
5	28	Bachelors	40	Cuba

Data Preprocessing

For the machine learning model to predict we have to train it using the dataset. But before that, we have to optimize the dataset properly. We first look for missing values and either fill them or completely remove those fields. We then look for outliers in the dataset and remove them. Then we encode the categorical features using label encoder. This will convert the categorical values into numerical values and make it suitable for training. Next, we make a train test split in which we use 80 percent of the dataset for training and 20 percent for testing.

Training and Fitting the Model

We train the model on 80 percent of the data from the dataset and test it on the remaining 20 percent[8]. GridSearchCV technique and RandomisedSearchCV technique was used to get the best set of hyperparameters to get the best scores as the output.

RESULTS

We studied about different regression models and performed some on our own to find the best model that fits and gives the optimal output.

Logistic Regression

Logistic regression is a machine learning algorithm in which a logistic function is used in order to give a probability value between 0 and 1. It is a supervised machine learning algorithm and is suitable for our needs as we are only classifying if a person makes less or more than 50000 and it can be represented as 0, if they are making less than 50000 or 1 if they are making more than 50000. Using Logistic Regression, we got f1 score as 0.77, precision as 0.77 and recall as 0.79.

XgBoost

XgBoost is an ensemble learning method which stands for Extreme Gradient Boosting and is used to train machine learning models efficiently and have good scalability. It can do classification and regression while also being able to handle large datasets making it suitable for our needs. It is also helpful in time saving and handling missing values. Once the training and testing of a data is done in the data splitting phase, we get accuracy value for that particular algorithm. In this case, we got approximately 83.47. So this was the highest accuracy we got and xgboost got finalised.

Random Forest

Random Forest is also an ensemble learning model which is mainly used for classification and regression. The results of multiple decision trees are combined to get better accuracy. It uses a technique known as Bootstrap and Aggregation known as Bagging. The value we got after training and testing phase was approximately 80.78.
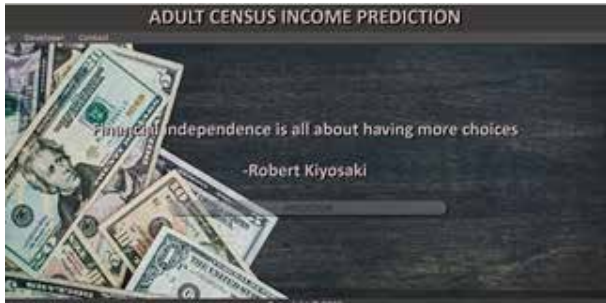
Figure 3. Home Page

Figure 4. Predict Page

Figure 5. Result Page

CONCLUSION

From our experiments we were able to come to the conclusion that XgBoost algorithm was better than Random Forest algorithm and Logistic Regression as it gave better performance and predictions than those two algorithms. Hence, we select the XgBoost algorithm as our main algorithm for salary prediction.

Salary prediction will help employees to know how much they can expect to get when looking for a job and it will also be beneficial to organizations to know how much they should pay their employees.

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Smart Shopping

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ABSTRACT

Price comparison sites are designed to compare the price of goods and services from a range of providers, which will help consumers in making decisions to choose products that will save their money online. Considering the customers' busy lifestyle, especially those who are living in the city area, most of the consumers prefer to buy their needs through the internet because it saves their time. Besides, consumers always go for the cheaper price in purchasing products therefore by using a price comparison website, customers don't have to travel from shop to shop only to survey the price offered by different shops for the same product. They can just check it from the price comparison website itself and decide where they should buy the products they need. The best deals will be clearly highlighted. Even though not all consumers are buying online, but it is one of the ways to help consumers increase their price awareness. Consumers have the right to know whether the price they are seeing in the shops are good deals as it is claimed or not.

INTRODUCTION

A price comparing system (PCS), (also known as Shop-bots or comparative shopping agents), providing online shoppers with opportunities to acquire a wide range of information on various products. It is well known that a PCS can help online shoppers reduce the amount of time or effort required when searching for products online .In addition, there are two major approaches to information-seeking through the Web, i.e., direct searching and browsing .

Need and Motivation It acts as a tool to assist consumer's make informed decisions before using Purchasing products by providing the list of prices offered by different Websites. Users will use this website as their reference to check on the price of any electronic items. Instead of taking hour's and energy to go to each shop just to check on the price, It offers a better solution by getting all the prices and users just need to go online and choose which product they want to know and the list of retailers and the price offer will be shown. Users can check it from anywhere, no matter at home or at work.

Basic Concept A basic concept of an online price comparison website is to provide users with a centralized platform where they can compare prices and other relevant information for products and services offered by various retailers and providers. These websites typically gather data from multiple sources and present it in a user friendly format, allowing consumers to make informed purchasing decisions. The core idea is to save users time and money by offering them a convenient way to quickly identify the best deals, promotions, and availability of products or services, all in one place. Such websites often include features like product reviews, specifications, and user ratings,

further aiding consumers in making well-informed choices. Price comparison websites play a crucial role in promoting transparency and competitiveness in the market, empowering consumers to find the best value for their money.

LITERATURE SURVEY

The Research talks about how in past few years online e commerce has boomed and it becomes necessary for user to get the right product for right price so the authors studied various research paper to find out consumer behaviour during times of the year and they designed a system which recommend the best product to the user [1]. [2] The research was focus on the price comparison sites and its connotation towards market efficiency and price competition. The price comparison sites attract all the involved parties no matter suppliers or the consumers to its platform as it has become the aggregator of product information . [3] This paper talks more about the disadvantages faced by the user which they faced while purchasing the product's like the consumer needs to check every websites and to select what's best for his/her pockets, the actual product may or may not identically looking like what has been expected while ordering. [4] The system generated is an ASP.NET website with a MySQL database backing it up and a user-friendly interface created with asp. net MVC and bootstrap style.[5] The study aimed to investigate the impact of price comparison websites on consumer behaviour, the benefits they offer to online retailers, and the methodologies employed in studying these platforms. Through a comprehensive literature review, it was found that price comparison websites have a significant influence on

Consumer behaviour, increasing price sensitivity and empowering consumers to make informed purchasing decisions. These platforms also provide benefits to online retailers by enhancing visibility, attracting new customers, and facilitating analysis of market trends and pricing strategies. [6] This work aims to create a robust and user-friendly web scraping-based price comparison system tailored for e-commerce websites. By leveraging advanced web scraping techniques, the system extracts and processes product prices from various platforms. It employs data analysis methods to uncover patterns and trends, enabling users to make well-informed decisions

when searching for the most competitive deals across multiple e-commerce platforms. Through its intuitive interface and visualization capabilities, the system empowers users to effortlessly navigate the vast online market and discover the best prices for their desired products [6][7] Comparison of E-trade merchandise the use of internet mining is product and fee evaluation internet site that is created the use of Flask framework. Products which might be been asked through person are queried in square database the use of an item relational mapper square. Admissions in reputed varsity. Now, right here we enlist the validated steps to put up the studies paper in a journal.[8] This project, is named as Price comparison website using web scrapping is the place where shoppers could find the great deals on the products. The best deals will be clearly highlighted. To obtain best deals from Price comparison websites web scrapping techniques are used to fetch detailed information. [9] This study addresses this gap in the literature by investigating the influence of price comparison websites on online switching behavior, and also suggests some additional factors that may be considered when looking at this relationship.[10] The goal of this model is to provide us with product details from various websites. Method: In this paper, we are attempting to construct a website to obtain the prices of any requested goods from Amazon and Flipkart using PHP, XAMPP, and MongoDB. Result: 96% of the time, this suggested website displays the requested product's pricing from Amazon and Flipkart, according to experimental assessments.

EASE OF USE

Objectives

To provide customers with a list of price comparison and highlight the cheapest price specifically in home groceries products. To increase price consciousness among consumers. To ensure that the price database is updated regularly so that customers will be able to get accurate results. To provide service for users to find the product's price. To help users find the best value for their money by identifying the most competitive deals, discounts, and offers available. [6] Comparison of E-trade merchandise the use of internet mining is product and fee evaluation internet site that is created the use of Flask framework. Products which might be been

asked through person are queried in square database the use of an item relational mapper square. Admissions in reputed varsity. Now, right here we enlist the validated steps to put up the studies paper in a journal.

Paper Survey

An online price comparison website functions as a dynamic platform designed to streamline the shopping experience for users seeking the best deals across various online retailers. The website's operational framework encompasses data aggregation, employing automated tools to crawl and scrape product information and prices from diverse online sources. This data is meticulously managed in a robust database that undergoes normalization to ensure uniformity. Users interact with an intuitive interface that facilitates product searches and comparisons, empowering them to filter and sort results based on their preferences. The website ensures real-time updates, reflecting the latest changes in prices and product details. Additionally, users can opt for notifications regarding price drops, special deals, or product availability. Integration of affiliate marketing enables the platform to generate revenue through commissions on referred sales. Security measures are paramount, safeguarding user data and transactions. User feedback is actively solicited to drive continuous improvement, with regular updates and feature enhancements implemented to enhance overall satisfaction. In essence, an online price comparison website serves as a comprehensive solution, combining technological intricacies, user-friendly design, and real-time data to offer a valuable resource for informed and economical online shopping decisions.

The companies shown on these price comparison sites often pay a fee when they are selected by a customer. Not all companies are on price comparison websites, meaning you could be missing out on a quote from one of the more reliable companies or even the market-leaders in a particular type of insurance. When you can research and buy insurance online with a few clicks, many end up with policies that weren't quite what they wanted. For some products they are paid commission i.e. a percentage of the cost to you of the insurance policy and this can be in the region of 20.

PROPOSED SYSTEM

The primary aim of creating an online price comparison website is to empower consumers with the knowledge and tools they need to make informed purchasing decisions. In a world of countless products, brands, and retailers, the aim is to simplify the shopping process by offering a centralized platform where users can efficiently compare prices, product features, and availability across a wide array of options. By providing a user-friendly and easily navigable interface, the website seeks to save consumers valuable time and money, enabling them to quickly identify the best deals and discounts.

You can save money: Checking quotes from hundreds of insurers and being able to sort by price enables customers to select the very cheapest option, based on the criteria specified. Convenient and time-efficient :With a few clicks of a finger you can get hundreds of insurance quotes with hardly any effort at all. This allows you to gather a large amount of condensed data, saving the time of trawling through dozens of individual websites. Wide variety and choice : Price comparison sites are big businesses, and there is no shortage of ones to choose from. All of the sites ask for slightly different information and don't all have the same insurers on their books.

Input

This is the textual information entered by the user that serves as the starting point for generating an output. The input text should be clear and descriptive, providing the necessary details about the scene or object to be generated.

User interface

The user interface is a crucial part in the price comparison system where it provides the detailed view of the interface to the user to make user making better decision the user interface (UI) of a digital platform plays a pivotal role in shaping the overall user experience and, consequently, determining the success of the application or website. It serves as the bridge between users and the underlying functionalities, impacting their interaction, engagement, and satisfaction. An effective UI design is characterized by its intuitiveness, clarity, and responsiveness, ensuring that users can easily

navigate through the features and accomplish their tasks with minimal friction. A well-crafted UI not only enhances the visual appeal but also considers the user's cognitive load, making complex operations appear straightforward. Thoughtful placement of elements, clear navigation paths, and visually appealing design contribute to a positive first impression and encourage user retention. Accessibility features also become integral, catering to a diverse user base. Ultimately, a user-friendly interface establishes a connection between the user and the technology.

Backend

The backend provides all the data that the system requires, the process of importing data from the backend is vital for the effective functioning and user experience of applications. The backend, responsible for storing and managing data, communicates with the frontend through various mechanisms like APIs or AJAX requests, or the traditional method ensuring that the information presented to users is current and accurate. This synchronization is crucial for real-time updates, interactive features, and efficient decision-making within applications. The backend retrieves data from databases or external sources, transforms it if necessary, and transmits it to the frontend.

Output

The process of importing data from the output is crucial for extracting meaningful insights and facilitating informed decision-making in various domains. Once an output is generated, whether from simulations, analytics, or computational models, importing this data allows for further analysis, visualization, and integration into decision support systems. This process is integral in fields such as business intelligence, scientific research, and data-driven decision-making. The output is the result fetched after the user inputs the query and accordingly the user is generated with the appropriate data that can be useful to the user in this scenario the output generated may include the image of the product, name of the product, the price of the product along with the different types of the products getting compared with the same product the different products can also include the same header details as the searched and fetched products form the query.

RESULTS

An online price comparison website operates as a dynamic platform designed to simplify and enhance the consumer shopping experience across various e-commerce platforms. The functioning of such a website involves several key components. Firstly, the site aggregates product information and prices from a multitude of online retailers, utilizing automated tools to crawl and scrape data from diverse sources. This collected data is then stored and organized in a database, ensuring accuracy and consistency. Users interact with an intuitive user interface that allows them to search for specific products and compare prices across different sellers. The backend regularly updates the database to reflect real-time changes in product prices and availability. Users can leverage filtering and sorting options to refine their searches based on criteria such as price range, brand, or product features. Additionally, many price comparison websites incorporate notification systems that alert users to price drops or special deals for items of interest. The revenue model often involves affiliate marketing, where the website earns commissions by directing users to make purchases through affiliated retailer links. Security measures are implemented to safeguard user data and ensure secure transactions. In summary, an online price comparison website serves as a centralized hub that empowers users to make informed purchasing decisions by presenting real-time, comprehensive data on product prices and features from various online retailers. The efficient aggregation, organization, and presentation of this data contribute to a seamless and valuable shopping experience for consumers in the competitive online marketplace.

CONCLUSION

Comparison of E-commerce products using web scraper is a web based system which will help users in decision making while buying products online. This website will facilitate users to analyze prices that are present on different e-commerce shopping websites so that they get to know the cheapest price of product with the best deal. The website will also have the facility of comparing products with all its specifications that Belong to the same category. This will surely save buyers' efforts and valuable time. Ultimately, this will bring together

strategies, Best offers and deals from all leading online stores and will help buyers to shop online.

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An Overview on Data Cleaning using Python

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ABSTRACT

Now a days data plays an important role in all fields. Industries have to deal with immense data. Decisions taken due to improper and incorrect data will determine the future of the organisation. The data collected is inaccurate. It will have many issues such as duplication, missing values, spelling mistakes. Improper data may lead to incorrect conclusion; thus, data cleaning plays an important role before analysing and reaching to any kind of conclusion. This paper explores various techniques for cleaning the data using python. Data cleaning techniques using Python is the most efficient as compared to other traditional methods.

KEYWORDS : *Data cleaning, Normalization, Null values.*

INTRODUCTION

As data is increasingly used to support organizational activities and business decisions, improper data will 0have a negative impact on an organization's productivity and efficiency[1]. Most organizations are concerned about data quality. This issue actually arises due to poor maintenance which leads to database inconsistencies. Low-quality data can lead to wrong decisions. We can provide a variety of services to businesses, and only with good data quality can we provide the highest level of service to your organization. The data cleaning process is divided into five steps: (1) data analysis, (2) transformation workflow and matching rules, (3) verification, (4) transformation, and (5) reverse data flow.

As data-driven decision-making has grown in popularity over the past few years, the need for accurate and precise forecasts has increased. The rapid growth of data is creating new economic opportunities, and data analytics processes are becoming increasingly important. Unfortunately, inaccurate data can lead to incorrect decisions, so data must be managed properly. Data cleaning, commonly known as data scrubbing, is no longer a new research topic. The goal of data cleaning is to eliminate the errors and to increase the quality of the data.[2]

DATASET

A data is a CSV file containing the records. A program's fundamental informational unit is called a record. A data set may contain information such as medical or insurance records that can be used by programs running on the system. It is also used to store application or operating system information, such as source programs, macro libraries, system variables, or settings. Data sets containing readable text can be printed or viewed in the console. Data sets can be catalogued so that they can be called by name without having to specify where they are stored before data analysis the data is cleaned. The dataset contains null values, duplicate values, extra spaces, etc., data analysis transformations, transformation validation, and backflow rules for cleaned data.

This data set must be cleaned using a variety of cleaning methods. In this way, accurate results can be obtained in less time. Correct decision making is also ensured. The cleaning process of dataset is as following: Detect and remove null values, manage extra whitespace, type conversion required, identify and remove duplicates,

highlight errors, change case, spell check and normalization. To demonstrate this, we use a sample dataset containing dirty data.

The above cleaning process is done using Python.

DIFFERENT TYPES OF DATA

There are three types of data: structured, semi-structured and unstructured data.

Fig1. Types of Data

QUALITY ISSUES IN DATA

There are various forms of data quality issues which range from data duplication missing data, errors to inconsistent format etc. the data quality issues are as follows [4].

1. Data that has been misspelled: For instance, the word "student" appears in one column while the word "stdent" appears in another.

2. Duplicate records or data: This occurs when the same data is recorded or stored in a database or dataset more than once.

3. Irrelevant data: This refers to the dataset's contents that have no bearing on the work. Such data must be deleted.

4. Mixed ranges: Few variables, like age or salary, are measured in ranges. The data must accurately and consistently reflect ranges[3].

DATA CLEANING USING PYTHON

Accuracy, consistency, and appropriateness of data is very important which can be done after cleaning the data. Data is cleaned up by correcting or deleting any errors manually.

Data cleaning is important because it improves data quality, which improves overall performance. Cleaning your data ensures that any outdated or incorrect information is removed so you have the highest quality

information [2].Here are some methods used to clean data[2]
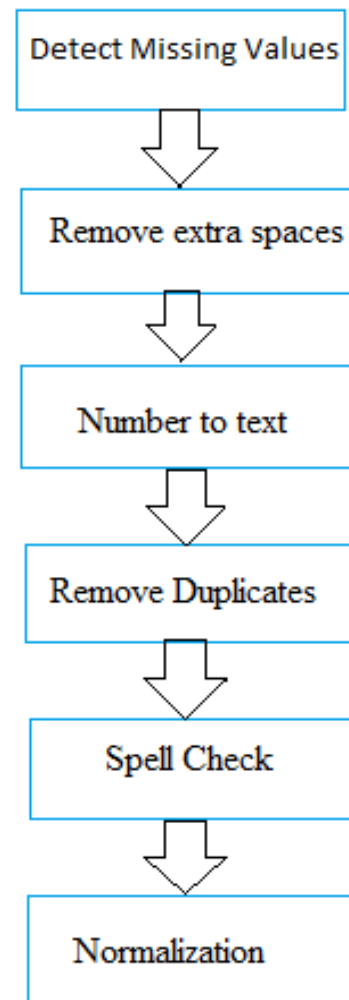
Fig. 2. Steps of Data Cleaning

BENEFITS OF DATA CLEANING

To increase the productivity of clean data it allows you to use the highest quality information to make decisions. The benefits are:

• Eliminate errors when using multiple data sources.

• Fewer mistakes mean happier customers and less frustration for employees [3].

• It has ability to relate different functions and also uses of data.

• Enhanced reporting and error monitoring to identify sources of error and facilitate the correction

of incorrect or damaged data in subsequent applications.

• Tools for data cleaning increase decision-making speed and business practice efficiency.

CONCLUSION

An essential component of data analysis is data cleaning. Numerous approaches exist for organizing the received data. I suggest using Python for faster results while utilizing these approaches. Several well-known data cleaning techniques were demonstrated using Python. Technique displayed Find missing values, eliminate extra spaces, convert text numbers to numbers, eliminate duplication, highlight mistakes, alter text to lowercase, uppercase, or regular characters, and verify spelling normalization suitable for[1] a wide range of data sets. When to apply these techniques arranges data

to produce more trustworthy and accurate data. Python's advantages for data cleaning It was brought up.

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Study of Marketplace Sentiment Analysis in Ecommerce Era using Python

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ABSTRACT

The swift rise in utilization of online services, like social media and e-commerce websites, has resulted in reviews and comments about daily activities. The practice of collecting and examining opinions, views of people, and perceptions about various products, and services is called sentiment analysis. Companies, governments, and individuals can all benefit from these opinions while gathering data and formulating their own ideas for decisions. The process of sentiment research and evaluation is not without its difficulties, though. The aim of this paper is to review some papers related to the research in sentiment analysis or customer review analysis on marketplace detailing the concepts and techniques used, as well as outlining a broader approach based on Python.

KEYWORDS : *Sentiment analysis, Marketplace, Python, Machine learning, Natural language processing.*

INTRODUCTION

Today's (2024) India shopping is more than 45% online. With a booming economy and a population of over 1.4 billion, 427 million individuals are predicted to be utilizing online shopping globally by 2027. The e-commerce sector, which is currently valued at about $100 billion, is expected to be valued at over 350 billion. Today's tech-savvy consumer in the age range of 20–40 , go for online shopping first whenever they wish to purchase something. Online shoppers are cautious as well; they consider at least two to three parameters before deciding on a purchase after considering several rival possibilities. Price, features, ratings, reviews, brand, guarantee, return policy, extra services, and delivery schedule are a few of the factors. Organizations who sell their products on popular e-commerce sites including Meesho, Flipkart, Shopify, Blinkstore, and Amazon are really concerned about these factors. Our paper mainly focuses on Ratings & Reviews analytics of e-commerce websites.

About Sentiment Analysis

Fundamentally, a sentiment refers to the reflection of emotions of people[4].The process of collecting and examining people's views, ideas, and impressions about a variety of subjects, products, and services is known as sentiment analysis[1].

According to the programming paradigm, sentiment refers to a class of components that the person performing sentiment analysis seeks for in the product reviews. An important consideration for determining any model's efficacy is the sentiment class dimension. For example, we can divide sentiment into three categories: negative, neutral, and positive. or into two classes, positive and negative.

There are various ways to do sentiment analysis. One is lexicon based and another is machine learning based. Lexicones and a score system are used in the lexicon-based approach, and it is an unsupervised analysis technique, to evaluate opinions. On the other

hand, feature extraction, datasets, and feature sets are used in the machine learning approach to train the model. The following are the basic steps in performing sentiment analysis: accumulating data, pre-processing it, extracting features, selecting baseline features, identifying sentiment, and categorizing the outcomes using basic computation or alternatively machine learning techniques[2].

LITERATURE REVIEW

Expense of computing, informal writing and the presence of variations in languages made sentiment analysis more challenging[2]. There are various online platforms like Kimola, ParseHub, Scrapy, Octoparse, Scraper API, Mozenda are available for fulfilling the same purpose. However, each of the above mentioned is not feasible for every organization. Also, hiring freelancers for limited time, this would be suitable for small set ups but not workable for a long period. Manual Dependency on reading & comprehension like going through all product reviews manually & summarising them for betterment can be impractical for big organizations.

Why is this important, since companies want to know about some of the questions like What their customers are thinking about their product/ service? How they can improve their product/ service, for better reviews/ ratings? What their product/ service offering gaps w.r.t. current product and How can they improve their sales?

Answer to all above mentioned questions is with following points or answers:

1. 95% of online buyers read reviews before making final purchases.

2. Reviews, which are left by47% of internet shoppers, are the most effective means of influencing future customers.

3. Zooming in the gap between customer perception for product/ service vs company's vision/ thought process behind the usage. Analysing own reviews for getting better at core expectations of customers.

PROPOSED METHODOLOGY

The information from the designated source must be gathered before we can perform sentiment analysis.

This raw data undergoes several pre-processing steps for enhancing its machine-readable quality. Following described are some python libraries that can be used for sentiment analysis.

Sentiment Analysis using Python

Python

Python was invented by Guido van Rossum. Python object oriented,high-level and interpreted programming language. Its few code lines and ease of reading make the language exceedingly well-liked. It defines block boundaries with whitespace inundation. Python has a huge standard library that may be applied to a number of tasks, such as data analysis, machine learning, and natural language processing. Because of its versatility, ease of usage, and dynamic nature, it is preferred for intricate tasks.

Pandas in Python

Wes McKinney created "Pandas" in 2008. It is a library in python."Pandas" are referred to as "Panel Data" and "Python Data Analysis". This is used to work with data collections. Its features include data manipulation, cleansing, analysis, and exploration. Panda library assists in the analysis of big data and generates the results on the basis of statistical theories.

Natural Language Processing (NLTK)

Python provides the functionality for text processing and classification with the help of Natural Language toolkit (NLTK). NLTK is a library in python. NLTK performs operations like tokenization, tagging, filtering, and text manipulation. A variety of trainable classifiers, including the naïve bayes, are also embodied in the NLTK library. It is also used in making bag-of-words models, or textual unigram models. To determine the overall sentiments of product reviews, a subjectivity score is applied to every phrase using a sentiment lexicon.

SCIKIT-LEARN

To work machine learning models and statistical modelling python provides the models or package called scikit-learn, or sklearn. Scikit-learn allows us to build a variety of machine learning models for clustering, regression, and classification with Scikit-

learn. Statistical analysis can then be performed on these models. Before using scikit-learn, the system has to have NumPy installed. A few functions that this library can be used for are as follows:

- Classification: Object categorization.
- Regression: Identify the continuous valued attribute linked to an object.
- Clustering: Creating set of similar object Automatically
- Dimension Reduction: Decrease the random variables count
- Model selection: Compare, validate and choose models and parameters.
- Preprocessing: Extraction of feature and normalization.

NumPy

A Python package called NumPy was founded by Travis Oliphant in 2005. It is an open source library. NumPy stands for Numerical Python and It provides a high-performance multidimensional array. Numpy provides functionality to work with matrices, the fourier transform, and linear algebra.

Environment setup for Sentiment Analysis Using Python

The following figure shows which components are required to be downloaded and installed properly.
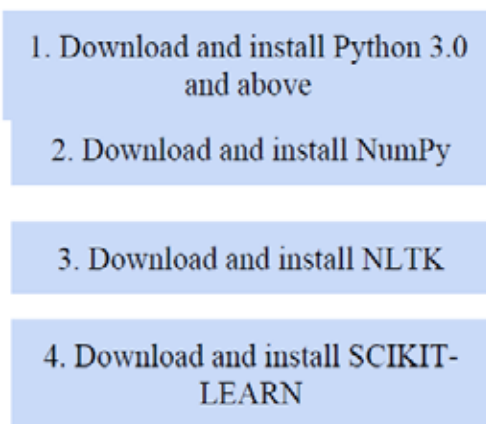
Figure 1. List of Required Python Components

CONCLUSION

Opinion and text mining are the categories under which marketplace sentiment analysis falls. Its primary goal is to evaluate the product reviews and send the information to a python-based model so that it may be trained and its accuracy confirmed. We can apply the model to different scenarios based on how well it performs. It entails actions including obtaining information, preparing and processing text for analysis, identifying and categorizing sentiment, training, and testing the model. Over the past ten years, this research area has evolved, with models now reaching about 85%–90% efficacy. However, the dimension of diversity in the data is lacking. In addition it also has a lot of application issues with the short forms or abbreviations and slang used. Many analyzers give performance issues when the number of classes are increased. Furthermore, the model's accuracy for topics other than the one in consideration is still not tested. Therefore,in the future, sentiment analysis has a highly promising future.

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Decentralized Art Marketplace with NFTs

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ABSTRACT

An NFT (Non-Fungible Token) art marketplace is a digital platform where artists, collectors, and investors can buy, sell, and trade unique digital assets known as NFTs, which represent ownership or proof of authenticity of digital art or other digital creations. An NFT art marketplace works by allowing artists to tokenize their digital creations as NFTs, which represent ownership and authenticity. Users can then buy, sell, and trade these NFTs on the platform using cryptocurrency. Smart contracts on the blockchain automate transactions and royalties for artists. Ownership is transparently recorded on the blockchain, and social features foster a community of artists and collectors. Blockchain is used in NFT art marketplaces to create unique and secure digital assets (NFTs), record ownership and transaction history transparently, enable automatic and secure transactions via smart contracts, verify authenticity and provenance of digital art, ensure artists receive royalties on secondary sales and foster trust and transparency in the marketplace. Cryptocurrency is used in NFT art marketplaces for buying, selling, and trading NFTs. Users use cryptocurrencies like Ethereum to purchase NFTs, and smart contracts on the blockchain facilitate secure and automated transactions, ensuring transparency and trust. Smart contracts in NFT art marketplaces are used to automate and secure various aspects of transactions such as Ownership Transfer, Payment Processing, Royalities and Immutable Roles. Ownership Transfer is when a buyer purchases an NFT, the smart contract automatically transfers ownership from the seller to the buyer. Smart contracts handle cryptocurrency payments, ensuring secure and instant transactions upon purchase. Smart Contracts enforce royalty payments to creators on secondary sales, distributing a percentage of the sale price as agreed. Smart contracts execute predefined rules without the need for intermediaries, ensuring transparency and trust in NFT transactions. An NFT art marketplace is a decentralized and digitized ecosystem that empowers artists and collectors while leveraging blockchain technology to ensure the uniqueness and provenance of digital art and assets. It represents a fundamental shift in how we perceive and trade digital creations in the modern era. NFT art marketplaces are needed in the modern world to establish ownership, monetize digital art, and provide transparency, trust, and economic opportunities in an increasingly digital and decentralized creative landscape.

KEYWORDS : *NFT, Blockchain, Cryptocurrency, Smart contract, Ethereum, Royalities, Monetize, Transparency.*

INTRODUCTION

The world of art and commerce is undergoing a profound transformation with the advent of blockchain technology and Non-Fungible Tokens (NFTs). Decentralized Art Marketplaces powered by NFTs have emerged as a groundbreaking paradigm shift, revolutionizing the way artists create, showcase, and sell their digital and physical artworks. NFTs, or non-fungible tokens, are unique digital assets that represent ownership or authenticity of a specific item

or content. [1]. Unlike cryptocurrencies such as Bitcoin or Ethereum, NFTs cannot be exchanged on a one-to-one basis because each NFT has its distinct value and cannot be replicated or substituted. This uniqueness makes NFTs ideal for representing ownership of digital and physical art, collectibles, music, videos, virtual real estate, and more [2]. A decentralized art marketplace with NFTs is a revolutionary platform where artists tokenize their art as unique digital assets (NFTs) on the blockchain. This provides transparency, provenance, and global access while empowering artists and collectors. It's transforming the art world by making art ownership and trading more secure, accessible, and artist- friendly decentralized art marketplaces with NFTs represent a transformative shift in the art industry, offering artists new opportunities, collectors increased confidence, and a transparent marketplace accessible to a global audience. As blockchain technology continues to evolve, this innovative approach to art ownership and distribution is likely to further disrupt and redefine the traditional art world [3].

LITERATURE REVIEW

The research paper highlights the development of a WEB3.0- based NFT marketplace, focusing on providing users with unique digital ownership and a platform for NFT trading. This marketplace operates on a decentralized network, eliminating the need for intermediaries and enhancing user security. We have learned about Aegis, a groundbreaking protocol aimed at addressing privacy concerns for NFT owners. Aegis allows users to shield their NFT collections' ownership details, providing protection against observers who can currently access this information. The protocol enables users to swap NFTs for fungible tokens while concealing transaction details, including parties involved, NFTs, and payment amounts. We came to know that platform-dependency and the lack of interoperability remain significant challenges in the blockchain space. The key requirements for interoperable royalty-friendly asset distribution and introduces the Royalty Management Token Level Smart Contract (RM-TLSC) paradigm. Tt is evident that ERC-4519, a novel Ethereum Improvement Proposal (EIP), introduces a versatile approach to Non- Fungible Tokens (NFTs) that goes beyond the capabilities of traditional ERC-721 tokens. ERC-4519 empowers developers to create NFTs with various attributes, including user and asset management, allowing for a wide range of innovative use cases. Usage of fiat currency as an analogy to NFT to better explain the NFT mechanism and how it operates. The various use-case scenarios in which NFTs will be beneficial. The NFT technology will nurture and support the broad development of the metaverse because it will provide metaverse users with everything they need to manage digital assets efficiently and securely.

METHODOLOGY

Frontend: This consists of an NFT catalogue, an NFT mint page, an auction page, and an NFT details page. These pages likely connect to the backend through a JSON RPC (Remote Procedure Call) MetaMask Wallet: This is a software cryptocurrency wallet used to interact with the Ethereum blockchain.

Authentication: This block authenticates the user and connects them to the backend.

REST API: This is an API (Application Programming Interface) that allows the frontend to communicate with the backend.

Backend: This consists of data models, business logic, authentication logic, transaction verification, and a smart contract. The backend likely uses the IPFS protocol to interact with the Ethereum blockchain.

IPFS Protocol: This is a protocol for storing and retrieving files in a decentralized manner.

Ethereum Blockchain: This is a public, open-source blockchain that supports smart contracts.

MongoDB: This is a NoSQL database that is likely used to store the data models. Overall, the block diagram seems to show a system for creating, auctioning, and storing NFTs (Non-Fungible Tokens) on the Ethereum blockchain. The frontend allows users to interact with the system, while the backend handles the business logic and interacts with the blockchain.
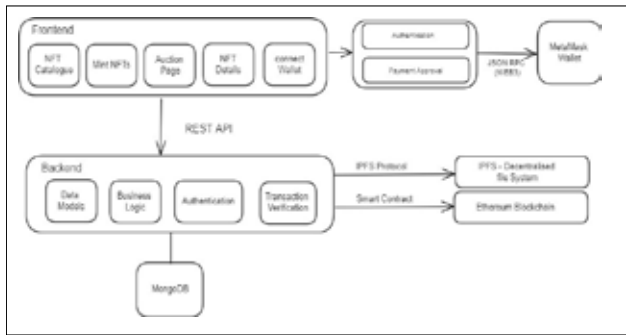
Fig. 1. Block Diagram

RESULTS
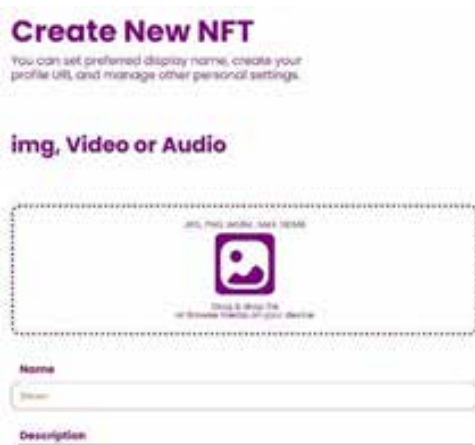
Fig. 2 Upload NFT Page

This page empowers you to transform your digital gems into unique NFTs. Simply upload your file (image, video, music).

Fig. 3 Featured NFTs

Top Creators Page: Discover the rising stars and established veterans shaping the NFT scene. This page showcases the hottest creators, ranked by their community engagement, trade volume, and overall impact. Explore diverse styles, uncover hidden talents, and get inspired by the innovative minds pushing the boundaries of digital art.

Fig. 4 Top Creators Section

Top NFTs Section: Immerse yourself in the trendiest and most coveted NFTs of the moment. This curated selection highlights the hottest digital assets based on recent sales, social media buzz, and community interest. From captivating artwork to groundbreaking collectibles, dive into the dynamic world of NFTs and discover the next potential gem to add to your collection.

CONCLUSION

In conclusion, our NFT marketplace project aspires to revolutionize the digital ownership landscape by offering a comprehensive ecosystem that empowers artists, creators, and collectors alike. Through a user-friendly interface built on Next.js and React, creators can seamlessly mint their digital creations as NFTs and curate collections that tell captivating stories. The integration of Ethereum blockchain, smart contracts (ERC-721 and ERC-20), and Solidity ensures the utmost security and transparency for all NFT transactions. With IPFS, we guarantee decentralized and secure storage for NFT assets. Moreover, the real-time notification system and chat functionality foster vibrant communities and enable seamless communication among users.

As we embark on this exciting journey, our commitment to innovation, security, inclusivity, and user-centric design stands as the foundation upon which we build a thriving NFT marketplace for the future. Join the NFT revolution with us!

ACKNOWLEDGMENT

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An Overview of Blockchain Technology

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ABSTRACT

A blockchain is a type of distributed ledger or database that is accessible to all nodes in a computer network. Its use cases extend beyond cryptocurrency, but it is best known for its central role in securing and decentralizing transactions within cryptocurrency systems. Any sector can leverage blockchain technology to ensure the immutability of data. This document offers a comprehensive examination of blockchain technology, beginning with an overview of its architecture and key characteristics. Additionally, it briefly outlines recent applications.

KEYWORDS : *Blockchain, Block, Cryptocurrency, Features.*

INTRODUCTION

A blockchain is essentially a database that stores and stores data. The main differences between a blockchain and a traditional database or spreadsheet are the data's structure and accessibility. In both corporate and academic areas, the word "cryptocurrency" is increasingly often used. One of the most well-known cryptocurrencies, Bitcoin, has grown astronomically; in 2016, its capital market was valued at $10 billion [1].

With a well-designed data structure, transactions can take place on the Bitcoin network without the need for a third party to act as a middleman. The core technology underlying Bitcoin is the blockchain, which was initially created in 2008 and implemented in 2009[2].

A blockchain is similar to a public ledger in that each committed transaction is recorded in a sequence of blocks. The chain gets longer as more blocks are added to it. To ensure ledger integrity and user security, asymmetric cryptography is used along with distributed consensus techniques. Persistence, auditability, anonymity, and decentralization are among the primary characteristics of blockchain technology [3]. Thanks to these properties, blockchain can save a substantial amount of money while increasing efficiency. Due to its ability to facilitate payments without the use of a bank or other middleman, blockchain can be applied to a variety of financial services, such as digital assets, remittance, and online payments [4]. Additionally, it can be applied to various fields such as the Internet of Things (IoT), smart contracts, and public services. Blockchain technology brings several benefits to these areas. Blockchain technology brings several advantages to these fields [5]. On the other hand, blockchain technology is immutable. Once a transaction is added to the blockchain, it cannot be modified. Businesses that need to conduct business with the highest integrity and trust can use blockchain to attract customers.

Additionally, blockchain is decentralized, which avoids single-point-of-failure situations. Miners may automatically execute a smart contract's instructions after it is put on the blockchain [6]. Blockchain technology is now facing a number of technological challenges, despite its huge potential for developing future Internet applications. Scalability is the main concern, above all else. A Bitcoin block can only be one megabyte in size at the moment, and they are mined around every ten minutes [7]. Therefore, high-frequency transactions are not supported as the Bitcoin network can only process 7 transactions per second.. On the other hand, larger blocks take up more storage space and move over the network more slowly [8].

Section II outlines the architecture of the blockchain. The functionality of blockchain is discussed in Section III. This paper presents new applications, which are summarized in Section IV.

BLOCKCHAIN ARCHITECTURE

Functions typically performed in databases, such as entering, retrieving, and storing data, are performed by programs called scripts that make up the blockchain. To be deemed valid, a distributed blockchain needs many copies to be stored on multiple machines and must coincide.

Blockchains collect transaction data and store it in blocks similar to cells in a spreadsheet. Once the data is entered, it is encrypted and a hexadecimal hash is created [1].

1. The hash is then added to the next block header and encrypted along with the rest of the block content. This creates a chain of connected blocks.
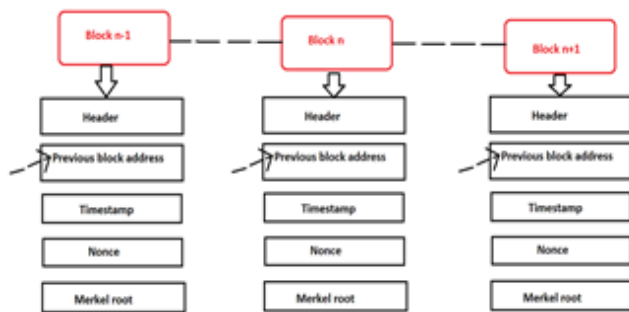
Fig. 1.   Blockchain Architecture

A specific block can be identified using the blockchain's header component. Monitor all blocks on the blockchain. Miners often hash block headers by changing the nonce value as part of standard mining operations.

Additionally, there are three types of block metadata in the block header: The ith block is linked to the i+1th block using the previous block address/hash.

This basically refers to the hash of the previous (parent) block in the chain.Timestamps are a mechanism for validating information within blocks of digital documents and providing the date and time of creation [2].

An integer that is used only once is called a nonce. This is an essential element in the block's proof of work.

The current target value is compared to see if it is less than or equal to this. People mine, evaluate, and delete multiple nonces every second until they conclude that the valuable nonce is genuine.

The various data blocks form the Merkel root of the data structure framework. All transactions are digitally recorded by the Merkle Tree, which stores all transactions together in blocks.

2. Core Components of Blockchain Architecture:

A node is a network node that acts as a hub for communication for different network activities and keeps an eye on the distributed ledger. Digital ledgers are used to record transactions, including asset transfers and contracts. Blocks are used to monitor transactions and, like chains, they contain encrypted transaction data. In the global blockchain architecture, chains link blocks. With bitcoins, miners manage cryptocurrencies and verify each step of a transaction. Consensus is a fault-tolerant method for maintaining records and reaching agreement on a single network state that is utilized in blockchain and computer systems.
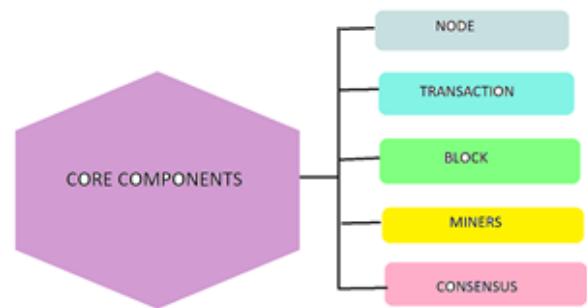
Fig. 2. Core components of Blockchain architecture

FEATURES

Decentralization in blockchain technology eliminates cost and performance bottlenecks by eliminating third-party verification by a central trusted authority. Blockchain consensus mechanisms preserve data consistency. Once a transaction is in the network, it cannot be deleted or reversed and is not erroneous. Blockchain allows people to connect without revealing their true identities by providing anonymity through a generated address. Transparency and cryptocurrency are comparable in that each transaction is traced using

the address, and the identity of the user is concealed both before and after the transaction. Blockchain's primary concept is cryptography, which uses cyphers and cypher languages to secure data. However, because blockchain is irreversible, it cannot provide complete privacy protection.
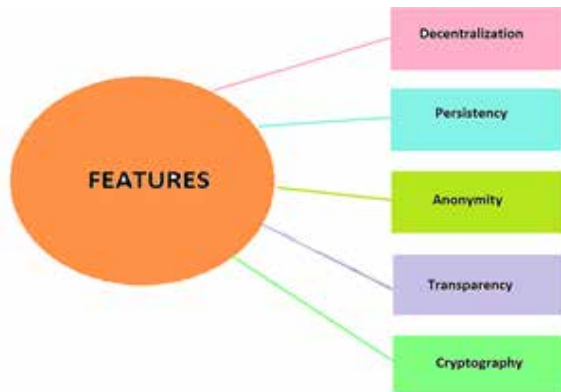
Fig. 3.   Features of Blockchain Technology

APPLICATIONS

Similar to Bitcoin, blockchain technology keeps transactional data on more than 23,000 different cryptocurrency platforms. It is also utilized to store data pertaining to different kinds of transactions. Blockchain is being investigated by businesses like Siemens, Walmart, Pfizer, AIG, and Unilever for possible uses. IBM developed the Food Trust blockchain to monitor food transportation and help companies detect potential Salmonella, Listeria, and E.coli outbreaks.

Blockchain technology allows brands to track food products from production to distribution, facilitating early detection and potentially saving lives. There are more blockchain applications being investigated. [4].

Banking and Finance

With its 24/7 transaction system and ability to shorten customer deposit times, blockchain technology has the potential to be extremely advantageous to the banking industry. If money doesn't arrive in banks' accounts by Monday morning, it can take until after business hours on that day. Transactions can be performed in minutes or seconds thanks to blockchain technology, regardless of the time of day or holiday. For big transactions in particular, this might save banks a great deal of money in fees and transit-related risks. The three-day settlement

and clearing process might be greatly shortened for stock dealers by using blockchain technology.

Currency

Cryptocurrencies like Bitcoin, which distribute operations across a network of computers, do away with the necessity for a central authority thanks to blockchain technology. Transaction, processing, and risk costs are decreased as a result. The original purpose of developing Bitcoin was to solve the issue of currency value depreciation in the event of failed banks or unstable governments. Blockchain reduces transaction and processing costs by doing away with the requirement for a central authority. Because they offer a safe haven to store wealth in nations with unstable or conflicting governments, cryptocurrencies are especially significant for those without a state identity. [1]

Health Care

Blockchain technology can be used by healthcare professionals to safely keep patient medical records. By entering their medical records onto the blockchain after they are created and signed, patients can feel secure knowing that their information cannot be altered. These personal health records may be encrypted and stored on the blockchain with a private key to protect privacy, granting access to only those who are authorized [2].

Smart Contracts

A computer programme called a "smart contract" can be introduced to the blockchain in order to facilitate contractual agreements. Users consent to a set of rules that control the operation of smart contracts. Upon fulfillment of such conditions, the agreement's terms take effect right away [3].

By paying a security deposit and receiving the unit's door code from the landlord, a renter can rent an apartment through a smart contract. If a tenant fails to pay rent or specific conditions are fulfilled, the code may be altered.

CONCLUSION

In order to facilitate academic study, this paper outlines the structure and properties of Blockchain, which is defined as a distributed database for data storage. Many

platforms are investigating blockchain technology due to its interesting features and extras. To ensure its full manifestation, a number of blockchain-related issues are still being looked into and improved.

Blockchain has shown the ability for transforming traditional industries through its essential features such as decentralization, persistence, anonymity, and auditability. We provide a thorough review of blockchain in this paper. First, we provide an overview of blockchain technologies, covering its architecture and salient features. Blockchain-based apps are becoming more and more popular these days, and we intend to carry out in-depth research on them in the future.

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Supportive Assistant Keeping Hope Intact (SAKHI)

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ABSTRACT

Depression is a pervasive and complicated mental fitness challenge affecting tens of millions internationally. It manifests as continual emotions of sadness, hopelessness, and a lack of hobby in lifestyle's pleasures. The stigma surrounding despair frequently deters people from seeking assistance, even as constrained get right of entry to mental fitness offerings compounds the problem. Spotting the pressing need for a complete and empathetic answer, we introduce "SAKHI" (Supportive Assistant Keeping Hope Intact).The "SAKHI" anti-melancholy internet app is a transformative solution designed to locate and reply to the feelings, textual content, and voice of individuals grappling with despair. It offers personalized assistance, network engagement, and professional integration to combat isolation and stigma. "SAKHI" pursuits to foster desire, resilience, and well-being, ushering in a new generation of mental health help.

INTRODUCTION

The "SAKHI" internet app represents a transformative approach to addressing depression through seamlessly integrating era and empathetic human interplay. At its core, "SAKHI" seeks to discover and respond to the feelings of people coping with melancholy, supplying tailor-made answers, non-public help, and a supportive community.

Motivation

A major mental health problem that affects hundreds of thousands of people worldwide is depression. Many human beings hesitate to search for professional assistance because of stigma or are restrained from getting admission to intellectual health services. The "SAKHI" web app addresses this need through supplying a virtual platform that detects feelings, text, and voice of depressed individuals and gives solutions to help them control and overcome depression.

Basic Concept

The fundamental concept of the "SAKHI" net app revolves around leveraging the superior generation to create a compassionate and supportive digital assistant for people dealing with despair. the important thing components of the app encompass:

Emotion Detection: The app uses pc vision and natural language processing (NLP) to stumble on and examine user feelings in real time. It is able to analyse facial expressions during video calls and interpret emotional cues from textual content and voice inputs.

Personalized Support: Based totally at the detected feelings and user profiles, the app affords personalised support and coping techniques. It gives self-help sources, relaxation strategies, mindfulness, sporting activities, and peer support alternatives tailored to the consumer's emotional country and dreams.

Network building: SAKHI fosters a network experience by providing a platform for users to connect to peers through community forums. customers can share their stories, take part in discussions on mental fitness topics, and provide guidance to one another.

Facts privacy and safety: making sure the utmost records privateness and safety is a center precept. The app encrypts personal statistics in the course of transmission and storage, obtains informed consent, and complies with applicable records protection policies.

Applications

The "SAKHI" app has a wide range of potential applications, including:

Individual Depression Management: The primary application is to provide support and solutions to individuals dealing with depression. It offers real-time emotional support and a toolbox of resources to help them manage their condition.

Community Support: SAKHI creates a supportive community where users can connect, share experiences, and provide emotional support to one another. It can be particularly beneficial for those who feel isolated or stigmatized.

Mental Health Education: The app serves as an educational tool, raising awareness about depression, its symptoms, and the importance of seeking professional help. It provides information and resources to help users understand and manage their mental health.

Professional Assistance: SAKHI acts as a bridge between users and mental health professionals. It facilitates connections for virtual therapy sessions, counselling, and support group meetings, expanding access to professional help.

LITERATURE REVIEW

Sr No.	Title	Author	Description
1	Harnessing emotions for depression detection(2022)	Rajesh Varagani, Sahana Prabhu, Sweccha Jha, Himangi Mittal, & Shivendra Singh	Human feelings can provide insight into someone's intellectual condition through textual cues, speech patterns, and facial expressions. Few classified datasets exist for multi-modal depression identification, although there are a lot of uni-modal datasets for emotion popularity.
2	Sentiment Analysis on Depression Detection: A Review	Noorihan Abdul Rahman, Norma Mohamad Nor, Zuriani Ahmad Zukarnain & Mohd Ridzwan Yaakub	This study reviews the literature on the most popular machine learning classification technique for classifying facial expressions, behavioural traits, and emotional characteristics in order to analyze human sentiment. It also presents a comparison of several methods for dealing with emotions.
3	Mental Health Monitoring System using Artificial Intelligence	Vrushti Modi, Vidhi Modi	In this research, we examine various frameworks for tracking mental fitness, particularly virtual counseling, precision treatment, and diagnostic systems, by going over the parameters and algorithms used in each device.
4	Depression detection using emotional artificial intelligence and machine learning	Nehal Kanoongo, Manju Lata Joshi	This study compares and contrasts numerous frameworks, such as CNNs and RNNs, and looks into depression analysis. as well as the algorithms that assess depression severity.
5	Facial Emotion Detection Using Convolutional Neural Networks	Mohammed Adnan Adil	In this study, features from photographs are extracted using convolutional neural networks (CNNs) to identify sentiments. 64 important spots on a face are identified and extracted using the Python Dlib toolbox.

6	Depression Detection of Tweets and A Comparative Test	Chatur Bhuja. G, Akshaya. P. R, Asim Nath	This is a vast collection of information about an individual's behaviour that can be utilized with natural language processing and deep learning to identify mental illness or depression.
7	The utility of artificial intelligence for mood analysis, depression detection, and suicide risk management	Siamak Zadeh and Bahman Zohuri	Stress and mood problems are frequently signs of hopelessness, and those who experience extreme mood swings may also be more likely to consider suicide and have stronger suicidal thoughts. In order to record their mood and conquer the degree of despair, the pressure level is measured.
8	Undergraduate student perceptions of stress and mental health in engineering culture	Joseph F. Mirabelli, Karin J. Jensen, Andrea J. Kunze, and Kelly J. Cross	Analysis shed light on how engineering students view the expectations surrounding stress and mental health in the field and how this affects their decision to seek mental health support. These results have significant ramifications for creating interventions and supportive environments for students' mental health.
9	**Mental Health Analyzer for Depression Detection Based on Textual Analysis**	Pranav Bhat	Among other deep learning models, Convolutional Neural Networks (CNN) and Bidirectional LSTM have been used and compared for the emotion classification task, mainly to classify and communicate emotions like disillusionment, anxiety, rage, and happiness that are expressed in a person's tweets.
10	Mental Health Prediction Using Machine Learning: Taxonomy, Applications, and Challenges	Jason Teo and Jetli Chung	In this paper, the main goal is to offer a scientific overview and summary of the gadget mastering strategies which might be being used to expect, diagnose, analyze, and perceive mental health issues befell in recent times.

PROBLEM STATEMENT

The Challenge

The challenge lies in several interconnected issues:

Stigma and Isolation: Stigma surrounding depression often prevents individuals from seeking help. They may feel ashamed or fear judgment, leading to isolation and delayed intervention.

Limited Access to Services: Access to mental health services varies widely, with many individuals facing geographical, financial, or cultural barriers that hinder their ability to access professional help.

Complexity of Emotions: Depression is characterized by a wide range of emotional experiences, making it challenging for individuals to recognize and express their feelings accurately.

PROPOSED METHODS

The "SAKHI" web app is designed to be a comprehensive and empathetic platform for detecting the emotions of depressed individuals and providing tailored solutions to help them manage their emotional well-being effectively. SAKHI aims to address the challenges faced by individuals with depression by offering immediate emotional support, personalized coping strategies, a supportive community, and access to professional help when needed.

Real-time Emotion Detection

SAKHI will employ advanced technologies inclusive of computer vision and natural language processing (NLP) laptop imaginative and prescient and herbal language processing (NLP) to stumble on and recognize the emotional country of users in actual time. Facial emotion recognition: Analyze users' facial expressions

during video calls to identify emotional cues. Text-based emotion analysis: Analyze users' written or spoken text to detect emotional tone and sentiment.

Immediate Emotional Support

The app will provide immediate emotional support through various channels:

Chatbot: A responsive chatbot will engage in conversations with users to offer emotional support, active listening, and guidance.

Crisis Button: Users can access a crisis button or emergency chat feature when they require immediate assistance or are in distress.

Human Intervention: Trained support personnel will be available to intervene and provide assistance when needed.

Personalized Coping Strategies

SAKHI will offer personalized recommendations and coping strategies based on users' emotional states and individual profiles. Users will receive suggestions for self-help resources, relaxation techniques, mindfulness exercises, and other strategies to manage their emotions effectively.

Community Support

SAKHI will foster a supportive online community where users can:

Connect with peers: Users can share their experiences, offer encouragement, and provide advice to one another.

Participate in forums: Engage in discussions on various mental health topics, coping strategies, and personal journeys.

Receive peer support: Benefit from the empathetic and understanding environment created by fellow users.

Access to Professional Help

For users requiring professional assistance, SAKHI will facilitate connections with mental health professionals or organizations.

Users can schedule virtual appointments with therapists, counselors, or support groups directly through the app.

Data Privacy and Security

SAKHI will prioritize personal statistics, privacy and security, making sure that sensitive emotional records are treated with the utmost care. The app will observe applicable information protection guidelines and hire encryption and comfy authentication mechanisms.
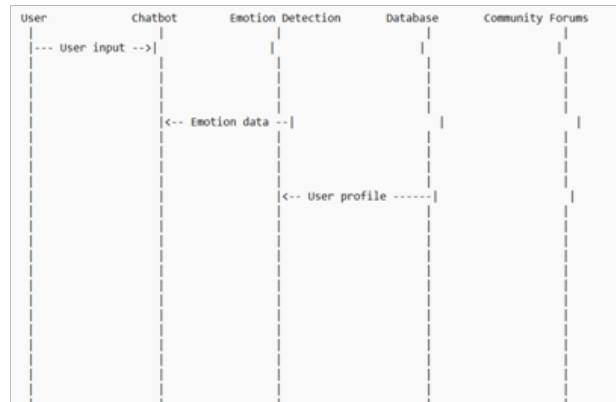
Fig. 1 Sequence Diagram

IMPLEMENTATION

Project Kick-off

Team Formation: assemble a numerous team of developers, designers, information scientists, mental fitness specialists, and challenge managers to ensure a multidisciplinary technique. Project constitution: define the project's scope, objectives, deliverables, timeline, and resource allocation in a proper project charter.

Research and Requirements Gathering

Consumer Interviews: Behaviour interviews with people who have experienced melancholy to recognize their wishes, challenges, and preferences. Mental fitness expert session: are looking for input from intellectual health experts to ensure the website aligns with proof-based practices.

Technology Stack Selection

Choose Emotion Detection Technologies: Select appropriate computer vision and natural language processing tools for emotion detection. Data Privacy and Security Measures: Define protocols for ensuring data privacy and security, including encryption and compliance with data protection regulations.

Website Development

Front-end Development: Design and develop the user interface (UI) to be user-friendly and accessible, ensuring a seamless user experience. Back-end Development: Create the back-end infrastructure for processing data, managing user profiles, and delivering personalized support. Emotion Detection Integration: Integrate emotion detection technologies into the website's functionalities.

Personalization and AI Integration

AI Algorithms: Develop and implement AI algorithms to personalize responses and recommendations based on user data and detected emotions. User Profiling: Create user profiles that capture preferences, goals, and emotional states to enhance personalization.

Data Collection and Evaluation

Data Collection: Enforce records series mechanisms to gather anonymized and aggregated person data for research and insights. Data evaluation: examine gathered facts to become aware of patterns, traits, and possibilities for enhancing depression management.

CONCLUSION

The development and implementation of the "SAKHI" anti-depression web app represent a significant step forward in addressing the complex issue of depression and mental health support. It represents a promising step toward improving mental health support and reducing the stigma associated with depression. As the app evolves, it will benefit from ongoing research, development, and collaboration with mental health professionals and organizations. Depression is a complex condition, but with innovative solutions like SAKHI, there is hope for a brighter future. SAKHI aims to provide a ray of hope and support to individuals dealing with depression, helping them find strength, resilience, and a path to improved emotional well-being.

FUTURE SCOPE

Enhance the app's mood tracking capabilities by incorporating more nuanced metrics and data points. This could include tracking sleep patterns, physical activity, and other lifestyle factors to provide a comprehensive view of users' mental well-being. Integrate advanced emotional analysis using artificial intelligence to interpret user inputs, such as text or voice messages. This can help in identifying patterns, detecting potential crises, and offering personalized recommendations based on emotional states.

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PersonaPro: A Novel Personality Prediction Platform

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ABSTRACT

The "PersonaPro" is a user-friendly platform that provides insights into an individual's personality through the integration of personality assessment tools like the Big Five Personality Model and the Myers-Briggs Type Indicator. The website uses machine learning and data analytics to interpret user responses, offering personalized recommendations for self-improvement, career choices, and interpersonal relationships. It also provides in-depth analyses of strengths and areas for development, enabling users to make informed decisions. The project aims to empower users to embrace self-discovery, foster personal growth, and make informed life choices based on their unique personalities.

KEYWORDS *: Personality prediction personality assessment, Self-discovery, User-centric design, Bias avoidance.*

INTRODUCTION

The "PersonaPro" is a groundbreaking digital platform that uses Artificial Intelligence (AI) and Machine Learning (ML) to provide users with a unique and insightful window into their personalities. This platform aims to empower individuals with the knowledge and understanding necessary to navigate their personal and professional lives with greater efficacy and insight.

The website integrates established psychological models, such as the Big Five Personality Model and the Myers-Briggs Type Indicator, into an accessible online environment, enabling users to engage in a journey of self-discovery unlike any other. Through AI-powered assessments and advanced ML algorithms, the website provides personalized and in-depth analyses of users' personalities, elucidating traits such as openness, conscientiousness, extraversion, and more, and guiding them towards self-improvement and informed life choices.

While technology is at the heart of this project, safeguarding user privacy and data security is paramount. The website incorporates robust measures to ensure the utmost protection of user information, building trust through transparency and confidentiality.

The "PersonaPro" reimagines the role of technology in shaping our understanding of the human psyche, unlocking the latent potential within each of us.[1] It encapsulates the spirit of innovation and empathy, using AI and ML to create a digital ecosystem that fosters personal growth, enhances decision- making, and empowers individuals to embark on a journey of self-discovery with confidence.

In the context of modern life, the importance of self-awareness and self-improvement has been further underscored. A nuanced understanding of one's

personality traits can be a decisive factor in making choices that align with their authentic selves, leading to more meaningful career decisions, better interpersonal interactions, and overall life satisfaction.

The "PersonaPro" is a website that offers a data-driven, accessible way to analyze an individual's personality. It integrates personality assessment tools into an online environment, allowing users to complete assessments and questionnaires to reveal their unique personality profiles. These profiles provide insights into traits like openness, conscientiousness, extraversion, and introversion. The project report will cover technical aspects, data collection and analysis, user interface design, and security measures. It will also explore the psychology and methodology behind personality assessments, emphasizing their relevance in personal and professional development.

REVIEW OF LITERATURE

The text explores various topics related to personality computing, natural language processing in psychology, and machine learning algorithms for autism spectrum disorder screening. The authors discuss various topics, including "Personality Computing: A New Frontier for Cognitive Science and Artificial Intelligence," "Personality Prediction from Text: A Case Study on Reddit,"[2] "Personality and User Behavior in Online Communities," "Natural Language Processing in Psychology: A Survey," "The Development and Validation of a Machine Learning Algorithm for Autism Spectrum Disorder Screening," "Ethics of Artificial Intelligence and Robotics," "Privacy in Personality Assessment: Ethical and Legal Issues," and "AI in the 21st Century: Privacy and Artificial Intelligence." The authors also discuss the ethical and legal issues surrounding privacy in personality assessment and AI in the 21st century.

EXISTING SYSTEM

IBM Watson Personality Insights

IBM Watson's Personality Insights is a pioneering system that employs natural language processing and ML algorithms to analyze textual data, such as social media posts and written content. It assesses an individual's personality traits, emotional states, and

needs, making it an invaluable tool for understanding online behavior. While its AI-driven analysis is robust, it primarily focuses on text data, limiting its scope to written content.

16Personalities

16Personalities is an established platform that utilizes ML to enhance the interpretation of the Myers-Briggs Type Indicator (MBTI), a widely recognized personality assessment tool. It categorizes users into one of 16 personality types and provides detailed descriptions. Its strength lies in its user-friendly interface and the provision of practical insights based on personality types, though it can be critiqued for oversimplifying the complexity of personality.

Traitify

Traitify utilizes visual assessments and AI to analyze user responses rapidly. It is known for its engaging user experience, making it popular for career counseling and matchmaking. Nevertheless, it may be considered less comprehensive in comparison to other systems, as it focuses on a limited set of traits based on image selections.

Crystal Knows

Crystal Knows combines AI and personality insights to offer personalized recommendations for communication and relationship-building. It analyzes public online data, including LinkedIn profiles, and generates advice on how to interact with specific individuals. However, concerns over privacy and data accuracy have been raised.

myPersonality

myPersonality is a research-oriented system that collected user data for psychological research purposes. While it has faced privacy controversies, it highlights the ethical considerations surrounding PersonaPros.

These existing systems collectively exemplify the diverse applications of AI and ML in personality analysis. They offer a range of assessments, from text-based analysis to visual assessments, and provide practical recommendations for personal and professional development.[3] However, ethical concerns, privacy issues, and potential oversimplification of personality

remain as challenges. The "PersonaPro" project aims to build upon these insights and address these limitations, offering a user-friendly platform that integrates the strengths of existing systems while emphasizing data security and nuanced analysis to foster self-awareness and personal growth.

AIM AND OBJECTIVE

The "PersonaPro" project aims to create an online platform using Artificial Intelligence and Machine Learning to provide personalized personality assessments. The platform aims to bridge the gap between psychological assessments and practical applications, enabling users to make informed decisions about personal and professional development, career choices, and interpersonal relationships. The project aims to create a user-centric solution that fosters self-awareness, self- improvement, and enhances the quality of individuals' lives. The platform will integrate cutting-edge AI and ML algorithms, interpreting user responses and generating in-depth personality profiles. The project prioritizes data privacy and security, ensuring transparency in data usage and consent processes. The project aims to be more than just a tool for assessment; it will serve as a comprehensive resource and guidance hub, providing users with insights into their personalities and the knowledge to apply these insights effectively in real-life scenarios.

PROBLEM STATEMENT

The "PersonaPro" project aims to address limitations in existing personality analysis tools and websites, such as oversimplification of personality traits, lack of personalized insights, and concerns about data privacy and security. By integrating AI and ML, the project aims to provide personalized and nuanced personality insights, empowering users to make informed decisions while prioritizing data privacy and security. The project also addresses the need for a more user-centric approach to personality analysis in the digital age, bridging gaps in fitness accessibility and safety, fostering a healthier and more active society.

PROPOSED SYSTEM FOR PROJECT

In today's fast-paced digital world, the quest for self-awareness and personal growth is increasingly vital,

and understanding one's own personality is a pivotal component of this journey. However, existing personality analysis tools and websites have certain limitations that the "PersonaPro" project aims to address. These limitations include the oversimplification of personality traits, the lack of personalized insights, and concerns regarding data privacy and security. Many current platforms categorize users into predefined personality types or offer generic advice without considering the nuances of an individual's character. Additionally, the collection of personal data for analysis often raises ethical concerns, as users may be unaware of how their information is being used. The "PersonaPro" project recognizes these challenges and seeks to provide a comprehensive, ethical, and technologically advanced solution that overcomes these limitations. [4] By integrating AI and ML, the project aims to offer users personalized and nuanced personality insights that empower them to make informed decisions about their lives while prioritizing their data privacy and security. This project addresses the critical need for a more sophisticated and user- centric approach to personality analysis in the digital age importance of regular exercise, prompting a surge in gym attendance as people realized the numerous mental and physical benefits it offers, including improved sleep, stress relief, mood enhancement, cognitive sharpening, and better cardiovascular health. However, a significant portion of the population still refrains from gym visits, citing various barriers such as time constraints, financial limitations, social anxiety, geographical distance, childcare responsibilities, and past negative experiences. Moreover, those who prefer working out at home face the challenge of ensuring proper exercise form, which is essential for avoiding injuries and effectively targeting specific muscle groups. The problem at hand is to bridge these gaps, making fitness accessible, safe, and effective for all, regardless of the setting or circumstances, thereby fostering a healthier and more active society.

REQUIREMENT ANALYSIS

The "PersonaPro" is a platform designed to meet user expectations by balancing technological innovation, user- centered design, ethical considerations, and technical limits of AI and ML integration. The platform

should allow users to create accounts, manage profiles, and view their personality assessment history, support various personality assessment tools, and provide personalized recommendations. It should also host educational resources to help users interpret personality insights.

Ethical and security considerations include data privacy, informed consent, data encryption, user rights, and ethical AI. Data privacy measures must be implemented, and users should provide informed consent for data collection and analysis. Data encryption protocols should be implemented to safeguard sensitive information.

Technical and performance requirements include scalability, reliability, user experience, data processing, security measures, legal compliance, and accessibility. The website should be available 24/7, with minimal downtime and reliable backup and recovery mechanisms. The user interface should be intuitive and engaging, and AI and ML algorithms should be used efficiently.[5]

Regulatory compliance is crucial, with adherence to legal frameworks and regulations regarding data protection, privacy, and user consent. Accessibility standards should be met to make the platform usable by individuals with disabilities.

FEASIBILITY STUDY

The feasibility study for the "PersonaPro" project evaluates the practicality and viability of developing and implementing the proposed system. The project is technically feasible due to the maturity of AI and ML technologies in personality analysis, supported by available tools, frameworks, and open-source libraries. The project team has the necessary technical expertise, and the user-friendly website is within current web development capabilities.

Operational feasibility is promising, with clear objectives, a well-defined scope, and an established development plan. The user-centric approach aligns with contemporary user expectations, enhancing user engagement and adoption. The focus on data privacy and ethical considerations ensures the project's operational integrity.

Economic feasibility analysis shows strong prospects

for the project's financial viability, with development costs within budget constraints and revenue streams from subscription models, targeted advertising, and partnerships. The website's scalability can accommodate increasing user numbers without substantial increases in operational costs, contributing to long-term financial sustainability.

Scheduling feasibility is well-planned, with a comprehensive timeline and milestones. The project is well-organized to ensure efficient progress and timely delivery. The feasibility study demonstrates the project's potential to offer significant value to users seeking enhanced self-awareness, personal growth, and data-driven decision-making.

IMPLEMENTATION PLAN

Hardware/Software Interface

This section lists the minimum hardware and software requirements needed to run the system efficiently.

Hardware Requirements

User System RAM: 2 GB and above

Dev Processor: Intel i5 and above

A Web Browser

Software Requirements

HTML CSS

JAVASCRIPT

Python

flask

Node.js

react.js

METHODOLGY

The methodology for the development of the "PersonaPro" is structured around a well-defined and comprehensive approach that encompasses the design, development, and deployment of the platform. It involves a blend of software engineering practices, data analysis techniques, and ethical considerations to create a user-centric, technologically advanced, and data- secure PersonaPro.

Requirements Analysis:

The project commences with a detailed analysis of user requirements and expectations. This involves understanding the specific personality assessments and recommendations users seek, as well as their expectations for data privacy and security. This phase also encompasses defining the target audience and their demographic and psychographic characteristics.

System Design

The system design phase involves crafting a blueprint for the website. It encompasses the architectural design, including database schema and system components, and the user interface design, focusing on creating an intuitive and engaging user experience. The website's AI and ML integration, as well as the algorithms for interpreting personality assessments and generating recommendations, are meticulously planned in this stage.

Development

Development is executed in parallel with system design. The project team employs modern web development technologies to build the website, ensuring cross-platform compatibility and responsive design. AI and ML models are developed and fine-tuned to interpret user responses and generate personalized insights.

Data Collection and Analysis

Personality analysis relies on the collection of user data, primarily through personality assessments and questionnaires. It involves data preprocessing, data cleaning, and the application of AI and ML algorithms to analyze the collected data. Data analysis aims to provide nuanced and accurate personality insights.

Data Privacy and Security Implementation

As data privacy is a fundamental concern, the project prioritizes the implementation of stringent security measures. This includes encryption of user data, secure authentication and authorization protocols, clear user consent processes, and adherence to data protection regulations. Ethical considerations are integrated throughout this phase.

User Testing and Feedback

The website undergoes extensive user testing to identify and rectify any usability issues or bugs. User feedback is solicited and incorporated to enhance the user experience and ensure that the platform aligns with user expectations.

Deployment

Following rigorous testing and refinement, the website is deployed to a production environment, ready to be accessed by users. Deployment is closely monitored to ensure a seamless transition from development to a live environment.

Education and Resource Integration

The project includes the integration of educational resources and guidance on how to interpret and apply personality insights in everyday life. This educational component enhances the value of personality analysis by empowering users with knowledge on how to utilize their results for personal growth and decision-making.

This methodology embraces a holistic approach, combining technological excellence, ethical considerations, and user-centric design to create a "PersonaPro" that not only meets the objectives but also delivers a transformative and secure user experience. By adhering to this methodology, the project is well-equipped to provide a sophisticated and valuable solution in the realm of personality analysis, utilizing AI and ML to empower users with insights and knowledge for personal growth and decision-making.

CONCLUSION

In the pursuit of constructing the "PersonaPro" we embarked on a transformative journey at the intersection of psychology, technology, and user-centric design. This project aimed to address the critical need for comprehensive, ethical, and technologically advanced personality analysis in the digital age. Through a meticulous integration of Artificial Intelligence (AI) and Machine Learning (ML) algorithms with established personality assessment tools, the proposed system offers users a profound and personalized exploration of their unique personalities.

As the project advanced, it became evident that the fusion of AI and ML with psychological analysis has the potential to empower individuals in their quest for self-awareness and personal growth. The

technology employed enables a more nuanced and dynamic understanding of personality, offering tailored recommendations that guide users toward informed decisions in their personal and professional lives. The website's emphasis on data privacy and ethical considerations safeguards user information, respecting their rights and trust.

Furthermore, the project's educational component, featuring resources and guidance on the interpretation and application of personality insights, enriches the user experience. By fostering self-awareness and personal growth, the "Personality Analysis Website" seeks to enhance the overall well-being and success of its users, aligning with the contemporary demands of the digital age.

The "PersonaPro" represents a significant milestone in the realm of personality analysis tools, embodying the synergy of technology and psychology. It underscores the project's commitment to creating a user-centric platform that contributes to the self-discovery, personal growth, and informed decision-making of individuals. With a focus on ethical considerations, data privacy, and cutting-edge AI and ML integration, this project stands as a testament to the potential of technological

innovation in enhancing the quality of users' lives. As we move forward, the "Personality Analysis Website" promises to play a pivotal role in the ongoing journey of self-discovery and personal development in the digital age.

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Automated Help Centers

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ABSTRACT

In the ever-evolving landscape of customer support, the integration of Generative AI technology has emerged as a transformative solution to address the persistent challenges faced by traditional help centers. This major project endeavors to design and implement a cutting-edge Generative AI-powered automated help center, poised to revolutionize customer support operations. The primary objectives of this endeavor are to overcome resource limitations, minimize response times, maintain unwavering consistency, and reduce operational costs to enhance the overall customer experience.

This innovative solution is aimed at providing timely and precise assistance to customers round-the-clock, mitigating the drawbacks of conventional support systems. Leveraging the capabilities of state-of-the-art Generative AI models, the automated help center will have the capacity to generate human-like text responses, ensuring interactions that are not only efficient but also feel natural and personalized. The integration of Generative AI into customer support promises to usher in a new era of efficiency, accuracy, and responsiveness, ultimately redefining the paradigm of customer service.

KEYWORDS : *Generative AI, Automated help center, Customer support, Large language model, LLAMA2.*

INTRODUCTION

In an era characterized by the relentless evolution of technology and the ever-growing expectations of consumers, the domain of customer support finds itself at a crossroads, necessitating a radical transformation. Traditional help centers, while dedicated to assisting, grapple with persistent challenges that hinder their effectiveness. Extended response times, resource limitations, the monotony of repetitive tasks, and the constraints of operating within rigid hours have become formidable obstacles to delivering seamless customer experiences.[3]

The pivotal role of customer support in ensuring satisfaction and fostering loyalty underscores the urgency.

for a solution that transcends conventional approaches. Recognizing this imperative need, we embark on an exploration of a groundbreaking paradigm shift – the implementation of a Generative AI-powered automated help center. This report delves deep into the intricate design and execution of this transformative solution, unraveling the methodologies, technologies, and myriad benefits it brings to the forefront of customer support. [6]

The traditional support model's struggles are emblematic of an industry in flux, caught between the rising tide of customer expectations and the limitations of existing infrastructure. As businesses strive to meet the demands of an increasingly discerning clientele, the need for an innovative, efficient, and scalable solution becomes paramount. The challenges faced by conventional help centers form the backdrop against which the emergence of Generative AI as a disruptive force in customer support gains significance. Generative AI, with its ability to understand and replicate human-like language, offers a promising avenue for automating intricate support processes. This report navigates the capabilities of Generative AI, unraveling its potential to revolutionize customer interactions, streamline operations, and elevate the overall support experience. The exploration extends to the specific components and approaches integral to crafting an automated help center powered by this cutting-edge technology.[2]

Through a comprehensive analysis, we aim to shed light on the transformative potential of this project. We scrutinize its efficiency in addressing customer needs, its impact on response times, the consistency it brings to support interactions, and the overall cost-effectiveness it promises. This Generative AI-powered automated help center is not merely an evolution; it is a revolutionary leap forward in reshaping the landscape of customer support, offering profound insights into the future of customer-centric operations.[5]

This paper sets out to explore and elucidate the contours of a pioneering solution—the design and implementation of a Generative AI-powered automated help center. At its core, this solution harnesses the cutting-edge capabilities of Generative AI, a technology at the forefront of natural language processing, to craft an environment where customer queries are met with instant and accurate responses. The journey unfolds by dissecting the challenges faced by traditional help centers, delving into the capabilities of Generative AI, and meticulously detailing the components and methodologies that constitute the bedrock of this transformative automated help center. The challenges faced by traditional help centers act as a poignant backdrop, illustrating the pressing need for innovation in customer support.

METHODOLOGY

The proposed methodology for implementing the automated help center revolves around a systematic approach to leverage Generative AI technology and address the identified challenges in customer support operations. The first phase involves thorough research and selection of state-of-the-art Generative AI models, ensuring they possess the capability to generate human-like text responses. This phase is crucial in determining the foundation upon which the automated help center will operate.[4]

The subsequent phase focuses on system architecture and design. A detailed block diagram (as illustrated in Figure 6.1) outlines the key components and their interactions, highlighting the integration of Generative AI models, input handling, and feedback mechanisms. The architecture emphasizes the importance of user-friendly interfaces, enabling intuitive input methods and clear presentation of responses. Additionally, provisions for error handling are incorporated to enhance the user experience. The heart of the methodology lies in the functional requirements, beginning with effective user input handling and progressing through text tokenization, semantic embedding, positional encoding, and the implementation of encoder and optional decoder layers. These components collectively contribute to the system's ability to understand and process user queries, ensuring accurate and contextually relevant responses. Multi-head attention and output layers, tailored to specific tasks such as language modeling or classification, further enhance the system's capabilities.[6]

The user interface is a critical aspect addressed in the methodology, emphasizing a design that prioritizes user-friendliness, clear response presentation, and robust error handling. This not only facilitates a seamless interaction between users and the system but also contributes to the overall satisfaction of the end-users.

In terms of non-functional requirements, the methodology emphasizes low response times to ensure efficient interactions and scalability to handle a large volume of concurrent user requests without compromising performance. Usability is prioritized

through an intuitive interface and natural interaction, contributing to a positive and engaging user experience.

The reliability of the automated help center is a key consideration, necessitating 24/7 availability and robust error handling to maintain consistent support for users. Continuous improvement is ensured through the incorporation of a feedback loop, allowing for ongoing enhancements to the system's performance.

In summary, the methodology encompasses meticulous research, thoughtful design, and a comprehensive focus on functional and non-functional requirements to develop an automated help center that not only addresses the existing inefficiencies in customer support operations but also sets the stage for a transformative and user-centric customer support experience.

RESULT

Our proposed solution aims to develop an automated help center that harnesses the power of Generative AI to provide instant and accurate responses to customer queries. The solution will leverage state-of-the-art Generative AI models to generate human-like text responses, ensuring a more natural and personalized interaction.
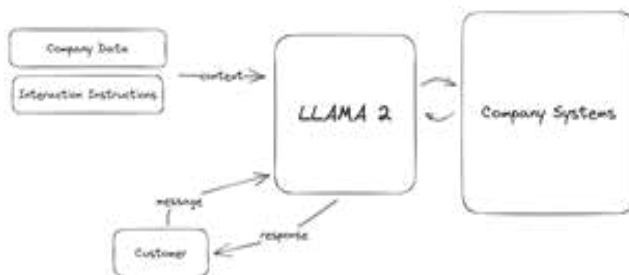
Figure 1: Block Diagram

By implementing the automated help center, we expect to reduce response times, improve customer satisfaction, and optimize resource allocation for customer support operations. Additionally, we plan to incorporate a feedback

loop to continuously enhance the system's performance and ensure ongoing improvements. The operational feasibility of the automated help center project evaluates whether the proposed system can be smoothly integrated into the existing customer support operations and processes.

User Adoption Assess the willingness of customer support agents to adapt to the new system. Conduct training sessions to familiarize them with the Generative AI-powered automated help center. Integration with Existing Systems Evaluate the compatibility of the proposed system with the current customer support infrastructure, including CRM systems and communication channels

Workflow Impact: Analyze the impact on existing workflows. Ensure that the automated help center enhances efficiency without causing disruptions. The technical feasibility study focuses on assessing whether the proposed system can be implemented from a technological perspective, considering the available resources and expertise.

Technology Stack Evaluate the availability and suitability of the chosen technology stack for implementing Generative AI in the automated help center. Data Requirements Assess the availability and quality of data required for training and fine-tuning the Generative AI models. Hardware and Software Infrastructure Verify if the existing hardware and software infrastructure can support the computational requirements of Generative AI models.

CONCLUSIONS

In the rapidly evolving landscape of customer support, the integration of Generative AI into automated help centers has emerged as a groundbreaking solution to address the long-standing challenges faced by traditional support systems. This major project embarked on the journey of designing and implementing a Generative AI-powered automated help center, with a core focus on enhancing efficiency, responsiveness, and the overall customer experience. As we conclude this endeavor, it is evident that the potential impact on customer support is nothing short of transformative.

Our project addressed a fundamental problem in customer support – the inefficiencies stemming from long response times, resource limitations, and repetitive tasks. By harnessing the capabilities of Generative AI, we have created a system that provides near-instant and accurate responses to customer queries, effectively mitigating these challenges. The system operates tirelessly, offering a consistent and reliable support

channel 24/7, elevating the customer experience to new heights.

The technology behind our automated help center encompasses the intricacies of the Transformer Model, involving input embeddings, encoder layers, optional multi-head attention, decoder layers, and output layers.

These components work cohesively to generate human-like text responses, ensuring that interactions are not only efficient but also feel natural and personalized. Moreover, this project has demonstrated the potential for significant cost reduction in customer support operations by minimizing the reliance on large human support teams, particularly for routine inquiries. This not only improves cost-effectiveness but also streamlines the allocation of resources to more complex and valuable tasks.

Looking forward, the implications of this project extend beyond the immediate gains in efficiency and cost savings. It underscores a shift in how businesses approach customer support, emphasizing the importance of technological innovation. By creating a system that offers consistent, high-quality support with Generative AI, we have set a new standard for customer service excellence and positioned our organization at the forefront of the evolving customer support landscape.

One of the notable advantages of our Generative AI-powered automated help center is its ability to continuously learn and adapt. The system leverages machine learning algorithms to analyze interactions, identify patterns, and improve response accuracy over time. This adaptability ensures that the automated help center remains relevant and effective in addressing evolving customer needs and inquiries.

Furthermore, the implementation of natural language processing (NLP) techniques enhances the system's understanding of varied and nuanced customer queries. This capability allows the automated help center to handle a wide range of issues, from simple frequently asked questions to more complex and specific inquiries. As a result, customers experience a seamless and personalized interaction, contributing to a positive overall service perception.

In addition to the direct benefits for customer support, our project has implications for data analytics and business intelligence.

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Plant Disease Identification through Image Feature Extraction Technique using MATLAB

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ABSTRACT

Identifying plant diseases involves investigating various aspects of farming, like organic farming, ongoing plant observation, and illness detection. Plant diseases are difficult to manually track on farms that grow completely different crops. This calls for a significant investment of time, a great deal of labor, and knowledge of plant diseases. Accurate disease prediction may be achieved by image processing, complex neural network techniques, and k-means clustering. Image segmentation, data pre-processing, image fragmentation, feature detection, and recognition are some of the techniques used in the disease diagnosis process. This paper has involved the processing of images using feature extraction techniques.

KEYWORDS : *K-mean clustering, Feature extraction, Plant disease.*

INTRODUCTION

Approximately 17 percent of the GDP is derived from farm- ing[1], which employs more than 60 percent of the workforce. In the context of agriculture, the identification of plant diseases is crucial. Indian farming includes crops like wheat, corn, and other crops. Each of these plants is cultivated with the energies of its roots and leaves. The plant disease experiments apply to studies using plants that exhibit clearly observable trends. An essential component of efficiently cultivating plants is managing plant health and illnesses. Plant disease tracking and examination were done manually in the past by someone with experience in this sector. This calls for a great deal of labor and processing time. Plant diseases can be identified using image processing techniques, and two distinct plant diseases can be predicted using algorithms. Research on plants that exhibit clearly discernible trends is covered by the plant disease trials. We have conducted a survey on the many plant diseases and the particular, specialized methods used to diagnose them in this article.

PLANT DISEASE

Plant Diseases

The plant disease severely damages the field and interferes with the physiological operation of the plants. Furthermore, there are numerous ways in which plant diseases might spread to other plants. The signs of each disease can be used to determine whether it is present in the plant may be found in the roots, fruits, leaves, flowers, and stems of the crops, among other parts. Plant diseases can cause unneeded changes to the size, shape, and appearance of fruits, leaves, flowers, and stems.

Plant diseases- Fundamentals

Plant diseases have an impact on both the quantity and quality of agricultural yield, which lowers crop production. Rice is the main food crop in Asian nations. Many methods are created to boost crop productivity in order to meet the demand for rice crops. Since rice is produced on expansive paddy fields, the spread of any disease would have an effect on production. These dangerous diseases infect the plant for a variety of

biological reasons, some of which are stated below:

1) *Bacterial Blight*: Plant diseases are called bacterial blight if they are caused by bacteria. One of the plant diseases that is commonly brought on by bacterial infection is called bacterial leaf spot. Young leaves are primarily affected by this bacterial leaf spot, and the affected leaves looks like a water- soaked, twisted, oily, and black in color.

2) *Fungal diseases*: These diseases have an impact on the soil, yield, and seeds. It makes the plant appear as gray- green patches that are saturated in water. White fungal growths beneath the plant's leaf forms the development of graygreen patches. It causes the leaf surface to expand outward and turn yellow.

3) *Leaf Blast*: The leaf Blast is produced by the fungus Magnaporthe oryzae. The majority of the rice plant's damaged components are those that are above ground, including the col- lar, neck, and sections of the panicle, node, and, occasionally, the leaf and sheath.

4) *Leaf Smut*: Fungi are the source of leaf smut. The whole leaf surface is affected by this disease.

5) *Brown Spot*: A fungal disease called brown spot affects several plant elements, including spikelets, panicle branches, leaves, glumes, leaf sheaths, and coleoptiles.

Image Processing for plant disease

A methodology was proposed by Sethy et al. (2019) to recognize the RBPH (Rice brown plant hopper) on rice stems. An image of a rice stem was obtained using a smartphone. Then, the image processing approach was applied to the cap- tured photos in order to scale the population density of RBPH. Steps including k-means clustering, picture enhancement, and median filtering were carried out for the segmentation. To prevent rice pest infection, farmers can use this software on their Android cellphones.

With the assistance of image processing, Devi and Nee-lamegam (2019) had developed an approach to conduct disease determination in paddy leaves automatically. The DWT, SIFT, and gray scale co-occurrence matrices were utilized to extract features. Then, in order to distinguish between healthy and sick plants, the

collected features were fed to a number of classifiers, including back propagation neural networks, multiclass SVM, KNN, and Naive Bayesian. Additionally, image processing was used to detect diseases and other issues lowering the quality of Malaysian rice.

LITERATURE SURVEY

An approach had been proposed by Sunny and Gandhi (2018) to detect the canker in citrus. The working of an efficient detection method of citrus canker using the Contrast Limited Adaptive Histogram Equalization Enhancement was described. Certain constraints such as weight adjustment, contrast limitation and brightness preservation were met in Histogram equalization. Contrast Limited Adaptive Histogram Equalization (CLAHE) approach is known as the combination of the adaptive histogram equalization and contrast limiting approach. The combined approaches were used at the starting of the pre-processing step for improving the contrast level of images of disease affected leaves. Statistical GLCM and K- mean Clustering were used to perform the segmentation and texture feature extraction respectively. In real-time, computer and medical applications, (CLAHE) was mostly implemented due to the fine statistical estimation results. In contrast with the traditional methods, digital image processing provides more accuracy in the detection of paddy leaf disease. An integrated method, based on image processing technique, was introduced by Bakar et al. (2018) for the recognition of Rice Leaf Blast (RLB). In this work, the HSV (Hue, Saturation, Value) image was employed and also the process such as image analysis, image pre-processing and image segmentation and classification were also performed. In the pre-processing, the activities such as image enhancement, noise restoration and resize of the image were carried out. The original image can be obtained by combining the segmented parts. Ahmad et al. (2017) had offered a segmentation method to identify the disease affected portions in leaf images. The major intention was to improve the previously implemented methods, based on both processing time and accuracy. The steps such as geome- try, artificial bee colony (ABC) and Otsu are involved in this process. The mathematical expressions for global searching and local searching were included via proposed geometry, Otsu and ABC. The performance

of the proposed approach was analysed based on processing time and accuracy. The combination of both Otsu and ABC provided high accuracy in image recognition within short time duration. The calculation based on geometry could produce a lesion area with minor variance difference from the original area than pixel counting.
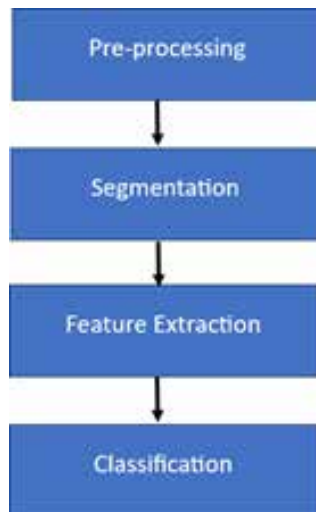
Fig. 1. Process involved in image processing

METHODOLOGY

The image pre-processing is required to boost the values of pixel by removing the various noise in the image, which results in quality enhancement in images. As a result of image enhancement, the required information is manipulated in the image, so that, the user can utilize the required information. The image pre-processing enhance the visual understanding regarding that image. The image processing techniques are categorized into the frequency and spatial domain techniques. In spatial domain techniques, the image pixels were directly manipulated, whilst, in the indirect method manipulation of pixels was performed at the frequency domain. In the fre- quency domain enhancement technique, the kernels or convolution was used to make the transformation. Poor contrast or blur are generally considered to be the weakness in images. Image preprocessing overcomes the above issues and improves the quality of the image.

Machine Learning

In machine learning, Image processing is a method to convert an image into digital form and perform some operations on it. The four types of machine learning are Supervised Learning, Unsupervised Learning, Semi-Supervised Learning, and Reinforcement Learning. Image preprocessing techniques are applied to enhance the quality of the images. This includes noise reduction, contrast enhancement, and image normalization to ensure uniformity in the dataset.

Preprocessing

Contrast level, Intensity level, Histogram equalization are the four pre-processing techniques.

Segmentation

It is the process of partitioning the pixels of an image into groups. The segmentation is to simplify or change the representation of an image into something more useful.

Feature Extraction

In this image can be analyzed by using different parameters such as size, colours.

Classification

The image processing classification system consists of a database that contains predefined patterns which are used to detect and classify in proper category. It is used to develop a statistical characterization of the reflectance in each information class. Dataset is of 1000 images with 13 classes.

Support Vector Machine

SVM is a supervised machine learning models which is used for classification.
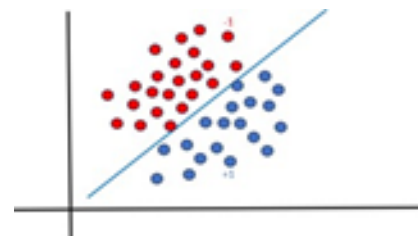
Fig. 2. Support Vector Machine

SIMULATION RESULT

Load Image

The input image is loaded as shown in Fig.3, and preprocessing technique is applied to the loaded image.
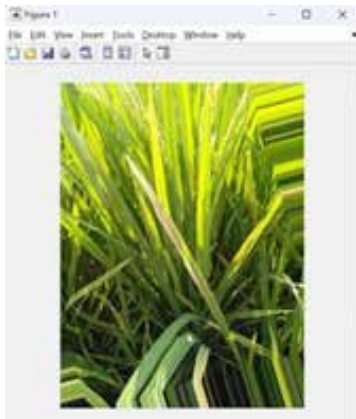
Fig. 3. Input Image

Conversion of input image to RGB

Following fig.4 specifies input image to RGB image.

Fig. 4. RGB Image conversion

Conversion of RGB image to HSV image

Here, fig.5 specifies RGB to HSV image.
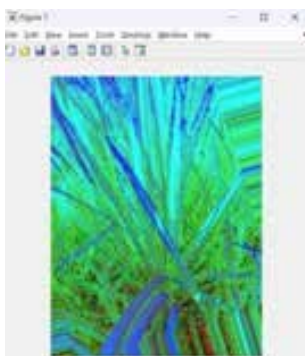
Fig. 5. RGB to HSV

Conversion of HSV image to RGB image

Here, fig.6 specifies HSV to RGB image.

Fig. 6. HSV to RGB

Conversion of image into clusters

After that, three types of cluster images have shown in fig. 7, which is helpful for classifying the disease.

Fig. 7. Cluster image

Performing segmentation

Then in fig.8, segmentation is performed.
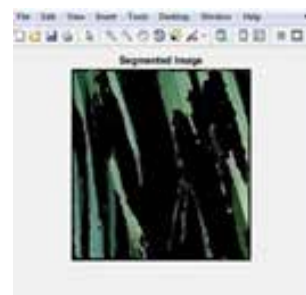
Fig. 8. Image Segmentation

Conversion of gray-scale image

Finally, gray scale image is generated as in fig.9.

Fig. 9. Gray Scale Image Conversion

Generated result

Finally, result is generated as in fig.10.
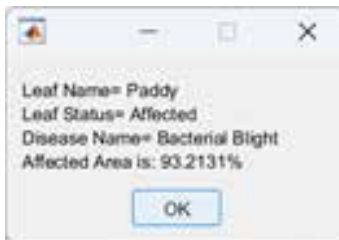
Fig. 10. Result

CONCLUSION AND FUTURE WORK

In the classification and selection procedures, the extracted features are used which tries to help in increasing the farm of production. The proposed method helps to find the plant disease and in monitoring the several environmental conditions. After processing the image in MATLAB, further neural network classification was used to determine the leaf's condition.

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Advanced Car Parking Booking System

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ABSTRACT

The Online Car Parking Booking System is a web-based solution designed to streamline and enhance the process of reserving parking spaces in urban environments. With the ever-increasing number of vehicles on the road, efficient management of parking resources has become a critical need. This system aims to provide a user-friendly and efficient platform for both parking facility operators and vehicle owners to reserve, track, and manage parking spaces. The concise overview in this paper aims to provide a snapshot of the Advanced Car Parking Booking System's functionalities, emphasizing its potential impact on improving the efficiency of urban parking management.

INTRODUCTION

In today's fast-paced and ever-expanding urban landscapes, the quest for a convenient and secure parking spot has transformed into an arduous and often frustrating endeavor for vehicle owners. The Online Car Parking Booking System is a digital platform that leverages the power of the internet and mobile technology to offer a dynamic and responsive solution to the parking woes of today's urban environments. This system revolutionizes the way we perceive, interact with, and manage parking spaces.

Key Components of the Online Car Parking Booking System:

Real-time Availability: One of the system's pivotal features is the ability for users to check the availability of parking spaces in real-time. This means that vehicle owners can now identify open spots, review pricing options, and make reservations, all at their fingertips.

Secure Payment Processing: The system places a strong emphasis on secure payment processing, ensuring that financial transactions are conducted efficiently, safely, and with minimal hassle.

User Reviews and Ratings: The transparency of the system allows users to provide feedback on their parking experiences. This feature promotes trust and accountability within the system, enabling users to make informed decisions.

Booking Reminders: To enhance the user experience, the system incorporates booking reminders, assisting users in keeping track of their reservations and ensuring a smooth parking experience.

Data Analytics: For parking lot operators, the system provides a comprehensive management dashboard. This dashboard offers insights into the performance of the parking facility, including peak hours, popular locations, and revenue projections.

Contactless Entry: Many parking lots integrated with the system offer contactless entry and exit, reducing the need for physical tickets or access cards. This not only enhances convenience but also aligns with the growing trend of contactless services.

LITERATURE SURVEY

The modern world is characterized by rapid urbanization, which has led to increased vehicle ownership and urban mobility challenges. Online Car Parking Booking Systems have emerged as a promising solution to address the pressing issues associated with urban parking. This literature survey aims to explore and analyze existing research and developments in this field, shedding light on the key trends and insights in the realm of online car parking booking systems.

- **"Smart Parking Solutions for Urban Areas: A Comprehensive Review"** - This paper likely reviews a range of smart parking solutions, including those involving advanced booking systems. It may discuss the underlying technologies such as IoT, RFID, or sensors used for real-time data collection. Case studies might be presented to illustrate the effectiveness of these solutions in managing parking in densely populated urban areas. Potential areas of discussion may include cost-effectiveness, scalability, and the integration of these systems with existing urban infrastructure.

- **"Integration of IoT and Mobile Applications in Parking Management"** - The focus here would likely be on the technical aspects of integrating IoT devices with mobile applications. Discussions might revolve around how sensors collect data on parking space availability, and how this information is seamlessly communicated to users via mobile apps. Challenges and solutions related to connectivity, data synchronization, and real-time updates could be addressed.

- **"Machine Learning Algorithms for Predicting Parking Space Availability"** - This paper might delve into various machine learning algorithms employed to predict parking space availability. It could discuss the training of models using historical data, the accuracy of predictions, and how these algorithms adapt to changing patterns in parking demand. Insights into the benefits of using machine learning for optimizing parking space utilization may also be explored.

- **"User Experience in Advanced Parking Booking Systems: A Human-Centric Approach"** - Focused on the end-user, this paper would likely explore the design principles of user interfaces in advanced parking booking systems. Discussions might cover user satisfaction, accessibility for different demographics, and potential barriers faced by users. The study could also touch upon the role of user feedback in refining these systems.

- **"Sustainable Urban Mobility: The Role of Advanced Parking Solutions"** - This paper may analyze how advanced parking systems contribute to sustainable urban mobility. Discussions could include the integration of electric vehicle charging infrastructure, incentives for eco-friendly vehicles, and the reduction of overall carbon footprints. It might also explore how these systems align with broader city-level sustainability initiatives.

- **"Security and Privacy Concerns in Advanced Parking Booking Systems"** - Focusing on the critical aspect of security, this paper could discuss the potential vulnerabilities in advanced parking systems. It might explore the use of encryption, authentication measures, and surveillance technologies to ensure the security and privacy of user data. Discussions on compliance with data protection regulations and user privacy considerations may also be included.

- **"Real-time Data Analytics for Parking Management: A Case Study"** - This case study-oriented paper would likely provide a detailed account of a specific urban area implementing real-time data analytics for parking management. It might discuss the challenges faced, technological solutions applied, and the measurable impacts on traffic flow, reduced congestion, and overall efficiency in parking space usage.

Online car parking booking systems represent a vital solution to urbanization, rising vehicle ownership, and outdated parking infrastructures. Studies indicate that these systems offer opportunities to elevate user convenience, increase transparency, decrease emissions, and streamline parking operations.

PROPOSED METHODOLOGY

The proposed system is an Online Car Parking Booking System, designed to address the challenges of urban parking, enhance user convenience, and contribute to

sustainable urban development. It leverages modern technology to offer a comprehensive solution for both vehicle owners and parking facility operators.

Systems based on the Internet of Things (IoT)

The Internet of Things (IoT) enables many devices in a network to be connected by assigning a unique identifier (UID) to each device. In smart public systems (SPS), IoT technology plays an important role, allowing sensors and devices to transmit data without human intervention.

Communication is facilitated through a variety of communication methods, including telephone and wireless connections. However, addressing security, privacy and data management issues is critical to fulfilling the SPS's role. Finally, IoT integration into public systems transforms these systems into more responsive, flexible and efficient systems that improve citizens' services and quality of life.

Machine Learning (ML) based systems

ML is a part of artificial intelligence that allows machines to learn and improve specific tasks from data or information without the need to clarify the system. In addition, parking systems based on machine learning and artificial intelligence can predict the parking situation in the coming days, weeks or months and offer effective solutions at affordable prices. Machine learning-based technology can monitor traffic on specific roads and provide intelligent solutions for smart parking.

The system is designed to transform city parking from a stressful and time-consuming process to a simple and easy-to-use process. By doing this, it not only solves existing problems but also supports the goal of sustainable urban development and eco-culture.

USE CASE DIAGRAMS

Sequence diagrams – These are used to depict the interplay of several components or objects in a system across time. They show the order in which these components exchange messages or perform actions. The components communicate with one another by sending messages to one another.

User: Initiates the process by accessing the mobile app or website.

System: Receives the user's request and displays the main menu.

User: Selects a preferred parking spot.

System: Validates the selection and presents the details, including pricing and location.

User: Confirms the reservation and proceeds to payment.

System: Processes the payment securely through a payment gateway.

Payment Gateway: Verifies the transaction and sends a confirmation to the system.

System: Confirms the reservation and sends a booking confirmation to the user.

User: Receives the booking confirmation and is now ready to use the reserved parking space.

Control Flow Diagram – The control flow diagram depicts how the user will move through the system as well as how the user's data will move.
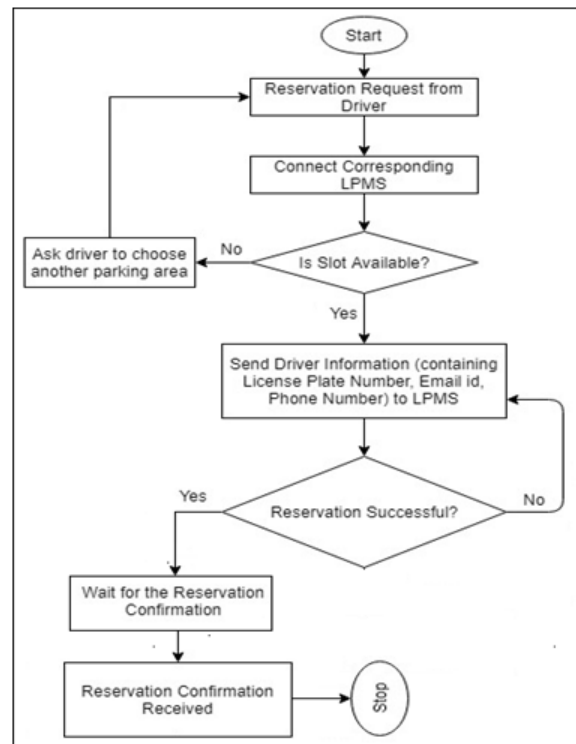
IMPLEMENTATION MODULES

In the preceding section, we delved into the architectural aspects and technical stack associated with the smart

parking system. Now, we shift our focus to the practical implementation and operational workflow of the system in a real-world setting. The entire process, spanning from reserving a parking slot to parking a vehicle and departing the parking area, is elucidated through the accompanying flow chart.

To validate the functionality of our system, we conducted an experiment in the parking facility of a tours and travel company. The following steps outline the process a driver must follow to utilize our smart parking system:

Step 1: Install the Advanced Parking app on your device.

Step 2: Use the application to search for parking spaces near your location.

Step 3: Pick a specific slot.

Step 4: Check multiple parking spaces in the selected parking area.

Step 5: Select the station option.

Step 6: Specify the time in hours when you intend to park your car.

Step 7: Complete the parking fee using e-wallet or credit card.

Step 8: After successfully parking your vehicle in the selected parking lot, confirm your registration via the mobile application.

This comprehensive process not only simplifies the user experience but also optimizes the utilization of available parking spaces. The integration of mobile technology and seamless payment methods enhances the efficiency and convenience of parking for drivers utilizing our smart parking system.

Availability of the slots

V.2. Time for which cars will be parked

CONCLUSION

In conclusion, the development and implementation of online parking represents an important step in solving the complex parking problem in the city. This system not only streamlines the parking process but also enhances user convenience, promotes transparency, and contributes to sustainable urban development. The project's aim to provide a user-friendly platform for real-time parking space reservations has been validated through our investigation.

Moreover, the technical feasibility of the system, leveraging modern technology for data accuracy, privacy, and security, was established. This is further complemented by the system's operational feasibility, ensuring day-to-day functionality that aligns with the needs of urban mobility. With its user-friendly interface, the Online Car Parking Booking System has the potential

to revolutionize urban parking, offering a solution that eases the daily challenges of finding a parking spot, while also contributing to the broader objectives of creating eco- friendly and efficient urban environments. The project aligns with the evolving demands of modern cities, striving for a more convenient, efficient, and eco-conscious urban future.

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Plagiarism: A Menace to the Academics

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ABSTRACT

Writing is the representation of one's thoughts and opinions. Ethical writing comprises one's own writing . The foundation of scholarly communication is academic writing, which serves as a tool for providing information, knowledge dissemination, the expansion of critical thinking skills, and rational advancement. The notion of academic honesty is of utmost significance in this domain. The basic tenets of scholarly discourse are put in danger by plagiarism, the contrast of academic integrity. This article explores the negative effects of plagiarism on a student's academic writing career, looking at broader academic, professional, and personal ramifications that go beyond personal ethics.

KEYWORDS *: Consequences, Ethics, Plagiarism, Research.*

INTRODUCTION

Plagiarism occurs whenever we take an exact content from a source and do not give them credit. In academics, plagiarism has grown to be a significant issue. Manuscript writing is an art. Plagiarism is regarded as an ethical transgression and academic dishonesty. Students frequently hear about plagiarism. It's common knowledge that avoiding plagiarism is important, but what exactly does that mean? Comprehending the exact meaning of plagiarism and its various forms is essential for upholding academic integrity and generating high-caliber, reliable work.

Presenting someone else's work as one's own, especially that of others, is known as plagiarism. Presenting ideas or works from other sources as your own by fusing them into your own compositions without properly citing the original author, whether or not they gave you permission to do so. This definition covers all literary works in manuscript, print, or electronic format, including those that have not yet been published. Plagiarism also includes reusing your own work without giving credit.

Plagiarism violates academic integrity and constitutes poor scholarship. Whether it was intentional or not, plagiarism can have a lasting impact on a future career.

It is the responsibility of the student or researcher to avoid plagiarism. Plagiarism can be avoided by learning to correctly identify ideas, words, images, information, etc. that belong to someone else. Plagiarism is not only unethical but also constitutes a type of theft, resulting in it being a punishable offense. However, there are numerous other reasons why it is imperative to steer clear of plagiarism. Initially, it erodes credibility and has the potential to severely harm one's reputation. For students, this could lead to consequences ranging from a failing grade to suspension or even tarnishing their academic standing completely. Similarly, for bloggers or copywriters, it puts their career at risk and can negatively impact any individual or entity associated with them. Ultimately, regardless of one's background, engaging in plagiarism diminishes trustworthiness. Therefore, it is crucial to comprehend how to prevent plagiarism, whether in an academic setting or as a business professional.

HISTORY OF PLAGIARISM

During the Renaissance, a significant shift occurred in the realm of religious writings. Previously, most of these

writings did not attribute authorship to a specific creator and were often copied and incorporated into other works without restriction. The term "scholarship" itself denoted a deep understanding of the ancient masters. However, this paradigm started to transform as original scholarship gained greater recognition and individual accomplishments were acknowledged across various fields. In 1709, the initial legislation on copyright in English was enacted.

TYPES OF PLAGIARISM

Thorough Plagiarism: The most serious type of plagiarism is complete plagiarism, which occurs when a researcher submits a paper or study that was written by someone else under their own name. It is the same as stealing and intellectual theft.

Self-plagiarism: Writers frequently argue that since they are the ones who created the work, they are free to use it again whenever they like. They also argue that since they are not copying words or ideas from other people, they cannot truly be accused of plagiarism. Although the question of whether self-plagiarism is conceivable is still being debated, self-plagiarism raises important ethical issues, particularly when it comes to publisher copyright violations.

Unintentional paraphrasing

It is the unintentional use of another person's words, phrases, or sentence structure without giving proper credit to the source, or failing to cite the source accurately. This is also called accidently plagiarism.

Source-based plagiarism

Source-based plagiarism can pose a challenge to comprehend. In this type of plagiarism, the author may accurately cite their sources but manipulate the presentation of those sources. An instance of this could be referencing a secondary source in their writing but attributing credit only to the primary source from which the secondary source originated. Additional instances involve citing an inaccurate source or fabricating sources.

CONSEQUENCES OF PLAGIARISM

Social Consequences

Betrayal of Trust: Because plagiarism presents the work of the plagiarist as real and original, it betrays the reader's trust in the author. This betrayal damages the writer's reputation and calls into question the validity of scholarly debate in general.

Academic Standards Violation: Plagiarism goes against the core values of academic scholarship, which include integrity, openness, and intellectual rigour. It ignores the tenets of scholarly inquiry and minimises the value of creative thought.

Educational Growth Stagnation: By denying people the chance to interact with and understand difficult ideas, plagiarism impedes people's ability to advance academically. The learning process that results from in-depth research and critical analysis is lost when someone copies or paraphrases without giving credit.

Loss of Academic Standing: Academic misconduct is a serious offence that can lead to failing grades, course expulsion, or even expulsion from the university. Plagiarism is taken very severely by higher education institutions. One's scholastic record may be permanently damaged by these consequences.

Consequences for Professionals

Damage to Reputation: In the academic community, plagiarism damages a person's reputation. Plagiarism puts academics at danger of losing the respect of mentors and peers, which can have long-term effects on their capacity to work with others, obtain funding for their research, or get jobs in academia.

Legal Repercussions: Plagiarism occasionally gives rise to legal action, especially when copyright is violated. Court cases may be costly, time-consuming, and harmful to a person's professional and academic prospects.

Limited Career Advancement: In academics, plagiarism can impede the growth of one's career. Journals and institutions are looking for people who can contribute novel and creative research. Plagiarism in the past

might make it difficult for someone to get employment, publish in respected publications, or advance in their career.

Impact on the Individual and Psychological Level

Anxiety and Guilt: When people consider the moral and scholastic ramifications of their conduct, plagiarism frequently causes feelings of guilt, anxiety, and stress. The emotional load has the potential to impact mental and general health.

Loss the sense of value: Learning that one has used dishonest methods to succeed academically can cause one to lose their sense of value and self-worth, which can hinder their ability to grow personally and confidently.

RESOURCES AND PREVENTIVE MEASURES

People should use the following tactics to protect their academic writing careers from the negative impacts of plagiarism:

1. We should follow appropriate references and citations

2. We should work hard to develop excellent writing and research skills.

3. We should use software to avoid plagiarism. During the process of researching a subject, it is possible that certain phrases or sentences may become ingrained in your mind to the point where you unintentionally incorporate them into your writing without proper attribution. If you are unsure, employing an online plagiarism detection tool can assist you in identifying and rectifying these problems prior to finalizing your work.

4. We should discuss and take help from the academicians and experts.

5. We should give top most importance to professional ethics.

6. When referencing an idea or language that is not original, it is essential to include a citation in your writing. This citation should include the complete name of the source, the publication date, and any other necessary citation elements as per the style guide you are following.

7. When incorporating a source's exact words into your writing, it is essential to use quotation marks to indicate that the words are not your own. Additionally, it is important to properly cite the source of the direct quote to give credit to the original author.

8. Rather than simply echoing the thoughts or words of your source, delve into your own thoughts on the matter. Consider what original perspective or insight you can bring to your writing that is distinctly yours. Remember that even if you reference the ideas or words of a source to support your argument, you must still adhere to the guidelines mentioned above to prevent plagiarism.

CONCLUSION

Plagiarism in all of its forms is a major threat to academic writing careers of researchers. The consequences of plagiarism go beyond the mere breach of ethical standards and extend to academic, professional, and personal ramifications. Protecting an academic writer's career by maintaining academic integrity, adhering to good research practices, and fostering a culture of integrity and transparency within the academic community are all important steps in protecting a writer's academic career from the damaging consequences of plagiarism in all forms. In the end, a dedication to originality, ethical scholarship, not only protects an individual's career, but it also strengthens the basis for academic research and knowledge sharing.

It is crucial to acknowledge that every scholarship requires a certain level of understanding, researching, and expanding on existing research. For example, undergraduate students frequently rely on selecting, organizing, summarizing, and interpreting the ideas of others to bolster their own academic arguments. Hence, it is essential to acquire the skill of referencing effectively, which entails consciously and explicitly acknowledging the sources utilized in one's work. This ensures that your own contribution can be easily identified and valued. It is imperative to raise awareness regarding plagiarism and ethical concerns within the scientific and authorial communities. Upholding honesty in our endeavors is crucial, and we must adhere

to copyright laws. Stringent measures need to be taken against authors who engage in misconduct, potentially leading to a tarnished reputation and the forfeiture of their academic standing.

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Institutional Preparedness to Implement NEP -2020 with Special Reference to Atharva College of Engineering, Mumbai

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ABSTRACT

Education plays an important role in the success of every individual. It gives proper direction to our journey towards a goal sharpening our skills and different aspects of our personality. Education helps us to be confident and skilful to face any kind of challenges and overcome the obstacles in our way of life. Knowledge in one particular field is not sufficient to sustain in this competitive world. We need to enhance our capabilities and potential by adopting a multidisciplinary approach. Government is keeping all these important aspects in mind and targeting to implement NEP 2020 in curriculum to strengthen the backbone of education. NEP 2020 is a roadmap to restructure the present education system and develop the qualitative and skillful resources to achieve the dream of new India. Atharva College of Engineering, Mumbai has proactively initiated to implement the NEP 2020. This paper highlights the efforts taken at Atharva College of Engineering to implement NEP 2020 and gives exposure to the students to escalate their knowledge and skills.

KEYWORDS : *Multidisciplinary, Skills, Education.*

INTRODUCTION

The Government of India unveiled the historic National Education Policy (NEP) 2020 with the goal of modernizing the nation's educational system to fulfill the demands of the twenty-first century. The National Policy on Education, 1986, and its ensuing revisions are superseded by the NEP 2020. An outline of the NEP 2020's main features is given below:

Holistic and Multidisciplinary Education

The NEP 2020 places a strong emphasis on a multidisciplinary and holistic approach to education, emphasising the development of ethical, socio-emotional, and cognitive skills in addition to academic knowledge. It encourages the curriculum to incorporate the arts, humanities, sciences, sports, and vocational topics in order to develop students' critical thinking, creativity, and problem-solving abilities. - NEP 2020 prioritizes basic literacy and numeracy as essential skills for all students. The goal is to ensure that every child achieves basic reading, writing and math skills by 3rd grade.

It proposes a national mission that focuses on basic literacy and numeracy, and targeted interventions and assessments to monitor progress.

Early Childhood Care and Education (ECCE): - The policy strives to give all children up to the age of six universal access to high-quality pre-school education, acknowledging the significance of ECC. The Higher Education Commission of India will be the primary regulating authority for higher education. Other changes outlined in the NEP 2020 include various entry and exit points, credit transfer mechanisms, and the integration of vocational education. In addition to promoting research and innovation through the creation of research clusters and the National Research Foundation (NRF), its objectives include raising the Gross Enrollment

Ratio (GER) in higher education to 50% by 2035. NEP 2020 offers a shift from routine learning to competency-based assessment methods that assess students' conceptual understanding, application of knowledge, and higher order thinking skills. It recommends a focus on formative and summative assessment strategies to regular feedback, self- and mutual evaluation.

The policy recommends a significant reorganization of the school curriculum, moving to a 5+3+3+4 curriculum structure, with three years of early childhood education (3-6 years old), followed by the main stage (1st-2nd grade), preparatory stage (grades 3-5), intermediate stage (grades 6-8) and intermediate (grades 9-12). It recommends reducing the content of the curriculum to focus on important learning outcomes and promote experiential learning, critical thinking and a multidisciplinary approach.

Foundational Literacy and Numeracy, Curricular Reforms, Assessment Reforms, Technology Integration are also the integral parts of NEP 2020. In order to provide teachers with the pedagogical expertise, subject knowledge, and socio-emotional capabilities they need, the policy places a strong emphasis on the value of teacher training and professional development. It suggests creating a National Mission for Mentoring to offer teachers ongoing assistance and direction throughout their careers. In order to improve access, equity, and educational quality, the policy places a strong emphasis on integrating technology into the classroom. This includes using digital and online materials, educational technology tools, and adaptive learning platforms.

All things considered, the NEP 2020 offers a thorough plan for revamping India's educational system, with an emphasis on quality enhancement, inclusion, adaptability, and equipping students for the demands of the twenty-first century.

SIGNIFICANCE OF INSTITUTIONAL PREPAREDNESS IN IMPLEMENTING NEP 2020

Atharva College of Engineering follows a multidisciplinary approach in regular teaching and learning activities in order to fulfill the guidelines of the NEP 2020 , all the latest technological methodologies are well adopted in the campus so that it is on path with the updated requirements. In learning activities the student is considered as a core in the education process ,giving an emphasis on individual student rather than the group of students in a class , teaching methodologies adopted are through presentation, collaborative learning, cooperative learning, google classroom , teaching- learning activities are in sync with the latest educational trends, thus it helps the students,as it builds a bridge between the educational activities and the industry requirements. ACE always maintains a healthy relationship with the students as well as the parents , value education is always given importance through induction activities for the students which help them to give importance to foster their creativity and embrace the inbuilt skills of a student. An all-round development of personality is developed through various co-curricular activities such as events and competitions at intercollege level. The teaching styles are designed in such a way that it creates an atmosphere to create interest in the given task, techniques such as scaffolding , team teaching, collaborative learning creates a suitable environment for learning.

MULTIDISCIPLINARY / INTERDISCIPLINARY

Atharva College of Engineering has adopted the National Education Policy's vision, which is to deliver high quality education. The core NEP concepts of supporting rational decision-making and innovation, critical thinking and creativity were brought up in a conversation among the faculty members. These principles also included diversity for all curricula and pedagogy with technological advancements in teaching and learning. In light of the NEP, the institute has taken initiative for interdisciplinary courses integrating departments in addition to the already-existing multi/ interdisciplinary academics and research. ACE has set up a Robotic center in order to train students of all departments. The skilled labour force will support the Indian manufacturing sector's adoption of cutting-edge technologies to boost output and quality. Additionally, ACE has established a cutting-edge iMac Lab to train recent graduates in a variety of fields that are essential to the modern digital world, such as cloud computing, multimedia, mobile computing, etc. In addition, the

institute provides a range of multidisciplinary certificate programmes to prepare students for the workforce.

ACADEMIC BANK OF CREDITS (ABC)

Atharva College of Engineering is affiliated to the University of Mumbai wherein we follow the choice based credit system defined by the University. Choice Based Credit System (CBCS) has been implemented as per the University guidelines to support the multidisciplinary approach to engineering problem-solving, the Choice Based Credit System (CBCS) is incorporated throughout the curriculum, including Professional Electives and Open Electives courses. The institute also encourages students to sign up for NPTEL/ MOOCS certificate programmes. The university's definition of the assessment structure is as follows:

Internal Assessment

Atharva College of Engineering follows theory and practical based courses as per University of Mumbai requirements, there are two midterm exams given during the semester. Mini and major projects are evaluated by the department's head, the project coordinator, and an internal guide. On the basis of concept development, project report, attendance, and problem-solving skills, projects are graded. Some of the instructional strategies used by the faculty called Active Learning Methods include: Discussions in groups: This incorporates group discussion to evaluate the application of different concepts and obtain a better understanding of the benefits and drawbacks of the notions. Assignments: Giving students homework can provide them a chance to practise using their critical thinking abilities. Interactive Seminars: Each group in a class will prepare and present a recent research topic or technical facts during their presentation skills hours. Workshops, guest lectures, seminars, and conferences are held annually to advance knowledge and boost the possibility for original research.

SKILL DEVELOPMENT

The institute determines the areas for teachers and students' skill development, it holds brainstorming sessions with academicians and business professionals. The Institute provides skill development courses in the fields including IoT, AI, ML, DL, Robotics, 3 D Printing

and Python in order to stay up with the Industry 4.0 transformation. Based on their areas of interest, students are assigned internships and projects that will help them develop their talents. The institute keeps the track of changing technology skill development of students and faculty.

The Institute focuses on quality standards and conducts periodic reviews to enhance the academic programmes in order to help students develop their technical and soft skills. The institute conducts Spoken English and Personality Development certificate courses during semester break.

INTEGRATION OF INDIAN KNOWLEDGE

In order to integrate the Indian Knowledge System, the Institute has been creating the requisite procedures. The Institute promotes parental learning. The stakeholders including parents and alumni are invited to share their professional and social experiences. The institute organizes annual cultural and technical events where students enhance the creativity. The Institute conducts an annual one-week NSS Camp in rural areas. During the camp students stay in villages, this gives an opportunity to understand rural life and Indian culture. Every year, the institution plans nationwide industrial visits for students, allowing them to experience and learn about the history, traditions, and way of life of many states. Additionally, the institution encourages students to enrol in NPTEL/MOOC certificate programmes where they can take additional courses in Indian languages.

FOCUS ON OUTCOME BASED EDUCATION (OBE)

Atharva College of Engineering implements the Outcome Based Education (OBE) following NBA defined POs for UG programs. Every course has a set of predetermined course outcomes. Course outcomes are determined by subject-matter experts and teaching faculty, and they are formally approved by the Department Advisory Committee (DAC). At the conclusion of the course, students fill out a survey that helps to further hone the COs. The institution abides by the Outcome Based Education (OBE) standards and specifies the lesson plan created by the College

Academic Advisory Committee (CAC), which is made up of the institute's head and the heads of all of the other departments. Writing appropriate COs for each programme course is the first step in achieving COs, POs, and PSOs. The institute requests feedback from stakeholders and IQAC for improvements. According to the new Bloom's Taxonomy, the relevant faculty member will use action verbs of learning levels while writing the course objectives. The institute prepares an academic calendar with extra activities like remedial classes, industrial visits, guest lectures, workshops, faculty development initiatives, and other events. The rubrics are created in order to gauge the outcomes.

DISTANCE EDUCATION/ONLINE EDUCATION

Since Atharva College of Engineering is a private institution affiliated with the University of Mumbai, we cannot provide online or remote learning on our own. In addition to Chalk & Talk and traditional teaching techniques, online teaching methodologies are equally important. To share notes, presentations, and assignments are shared on Google Classroom. Google Forms and the classroom are utilised to administer the tests and objective assessments. Furthermore, the institute organizes online workshops, seminars, conferences, STTPS and guest lectures. The institute began promoting MOOCs in July 2015 and has earned 11058 MOOC certifications by December 2022. The institute has used google meet for online teaching and conduction of university and institute level exams during Covid-19 pandemic. The institute is fully equipped for hybrid teaching mode.

CONCLUSION

NEP 2020 is a new horizon which came with new guidelines and an updated structure which not only enhanced the quality of teaching but the quality of the whole education structure at a great level. It gave learners fresh possibilities and a variety of experiences to use in completing curriculum tasks. A learner represents a nation's economic potential of tomorrow. In response to the NEP, the institute has taken the lead in developing interdisciplinary courses that integrate departments in addition to the multi/interdisciplinary academics and research that are currently in place.

University of Mumbai adopted the Choice Based Credit System (CBCS) throughout the curriculum, including Professional Electives and Open Electives courses, to support the multidisciplinary approach to engineering problem-solving. The Institute encourages learners to think about and identify solutions to the technology they are studying in a problem-solving manner. The Institute has been developing the necessary procedures in order to incorporate the Indian Knowledge System. Parents and alumni are among the parties involved who are invited to discuss their professional and social experiences. The online certification has enhanced the students' curricula by giving them access to new information and providing them with alternative ways to learn.

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In-Depth Exploration: Implementing MLP from Scratch

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ABSTRACT

Multi-layer perceptrons (MLPs) are feedforward artificial neural networks utilized in supervised learning for tasks like classification and regression. Although frameworks such as TensorFlow simplify MLP construction, implementing one from scratch provides invaluable insights. This project created an MLP for binary classification without relying on specialized libraries. Implemented in Python using numpy for mathematical operations, the network comprises an input layer, a hidden layer with a sigmoid activation function, and an output layer. Random weight initialization and backpropagation were employed for training, with dropout for regularization. Training on a binary dataset for handwritten digit recognition showcased core MLP components: forward and backward propagation, weight updates, and regularization. Debugging without library assistance provided valuable experience, culminating in a successful MLP implementation from basic neural network math and Python. This project serves as a practical exercise, enhancing understanding of the internal workings of fundamental deep learning models.

KEYWORDS : *Neural networks, Multi-layer perceptron, Backpropagation, Stochastic gradient descent, Python, deep learning.*

INTRODUCTION

The ever-advancing landscape of machine learning has witnessed the emergence of powerful frameworks and libraries, simplifying the implementation of intricate algorithms. However, this study stands out by charting a course that diverges from established machine learning libraries such as TensorFlow. Focused on the creation of a Multi-Layer Perceptron (MLP) for MNIST classification [1], this research endeavors to construct a neural network entirely from scratch. The primary aim is to delve into the intricacies of MLP architecture (Fig. 1) and training processes, offering a distinctive perspective that enhances our understanding of the fundamental principles that underpin machine learning [3][5][7]. By sidestepping the convenience of popular libraries, this study highlights the educational value inherent in grappling with the intricacies of neural network construction, emphasizing a holistic comprehension of machine learning principles [2]. This introduction sets the stage for a study that not only contributes to the academic discourse but also propels the reader into a deeper exploration of the underlying complexities of machine learning implementation.
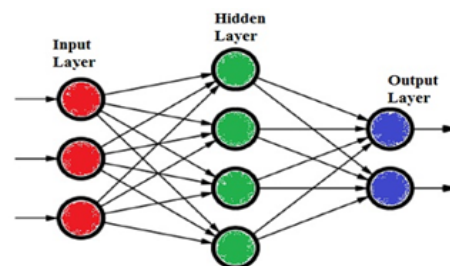
Fig. 1. Basic structure of neural network

LITERATURE REVIEW

The literature survey encompasses a comprehensive exploration of neural networks, shedding light on their architecture, applications, and challenges. One study focuses on the application of multi-layer perceptron (MLP) neural networks for offline handwritten Gurmukhi character recognition, showcasing proficiency in handling intricate scripts [1]. A separate investigation conducts research on image classification algorithms based on Convolutional Neural Networks (CNNs), providing valuable perspectives on the efficacy of CNN architectures [3][7]. Additionally, a study provides a theoretical understanding of CNNs, unraveling key concepts and future directions in neural network theory [4]. Another exploration focuses on convolutional neural networks for image classification, presenting insights into advancements and challenges in this domain [5]. A comprehensive review spans deep learning concepts, CNN architectures, challenges, and applications [7]. Further research delves into the challenges and applications of deep learning in big data analytics, emphasizing the relevance of neural networks [8]. Another survey concentrates on deep learning tools addressing data scarcity, offering definitions, challenges, solutions, tips, and applications [9]. Lastly, a comprehensive overview provides a taxonomy of deep learning techniques and applications, serving as a valuable resource for understanding the broader landscape of deep learning [10]. Collectively, these studies contribute rich insights into diverse applications, architectures, and challenges within the realm of neural networks, enriching our understanding of this dynamic and evolving field [2].

III.   METHODOLOGY

Data Preprocessing

Before feeding the data into the MLP, a crucial preprocessing step is undertaken to normalize pixel values and convert labels into a format suitable for training. This ensures that the input data is appropriately formatted for effective neural network learning.

Neural Network Architecture

The constructed MLP follows a meticulous design, incorporating the fundamental steps of forward propagation. Here, input data traverses through the network, undergoing transformations at each layer, with ReLU as the chosen activation function for hidden layers and softmax for the output layer. The use of ReLU introduces non-linearity, while softmax ensures the model outputs probabilities across multiple classes.

Loss Calculation

Following forward propagation, predictions are compared to actual target values using the cross-entropy loss function. This metric quantifies the disparity between the predicted and actual outcomes, providing a measure of how well the neural network is performing on the task.

Backward Propagation (Backpropagation)

In the backward propagation phase, gradients of the loss function with respect to the network's parameters are computed. This process involves systematically calculating how much each parameter contributed to the overall error. These gradients are crucial for updating the parameters during the subsequent step.

Parameter Updates

Using the computed gradients and a specified learning rate, the parameters of the neural network, including weights and biases, are updated to minimize the loss function. This step is a key aspect of gradient descent or other optimization algorithms, ensuring the model converges towards an optimal solution.

Iteration

The entire process of forward propagation, loss calculation, backward propagation, and parameter updates is repeated iteratively for a specified number of epochs. This iterative process refines the model's performance over time, allowing it to learn complex patterns within the data.

PROPOSED SYSTEM

The proposed system uniquely leverages the absence of external libraries, challenging practitioners to delve into the intricacies of each stage of the machine learning pipeline. The main function code, train_neural_ network, encapsulates the essence of this system, exemplifying how a carefully orchestrated sequence of steps can lead to the successful implementation of an MLP for MNIST classification. The explicit definition

of each component, from parameter initialization to gradient computation and parameter updates, provides practitioners with a hands-on educational experience (Fig 2). This approach, free from the abstractions often provided by libraries, fosters a profound understanding of the inner workings of neural networks.
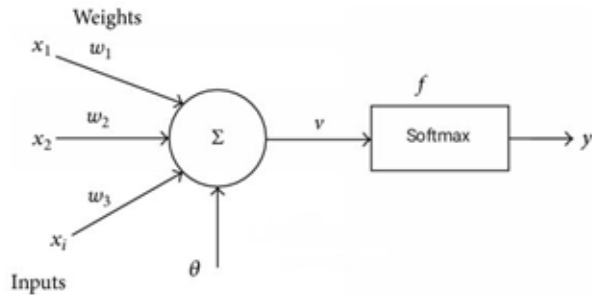
Fig. 2. Single neuron block diagram

RESULTS AND DISCUSSIONS

The performance evaluation of the Multi-Layer Perceptron (MLP) across varying configurations of neurons and hidden layers reveals intriguing insights into the model's accuracy on the MNIST dataset.

Fig. 3. Accuracy using different model configurations

In the first set of experiments, altering the number of neurons in the first hidden layer yielded distinct accuracy outcomes. Notably, with 10 and 64 neurons, the model achieved an accuracy of 86%, but the optimal performance was attained with 128 neurons, resulting in a peak accuracy of 90% (Fig. 3). This underscores the impact of the number of neurons on the model's ability

to capture complex patterns, with a larger hidden layer contributing to enhanced representation capacity.

In the second set of experiments, exploring different combinations of neurons in two hidden layers elucidated additional nuances (Fig. 3). Configurations such as 10 neurons in both layers and 16 neurons in the first layer with 32 in the second demonstrated competitive accuracies of 88% and 81%, respectively. However, the model's performance fluctuated with larger configurations, reaching an accuracy of 86% with 64 neurons in the first layer and 128 in the second. This highlights the intricate balance required in configuring hidden layers, with excessive complexity potentially leading to suboptimal performance.
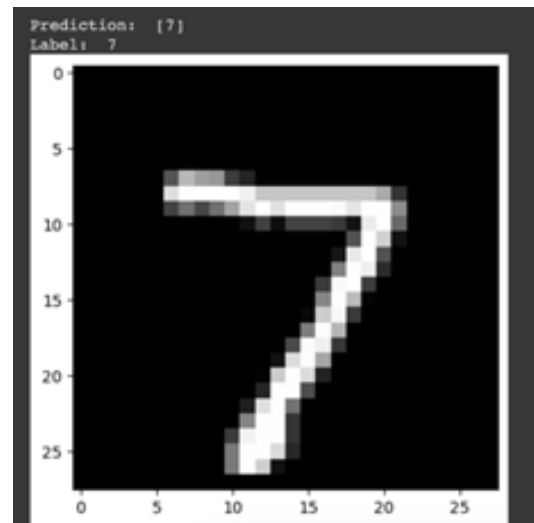
Fig. 4. Final output

The results collectively showcase the sensitivity of the MLP to variations in neural network architecture. The optimal configuration, featuring a single hidden layer with 128 neurons, reinforces the importance of judiciously selecting model parameters to achieve optimal performance. These findings contribute valuable insights into the nuanced interplay between architecture and accuracy in MLPs, providing a basis for informed decision-making in the design of neural networks for image classification tasks (Fig 4).

FUTURE SCOPE

The future scope of this research extends in multiple dimensions. Firstly, exploring the scalability of the manually implemented Multi-Layer Perceptron (MLP)

to more complex datasets and tasks could unveil its potential in diverse applications. Investigating the integration of additional neural network layers, activation functions, and optimization techniques may enhance the model's adaptability and performance. Moreover, considering alternative regularization methods and advanced initialization techniques can contribute to a more robust and generalized MLP. Incorporating parallel processing or GPU acceleration could further optimize training times for larger datasets. Additionally, extending the study to convolutional or recurrent architectures broadens the understanding of neural networks. Lastly, evaluating the MLP's performance on real-world datasets beyond MNIST establishes its practical applicability, emphasizing the model's adaptability and potential for broader adoption in machine learning tasks.

CONCLUSIONS

In conclusion, this research signifies a significant step towards democratizing machine learning understanding by demonstrating the feasibility of implementing an MLP for MNIST classification without relying on popular libraries like TensorFlow. The absence of such frameworks not only highlights the importance of understanding each intricate step in the machine learning process but also serves as an educational tool for aspiring practitioners. The provided main function code stands as a testament to the viability of constructing a neural network without external dependencies. As machine learning continues to evolve, this study contributes to the academic discourse surrounding the educational aspects of machine learning implementation. Future work may explore extending this approach to more complex datasets and architectures, further enriching the educational landscape of machine learning.

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A Survey on Automatic Disease Detection using AI ML Techniques

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ABSTRACT

Machine Learning and Deep learning techniques are playing vital role in early detection of disease. Advancement in the CNN algorithms with the help of image processing and segmentation techniques with computer aided disease diagnosis have become the most important method for doctors as a helping tool for early disease detection. This paper survey's different diseases classification techniques based on pattern recognition, segmentation and lesion detection in medical imaging domain. Paper mainly survey's on diabetic retinopathy, breast cancer and COVID detection using computer Aided Diagnosis and gives overview on algorithms, datasets, imaging modalities and current trends and opportunities.

KEYWORDS : *Computer aided diagnosis, Medical imaging, Diabetic retinopathy, Breast cancer, COVID, Deep learning.*

INTRODUCTION

Machine Learning (ML) and Deep Learning (DL) algorithms have become an integral part of automatic computer aided diagnosis enabling them to predict and classify disease in early stage [1]. ML plays magnificent role in medical imaging with the large spectrum of dataset and training can easily classify the image whether it's normal image or diseased image [2]. Medical imaging represents a advancing research field crucial for the early diagnosis and treatment of disease. The role of image processing has a major impact on the segmentation of features and decision making, relying on predictive analysis. It enhances feature extraction and precision, contributing to improved accuracy [3]. Diagnosis of medical conditions poses a significant challenge within the realm of machine learning. The abundance of available medical data with ground truths serves as a valuable resource for constructing ML models. Within medical research, a scoring prediction system is used to anticipate the risk of disease among patients [4].

Automatic disease detection refers to the use of advanced technologies, particularly artificial intelligence (AI) and machine learning (ML) algorithms, to automatically identify and diagnose various medical conditions from diagnostic data such as medical images, clinical notes, and physiological signals. This approach offers several benefits, including improved accuracy, efficiency, and scalability in healthcare delivery. Here's how automatic disease detection is transforming medical practice:

Medical Imaging

In radiology, AI algorithms analyze medical images such as X-rays, CT scans, MRI scans, and ultrasound images to detect abnormalities and diagnose diseases. For example: AI can detect lesions indicative of cancer in mammograms, helping radiologists identify breast cancer at an early stage. AI algorithms can analyze chest X-rays to detect pneumonia, tuberculosis, or other pulmonary conditions. AI-powered software can segment and quantify brain lesions in MRI scans for the diagnosis and monitoring of neurological disorders like multiple sclerosis.

Pathology and Histology

AI-based image analysis is used in pathology to assist pathologists in diagnosing diseases from tissue samples and cytology slides. For instance: AI algorithms can analyze histopathology slides to identify cancerous cells, classify tumor subtypes, and assess tumor grade and stage. AI systems can detect abnormal cells in Pap smears and cervical biopsies, aiding in the early detection of cervical cancer.

Dermatology

AI-driven image analysis is employed in dermatology to diagnose skin conditions and assess skin lesions. Examples include: AI algorithms can classify skin lesions in dermoscopy images and differentiate between benign and malignant skin tumors. AI-powered smartphone apps enable users to conduct self-assessments of skin conditions, providing preliminary diagnoses and recommendations for further evaluation by healthcare professionals.

Ophthalmology

In ophthalmology, AI is used to analyze retinal images, OCT scans, and visual field tests for the detection and monitoring of eye diseases such as diabetic retinopathy, glaucoma, and age-related macular degeneration. For example: AI algorithms can identify signs of diabetic retinopathy, such as microaneurysms and hemorrhages, in retinal photographs, enabling early intervention to prevent vision loss. AI-based systems can analyze OCT images to detect structural changes in the retina associated with glaucoma and other retinal diseases.

Remote Monitoring and Telemedicine

Automatic disease detection enables remote monitoring of patients' health status and facilitates telemedicine consultations, particularly in underserved or remote areas. For instance: Wearable devices equipped with AI algorithms can continuously monitor physiological signals such as heart rate, blood pressure, and glucose levels, alerting users and healthcare providers to abnormal findings. Telemedicine platforms integrate AI-based diagnostic tools to facilitate remote consultations and triage patients based on their symptoms and medical history, enabling timely intervention and referral to specialists when necessary.

Integration with Electronic Health Records (EHR)

AI-driven disease detection systems can seamlessly integrate with electronic health record (EHR) systems, providing healthcare providers with real-time access to diagnostic data, clinical decision support, and predictive analytics. This integration enhances care coordination, facilitates data-driven decision-making, and improves patient outcomes. In summary, automatic disease detection leveraging AI and ML technologies offers significant potential to enhance healthcare delivery by enabling early diagnosis, personalized treatment, and remote monitoring of medical conditions. By leveraging the power of data-driven insights and advanced analytics, healthcare providers can improve patient care, optimize resource allocation, and ultimately save lives.

In this paper we review on importance of AI-ML techniques in medical imaging domain for computer aided diagnosis of disease. Additional we have focused on three diseases which are diabetic retinopathy, breast cancer and COVID-19. Flow of the paper includes, SECTION I includes basics and background of AI-ML techniques, SECTION II gives background of diseases with imaging modalities used during disease detection including Datasets related information. SECTION III briefs about generalized process of computer aided disease detection with performance metrics and last SECTION IV focuses on summary, conclusion and future scope.

LITERATURE REVIEW

Automatic disease detection using AI (Artificial Intelligence) and ML (Machine Learning) techniques involves the application of advanced algorithms to analyze medical data and identify patterns indicative of specific diseases [9]. This approach has the potential to improve diagnostic accuracy, reduce human error, and enhance the efficiency of healthcare systems. Here is a theoretical overview of the key components and steps involved in automatic disease detection using AI and ML techniques:

Data Collection: Medical Imaging Data: Collect high-quality medical images such as X-rays, MRIs, CT scans, or pathology slides. These images serve as input data for training the AI models.

Clinical Data: Gather relevant clinical information, including patient history, symptoms, and laboratory test results, to provide a comprehensive dataset.

Data Preprocessing

Image Preprocessing: Clean and enhance medical images to remove noise, standardize pixel values, and improve overall quality.

Feature Extraction: Extract meaningful features from both images and clinical data. This step involves identifying relevant characteristics that contribute to disease identification.

Data Labeling: Annotate the dataset with labels indicating the presence or absence of specific diseases. This labeled dataset is crucial for training supervised machine learning models.

Model Selection: Choose an appropriate machine learning algorithm or deep learning architecture based on the nature of the data and the complexity of the problem. Convolutional Neural Networks (CNNs) are commonly used for image-based disease detection.

Model Training: Train the selected model using the labeled dataset. During training, the model learns to recognize patterns and features associated with different diseases.

Validation and Hyperparameter Tuning: Validate the model using a separate dataset not used during training to assess its performance. Adjust hyperparameters to optimize the model's accuracy and generalization.

Evaluation: Evaluate the model's performance using metrics such as sensitivity, specificity, accuracy, precision, and recall. These metrics help assess how well the model can correctly identify instances of the disease.

Deployment: Integrate the trained model into the healthcare system for real-time or batch processing. This may involve creating a user-friendly interface for healthcare professionals to interact with the AI system.

Monitoring and Updating: Continuously monitor the model's performance in real-world scenarios. Periodically update the model with new data to adapt to evolving patterns and ensure continued accuracy.

Ethical Considerations and Regulatory Compliance: Address ethical concerns related to patient privacy, data security, and bias in AI models. Ensure compliance with regulatory standards and guidelines for medical applications of AI.

Examples of diseases that can be detected using AI and ML techniques include cancer, diabetes, cardiovascular diseases, and neurological disorders. The success of these systems relies on the availability of high-quality and diverse datasets, robust algorithms, and collaboration between healthcare professionals and AI experts.

Diabetic Retinopathy (DR)

Diabetes is a prevalent global health condition characterized by elevated blood sugar levels beyond the normal range. As per the survey done by International Diabetes Federation diabetes affect all organs of the body and first organ affected by diabetes is eye of the person suffering from diabetes leading to retinal diseases like Diabetic Retinopathy [5]. Retinal Images i.e. fundus images are considered for automated diagnosis of DR, fig. 1 shows the sample of retinal image taken from IDRiD dataset [6]. For detection of DR segmentation of normal retinal features and abnormal features should be correctly done to classify image into DR and Non-DR. Normal retinal features of retina are nothing but optic disc, macula , blood vessels and abnormal retinal features include microaneurysms, hemorrhages, exudates and uncontrolled growth of blood vessels leading to neovascularization [3]. DR is considered as a silent disease and leads to vision loss hence early detection of disease will help doctors and patients to detect disease at the beginning stage. The most commonly used ML techniques for detection of DR are convolutional neural networks CNN, U-Net algorithm, and region based CNN etc [7]. Popular datsets used for retinal imaging are STARE, DRIVE, MESSIDOR, IDRiD, DIARETDB0, DIARETDB1, and Kaggle APTOS etc which are available publicly with ground truths like DR classification data, segmentation [9].

Breast Cancer

Breast cancer is mostly seen in 40 years old ladies and also marked a 2nd leading cause of death [10].

Computer aided diagnosis focuses on analyzing suspicious are differentiating as benign and malignant tumor. Fig. 2 shows the sample images of distinct types of breast cancer history [11]. Digital mammography is widely used imaging for breast cancer detection. The most commonly used datasets are BreaKHis dataset, Bioimaging Challenge 2015 dataset etc. CAD follows image preprocessing to remove noise followed by segmentation using CNN and then classification of disease [11].
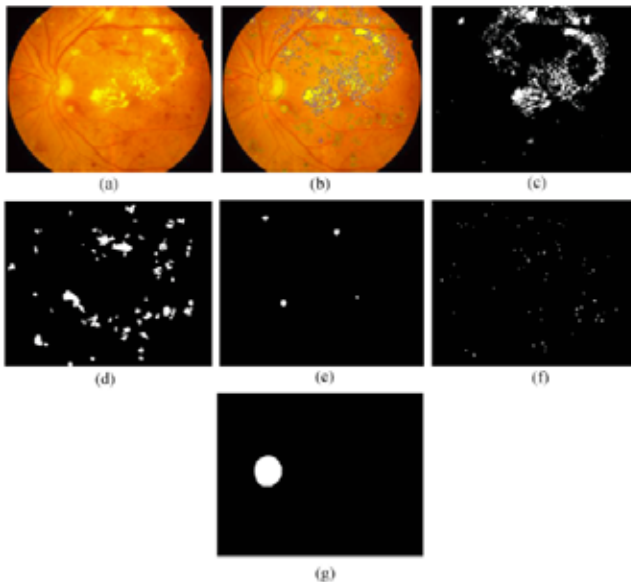
Figure 1: Retinal Images from IDRiD Dataset (a) Sample Fundus Images (b)groundtruth markups (c-g) sample ground truths of hard exudates, hemorrhages, soft exudates, microaneurysms and optic disc respectively[7]
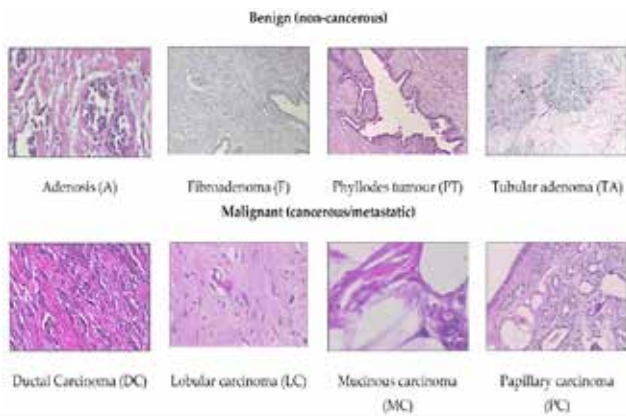
Figure 2: Sample images of cancerous and non-cancerous histopathalogy from BreakHis dataset [12]

COVID-19

The novel coronavirus disease attacks on respiratory system causing viral infection in lungs. Lungs X-ray images and CT scan images are mainly considered for early detection COVID.As dataset availability is the main part in detection of any disease and due to less data more focus is given on fine tuning or transfer learning which includes AlexNet, ResNet18, InceptionV3 etc[13].

Figure 3: Sample images of chest X-ray from kaggle dataset

PERFORMANCE METRICS

The main aim of computer based diagnosis it's very important that classification of image should be done properly that diseased image and normal image should be classified properly. Generalized block diagram of disease detection as shown in fig. 4.
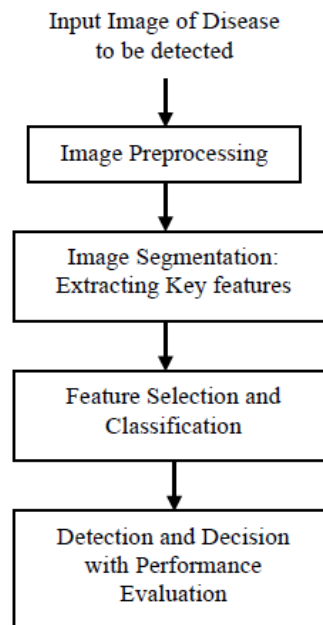
Figure 4: Generalized block diagram of Comaputer Aided Disease Detection

There are four main performance measures followed which are sensitivity, specificity, accuracy. This depends on True Positive (TP), True Negative (TN), False Positive (FP) and False Negative (FN) nothing but parameters implying number pixels.

A. Sensitivity : Represents how accuractly image is classified as disease or non-disease image.

$$Sensitivity = Tp/(TP+FN)$$

B. Sepcificity :Represents how accurately image is classified as disease image.

$$Sepcificity = Tn/(TN+FP)$$

C. Accuracy: Represents correct classification rate.

$$Accuracy = TP+TN/No.\ of\ Samples$$

CONCLUSION AND FUTURE SCOPE

In this paper we have focused on how computer aided diagnosis for Diabetic Retinopathy, Breast Cancer and COVID-19 giving brief idea about techniques used with imaging modalities and datasets availability. AI-ML techniques have become important part of day to day life and likely in disease detection. There are many advantages like early and accurate detection of disease with telepathy disease detection. The main drawback is imbalance dataset as AI-ML techniques output is completely dependent on training the model with data. In future more focus can be given on creating large datasets.

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Forensic Face Sketch Construction and Recognition

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ABSTRACT

In the realm of computer systems, face reconstruction holds immense significance and finds applications in various domains such as forensics, entertainment, and healthcare. This article presents a novel approach to face reconstruction by leveraging sketches and deep learning techniques. Our methodology involves training a neural network with drawings created by human artists to generate a lifelike 3D representation of a face. The key advantage of our method lies in its ability to achieve precise and efficient face reconstruction without the requirement of complex 3D scanning equipment or extensive manual labor. To enhance the robustness and accuracy of the model, we employ deep learning techniques like convolutional neural networks (CNNs) and generative adversarial networks (GANs), along with data augmentation techniques such as rotation, scaling, and translation of the input sketches. Additionally, we incorporate prior knowledge about facial anatomy and features to guide the reconstruction process.

KEYWORDS : *Face reconstruction, CNNs, GANs, Data augmentation, Deep learning, Two step verification.*

INTRODUCTION

The captivating fusion of art and science lies at the heart of sketch-based face reconstruction. This process involves constructing a three-dimensional representation of a face using a two-dimensional sketch or drawing. The applications of this technology are vast, spanning from forensic investigations to the realm of entertainment. If you have an interest in delving deeper into the world of face reconstruction through sketches, the following introduction will provide an excellent starting point[1].

This endeavor is driven by a multitude of practical, artistic, and technological factors. Its primary aim is to enhance the accuracy of investigations by improving identifications based on eyewitness sketches. Furthermore, it holds great potential in addressing cases of missing persons and cold investigations by

transforming incomplete sketches[2]. However, it is important to encourage collaboration between artists, researchers, and experts while also addressing ethical issues such as privacy and exploitation. This collaboration is essential for the responsible development and use of this technology [2][3]. This collaboration is essential to ensure the responsible development and deployment of this technology.

Deep learning models for face reconstruction from sketches commonly consist of two key components: an encoder network and a decoder network. The encoder network takes a 2D facial drawing as input and encodes it into a feature vector. Subsequently, the decoder network utilizes this feature vector to generate a 3D model of the face[1].

Various methods in Networks such as Convolutional Neural Networks (CNN), Recurrent Neural Networks

(RNN), and Generative Adversarial Networks (GANs) are used to create encoder and decoder networks. Some models also incorporate additional information, such as facial landmarks or texture details, to enhance the quality of the resulting 3D face model[17].

The process of reconstructing and identifying faces has a long history, stretching back to ancient times. During this period, artists would painstakingly create sketches and portraits by hand in order to capture the unique characteristics of individuals. These artists would dedicate themselves to refining their abilities, skillfully translating the three- dimensional aspects of human faces onto two-dimensional surfaces[22].
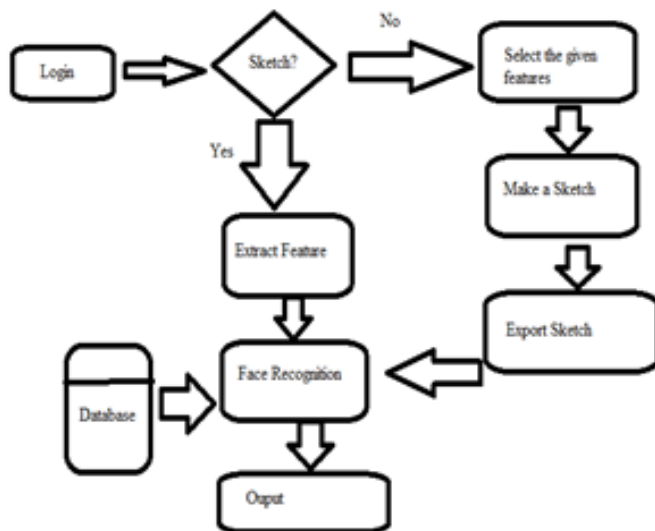
Figure 1. Flow Chart of the Methodology Used

BACKGROUND AND RELATED WORK

Experiments have been carried out by researchers employing methods to construct and distinguish facial sketches. Respected scientists have devised a software application for generating and recognizing facial visuals. At first, the system was intricate and perplexing, much like the technique itself. Nevertheless, they subsequently embraced an approach wherein the individual in question could select from a collection of faces that bore a striking resemblance to the suspect. Subsequently, the system would amalgamate these chosen characteristics to produce images for the purpose of identification.[1] The results were encouraging: 5 out of 6 faces were identified correctly, and when witnesses

created the faces with the help of department staff, the exact result was 23.9%, compared to 23.9% when witnesses tried. The success rate when collecting these is 19.4%.

The study of computing has demonstrated a keen interest in the process of reconstructing facial images from sketches. In computer vision applications, such as law enforcement and digital entertainment, the technique of synthesizing features from sketches has garnered growing attention.[2] This innovative approach utilizes superpixel-based face reconstruction by estimating structures through segmentation.

The initial approach [3]to carrying out such reconstruction is presented by previous research, which is based on face sketches, shape, and texture instructions of a sketch or image. This method utilizes local features to recreate faces from sketch images. Facial reconstruction is a widely used biometric method for identifying an individual, where the facial features in a provided photo or sketch are compared to digitally recorded photos. Analyzing the identity of criminals using their hand-drawn or composite sketches is one of the significant applications for facial reconstruction.

An image can be translated from one domain to another via image-to-image translation. The objective is to understand the link between translation and several image domains[6]. Testing many proposed models on various datasets, including painting style and season transfer datasets, produced positive results.

LRBP, a novel face descriptor, has been developed in a cited study to directly compare face images and sketches of different types [7][8][9]. LRBP was inspired by the resemblance between the shape of a face photo and its corresponding sketch, even when the sketch is exaggerated. In order to expedite the creation and identification of facial composites, researchers have explored methods to reduce the time required by law enforcement. They have also constructed a small composite database to facilitate identity matching. Furthermore, the possibility of improving the efficiency of automated face forensic sketch matching through incremental learning from previous instances of facial amnesia has been investigated. Despite its significance in law enforcement, the identification of forensic facial sketches remains an unresolved challenge..

Near-infrared (NIR) cameras are utilized to capture images that are most suitable for human eyes. An instance of a composite sketch-to-photo matching technique that merges visual saliency and textural features is provided. Gender and ethnicity data are incorporated to enhance recognition performance. Drawings from various artists or diverse specialties are blended together. [20].

REQUIREMENTS AND PRELIMINARIES

It is crucial to gather a diverse and extensive dataset of facial images. This dataset should encompass various poses, lighting conditions, and expressions in order to effectively train a robust model. Commonly used datasets include LFW, CelebA, and CASIA-WebFace. However, it is important to note that deep learning models for face reconstruction and recognition can be computationally intensive.

In order to train and infer efficiently, access to powerful GPUs or TPUs is essential. Additionally, deep learning frameworks such as TensorFlow, PyTorch, or Keras are necessary to implement and train your models. Furthermore, libraries like OpenCV, which specialize in computer vision tasks, can be beneficial. Leveraging pre-trained models like VGG-Face, FaceNet, or ArcFace can significantly accelerate the development process and enhance performance. An annotation tool is also useful for creating a dataset or annotating existing data with facial landmarks.

Before creating a system, the first and foremost step is to formulate the problem. It is crucial to clearly define the problem that you aim to solve. Additionally, preparing the dataset by cleaning and resizing images, normalizing pixel values, and augmenting the dataset with transformations such as rotations, flips, and noise addition is essential.

To detect and extract faces from images, you can utilize pre-trained face detection models such as Haar cascades, Single Shot Multi-Box Detector (SSD), or Faster R-CNN. For face recognition, you can employ a pre-trained model or a custom deep neural network to extract facial features. Convolutional Neural Networks (CNNs) are commonly used for this purpose. To enhance the dataset, you can annotate it with ground truth labels, including facial landmarks, identity labels, or reconstruction targets.

When it comes to choosing a suitable deep learning architecture, popular options include CNNs, Siamese networks, and GANs (Generative Adversarial Networks) for face reconstruction, and CNNs with soft-max or triplet loss for recognition. You should train the selected model using the prepared dataset. Fine-tuning a pre-trained model with your dataset is a standard practice that often leads to improved results

To optimize the model's performance, you can experiment with hyperparameters such as learning rate, batch size, and network architecture It is important to evaluate the model using appropriate metrics like accuracy, precision, recall, F1-score, or Mean Squared Error (MSE) for face reconstruction.

Cross-validation can be useful in estimating the model's generalization ability. Finally, when deploying the model in a real-world application, optimize it for inference speed and seamlessly integrate it into the target system.

The Concept of Deep learning has been instrumental in the recent progress made in face identification. Nevertheless, the application of deep learning techniques in sketch face recognition poses challenges due to the scarcity of face photo-sketch data. Fortunately, the rapid development of sketch-to-image translation systems has enhanced the investigative procedures within law enforcement agencies. [17].

PROPOSED MODEL

The deep learning-based model proposed for facial reconstruction and recognition signifies a significant breakthrough in the fields of computer vision and artificial intelligence. This comprehensive model seamlessly integrates image reconstruction and facial recognition, providing a flexible solution for various applications. By utilizing convolutional neural networks (CNNs), it effectively captures intricate facial attributes, enabling it to comprehend and depict the distinctive features of every individual's face. Moreover, the model's capacity to reconstruct facial images from these representations not only enhances image quality but also proves valuable in domains such as facial super-resolution and forensics.

In addition, the deep learning model performs exceptionally well in facial recognition tasks by converting facial characteristics into embeddings of fixed length. This allows for accurate comparison and identification of individuals. Through the integration of these capabilities, the suggested model offers a sophisticated blend of deep learning and computer vision techniques, poised to transform the manner in which we comprehend and engage with facial data.

The face reconstruction model that has been proposed comprises of five layers. These layers are constructed in a sequential manner, each with its own set of responsibilities. The proposed model is presented in Figure 2 Each of the steps has the designated responsibility as presented below.
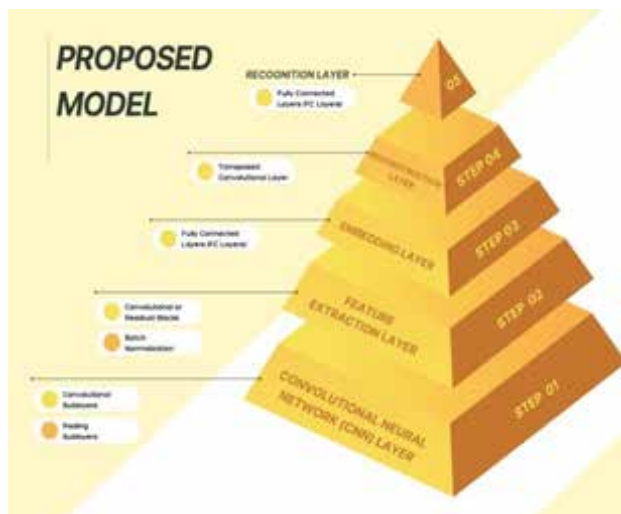
Figure 2. Layered model of the proposed Face Reconstruction

Convolutional Neural Network (CNN) Layer

Convolutional Sublayers: A collection of trainable filters is utilized to apply convolution operations to the input image, aiming to extract features. The sublayers comprise Convolutional layers with various types and quantities of filters. Following the convolutions, activation functions such as ReLU (Rectified Linear Unit) [20] are applied.

Feature Extraction Layer

Convolutional or Residual Blocks: These blocks consist of several convolutional and activation layers arranged together. The sublayers consist of stacks of convolutional layers [22] with progressively larger receptive fields.

Batch Normalization: It is utilized after the convolutional layers to ensure stable training..

Embedding Layer

FC Layers are employed to transform the feature map into a fixed-length embedding vector. Dense layers, which are one variety of FC layers, are responsible for mapping high-dimensional feature vectors to lower-dimension embeddings. Following the dense layers, activation functions like ReLU or sigmoid [22][23][24] are applied. In addition, batch normalization layers are utilized for regularization..

Reconstruction Layer

The Decoder sublayer, known as the Transposed Convolutional Layer, is responsible for reconstructing the face image using the embeddings. Within this sublayer, there are Transposed convolutional layers that upscale the embeddings to match the size of the original image.

Recognition Layer

Fully Connected Layers (FC Layers) are responsible for calculating similarity scores between embeddings for face recognition. Within these sublayers, Dense layers are utilized to process pairs of embeddings, such as those from two different faces. The Dense layers then compute a score for the similarity between the embeddings, which can be accomplished through methods like cosine similarity or a dot product calculation [24][25].

RESULT SECTION

In the outcome section, two types of results are displayed in Figure 3 and Figure 4. These graphs depict data that presents a sequence of comparisons between a collection of images, with the objective of evaluating the precision of a matching algorithm.

In the initial case, 200 images were assessed as depicted in Table 1. Out of these, 186 images were accurately matched while 14 images remained unmatched. Consequently, the image matching process demonstrated a commendable accuracy rate of 93.8%, highlighting its high effectiveness.

In the second case, where 200 images were involved, there were 187 successful matches and only 13 images that could not be matched. Despite a slightly lower accuracy rate of 93.5%, this scenario showcased the algorithm's ability to proficiently identify images..

In relation to the third situation, an extensive collection of 300 images was analyzed, resulting in 276 successful matches and 24 unmatched images. The algorithm demonstrated a commendable accuracy rate of 92.6%, further solidifying its dependability in managing larger datasets.

In the fourth scenario, a different batch of 300 images underwent analysis. In this instance, the algorithm successfully matched 282 images, leaving only 18 unmatched. The accuracy rate for this particular scenario reached an impressive 94.5%, signifying the algorithm's exceptional performance in identifying image matches.

Table 1. Result on Images Match to Sketch

Sr. No.	Sum of Images	Image Matched	Unmatched Image	Accuracy
1.	200	186	14	93.8%
2.	200	187	13	93.5%
3.	300	276	24	92.6%
4.	300	282	18	94.5%
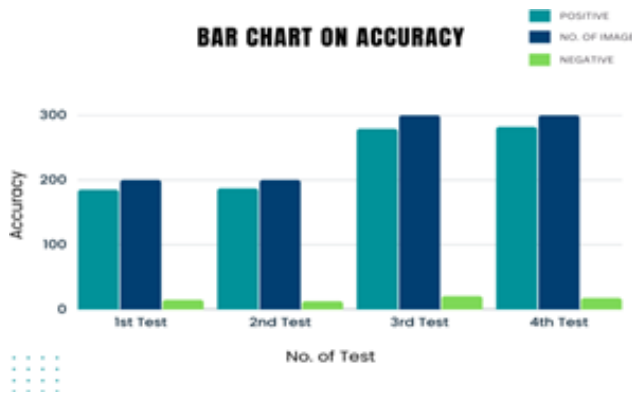
Figure 3. Bar Chart Graph Result on Accuracy

CONCLUSION

To summarize, the incorporation of deep learning techniques into face reconstruction and recognition has opened up a realm of possibilities in computer vision and biometrics. These models, characterized by their multi-layered structures and advanced algorithms, have demonstrated impressive abilities in extracting, representing, and reconstructing facial attributes. The simultaneous accomplishment of image reconstruction and recognition within a single model highlights the adaptability and effectiveness of deep learning in tackling intricate tasks. This technology has been applied across various domains, encompassing security, surveillance, user authentication, and personalized user experiences. Nevertheless, it is imperative to consider the ethical and privacy implications associated with such technology, while also emphasizing the necessity for continuous research to enhance accuracy, fairness, and robustness.

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AR in Medicine is an Emerging Technology

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ABSTRACT

an AR technology's interactive example called augmented reality adds computer-generated perceptual data to the physical world. Augmented reality is the process of superimposing digital content such as apps, software, and hardware like AR onto actual locations and things.AR helps to improve the experience, augmented reality overlays a virtual. For an example the popular mobile game, where players explore their actual neighborhoods in pursuit of animated figures that appear on their phones or tablets.

AR APPLICATION

Through a device like a smartphone or glasses, augmented reality (AR) provides the user with visual elements, sound, and other sensory information. AR device use this data to produce an immersive experience. The ability to create distinctive digital experiences that combine the greatest aspects of the digital and physical worlds is the main benefit of augmented reality. Furthermore, no additional hardware or software is required to fully enjoy the experience. The use of augmented reality in healthcare has enormous promise [1]. Technology has the potential to improve healthcare accessibility and lower costs for millions of people. Health awareness, disease outbreaks and preventions, diagnosis, maintenance and training for medical equipment, treatment and therapy planning, patient monitoring, lifestyle enhancement, and patient care are among the issues that technology may help with. Augmented reality has a lot of potential to change medicine as technology advances. The surgical room, dentist office, emergency department, and general care clinic might all use augmented reality at some point. For example, it might be used by medical professionals to schedule intricate procedures like plastic surgery. Additionally, they might utilize it to direct them during different types of procedures. Using a headset equipped with a display that the doctors could see through to the patient, the augmented reality technology was used. It enabled them to simultaneously view images from CT scans and X-rays, for example, by projecting them onto the body. It appears as though surgeons have X-ray vision as long as those pictures are perfectly aligned. With the ability to provide whole new kinds of treatments and diagnostics as well as alter how and where care is provided, augmented reality and virtual reality, or AR/VR, have the potential to completely change the health care industry [2]. Their ability to remotely offer both standard and completely new sorts of content in extremely immersive and realistic ways, customized to a range of therapeutic scenarios, is essential to their potential in diagnosis and therapy. AR/VR can be used by doctors, patients, and caregivers to assist in treatment planning and execution. The future of healthcare and medicine is being altered by AR and VR, but AR is affecting things in a different way. Through the use of a virtual reality headset, virtual reality technology produces a three-dimensional world that fully isolates the user from reality; in contrast, augmented reality allows users to maintain contact with reality and comprehend information as soon as possible.

AR can be used to help patients comprehend their treatment options, show how a medical equipment works, or

illustrate the effects of a medicine. By raising patient comprehension and participation, this can result in better outcomes and patient satisfaction.

By giving doctors real-time access to patient information and vital signs, augmented reality (AR) and virtual reality (VR) technologies are improving remote consultations and making the experience more immersive and educational for both patients and healthcare professionals. In the past, clinics mostly employed AR and VR for medical training and diagnostics, but now days; they also use it for treating chronic pain and mental health issues. They can also assist in faster medical equipment repairs and the mapping of the human body.

KEYWORDS : *Augmented reality (AR) and virtual reality (VR) technologies, Perceptual data, Superimposing digital content, Therapeutic scenarios, Telementoring, telecommunication.*

INTRODUCTION

With the use of digital data, augmented reality (AR) technology expands the user's perception of reality. It's now a widely talked-about subject in our culture and an ideal area for developing new medical app categories. AR is used in various facets of medicine. One of the reasons for the rapid development of augmented reality (AR) and virtual reality (VR) is the rising stress in public health systems, which has led to a high demand for aiding systems.

Augmented reality (AR) and virtual reality (VR), in conjunction with computer vision and artificial intelligence, are revolutionizing the healthcare sector as a result of the growing usage of linked devices. Surgeons may now view patient vitals throughout a procedure without having to turn away by donning an AR-enabled head-mounted device, which eliminates the need for them to gather data from various displays [3]. By doing this, surgeons can reduce the likelihood of errors resulting from incorrect reading and/or interpretation of the data. When asked to accurately describe their symptoms to their doctors, patients frequently find it difficult. In other instances, people can find themselves downplaying or exaggerating a medical issue in response to a situation. Augmented reality could be the solution for patient education in ophthalmology. It is common knowledge among physicians and patients alike that surgical precision is crucial. AR can now improve a surgeon's surgical efficiency. AR healthcare apps can be used to locate liver tumors and perform minimally invasive procedures, respectively, saving lives and facilitating patient care.

Augmented reality has gained popularity across a number of industries, and its significance has been growing. Numerous studies have also been done on its medical applicability [4]. In particular, augmented reality may be a more viable method for extremely precise surgeries. An overview of augmented reality is presented in this study along with a discussion of its current medical uses. Following an explanation of the fundamental ideas, a brief description of each of the three parts that make up augmented reality is given. Augmented Reality (AR) refers to a method of fusing virtual objects—computer-generated digital content—with the real environment .Since registering virtual and real-world objects is another facet of augmented reality, its goal is to estimate the three- dimensional (3D) position of virtual objects in relation to the real world. As a result, AR can let users see 3D virtual items overlaid on the actual environment. By engaging with the actual world, augmented reality (AR) in medicine can enable surgeons glimpse hidden organs inside a patient's body and enhance their understanding of the treatment process. It was suggested to use a surgical navigation system to direct the intervention of chronic complete occlusion. The experience of the surgeon and the 2D X-ray pictures are crucial factors in conventional intervention for chronic complete blockage of the coronary artery. As a result, differences in the patient's position or orientation from the collected images may result in significant displacements in the surgeon's hand-eye coordination. An embedded camera on a tablet PC was part of the AR system for bone tumor resection surgery, which allowed for tool and patient tracking. The tablet PC also showed AR visualization. It consists just of a tablet PC and multi-faced reference markers without the need for an external optical tracking device. The positions of the patient and tool reference markers are tracked and realized by the tablet camera. The paired point registration method was used to accomplish registration between the patient and the 2D camera

image. Four to six artificial and anatomical markers were matched before calculating the transformation to align two point sets [5]. Then, using the perspective n-points algorithm, their relationships between the camera and markers are defined depending on the registration. Due to the benefits offered by AR technology, several programs have been successfully implemented in the medical field. Broadly speaking, these can be divided into two subgroups. The first is a treatment program that assists patients and physicians in hospitals and clinical settings through treatment, rehabilitation, and surgery. The second includes training programs designed to support teaching and learning outcomes in university academic environments.

Figure 1. The main goals of augmented reality in medical education

AR-based learning can support student experiences; it is not surprising that this can lead to improved learning outcomes. Students who successfully complete learning activities supported by AR programs are likely to improve both their theoretical knowledge and practical skills. AR-based learning increases outcomes in several important aspects of training, including subject matter knowledge, cognitive and practical skills, social skills, innovation, competence, and creativity. Here, we focus on the impact of AR-based programs on student experiences and learning outcomes in relation to her three impact areas: knowledge and understanding.

LITERATURE REVIEW

The popular research topics, important writers, academic institutions, nations, and journals were identified and examined using a bibliometric approach to the scientific literature on VR and AR research in medicine.

Additionally, we wanted to identify and characterize the subjects and illnesses that VR and AR researchers most frequently study.

In the past ten years, augmented reality (AR) has become a useful tool in the medical field for improving simulation learning and data visualization. Augmented reality (AR), which has mostly been investigated for collaboration and communication in non- health contexts, may influence future remote medical services and training. In order to offer health care professionals and technology developers with a basis for understanding future potential in remote care and education, this review analyzed previous studies employing AR in real-time telemedicine and telementoring. Studies using augmented reality (AR) in telemedicine and telementoring showed how the technology may improve information access and make advice easier in a variety of healthcare settings. However, there is still a lack of thorough research in many disciplines and provider-to-nonprovider uses, making it difficult to confirm AR's potential as a substitute for existing telecommunications platforms or even face-to-face interactions. Larger longitudinal and randomized controlled trials have been difficult to execute due to the early stage of technology development, lack of standardized tools, and acceptance issues. However, more research comparing current methodologies may provide greater insight into this intersection. All things considered, augmented reality (AR) has the potential to enhance and supplement remote medical care and learning, presenting special chances for patient, provider, and innovator interaction.

One of the key components of telemedicine is remote medical communication, which originated with the idea of using phones to transfer data across hospital systems. Remote health care visits and interventions have been made possible since the invention of the internet and portable gadgets, and as new technology advancements are made, the breadth of care will also grow [6]. As of right now, there isn't any literature that summarizes AR's uses in synchronous telemedicine, which is the term for using electronic devices to communicate in real-time while receiving medical care for patients A subset of telemedicine called telementoring refers to the real-time remote supervision of medical operations or abilities. The provision of remote access to care and

expertise through telementoring facilitates the exchange of specialized knowledge.

The ability to have a more thorough grasp of the human body is AR's greatest benefit. It makes practical instruction easier by enabling students to practice surgery in a secure setting. This fills up the gaps between theoretical understanding and real-world proficiency. Doctors find that augmented reality greatly aids in patient diagnosis and treatment. It can simplify difficult-to- understand medical pictures, such as those from MRIs and CT scans. This improves the accuracy with which doctors can diagnose illnesses. Moreover, AR aids in better treatment planning for physicians. It can, for instance, illustrate how a medication might effect a patient's physiology, enabling doctors to adjust the medication or dosage as necessary. AR can create intricate 3D brain images from CT scan data when combined with machine learning algorithms. This 3D image can be shown to the surgeon as guidance.

As a result, AR facilitates the interpretation of medical CT scan images to better grasp the condition and lay the foundation for surgical procedures. The intricate network of veins that distribute blood to various body areas is referred to as the body's venous system. It's quite difficult to meander through them because of the quantity and interweaving of the veins. This makes drawing blood samples challenging. However, medical practitioners can see the skin's vein beneath the surface thanks to AR hand-held scanners. A combination of hardware, software, and sensors are used in augmented reality (AR). A gadget with a camera and sensors, such a smartphone or AR headset, is the first step in the process. While the sensors gather information about the user's position and orientation, the camera records the user's perspective of the real world. The user's location and the locations of virtual objects in the real world are ascertained by the software through the analysis of sensor data and camera input. After that, it aligns the digital content with the real world by rendering and superimposing it over the live camera stream. The illusion that the virtual things are actually present in the user's environment is produced by the merging of real and virtual aspects. A dynamic and immersive experience is made possible by the user's ability to move the device and interact with the virtual

items through touch or gestures in augmented reality. In general, augmented reality improves our understanding of reality by incorporating interactive features and a digital layer of information into our surroundings.

METHODOLOGY

Expanding knowledge and understanding with AR

Due to the benefits offered by AR technology, several programs have been successfully implemented in the medical field. Broadly speaking, these can be divided into two subgroups. The first is a treatment program that assists patients and physicians in hospitals and clinical settings through treatment, rehabilitation, and surgery. The second includes training programs designed to support teaching and learning outcomes in university academic environments. This review focuses on the latter of these two categories and explores how key features of this technology have been used to develop or improve knowledge, learning, and skill outcomes.

AR is beginning to make a significant contribution to this overall goal, with several cohort studies showing that using AR-based tools to teach practical procedures such as surgery is an effective way to improve practical competencies in medical education and training. It has been confirmed that it contributes to the improvement of students' skills and practical abilities. These programs can also support the performance of the actual surgical procedure itself, overlaying patient-specific anatomical information obtained from image scans, such as during spinal surgery.

With the introduction of AR, virtual oral tissue models reconstructed from images of the mouth can be superimposed on the patient's corresponding organ locations, improving doctors' visual systems and improving surgical techniques [6]. At the same time, the internal structure of oral drugs becomes more clear and intuitive, reducing blind spots and difficulties in oral repair and oral surgery, improving surgical success rates and benefits to patients. During surgery, AR tracking and positioning technology can be used to track the doctor's position in the surgical scene, the viewing angle and direction of the head in real time, and control the repair/surgical operation in real time. In oral medicine, the AR system needs to calculate the camera pose based on the feature information of the actual surgical scene,

obtain the transformation matrix between the oral cavity virtual model and the visual plane, and identify the overlay position of the oral cavity virtual model. To prevent excessive registration errors during operation, the entire AR system must be able to determine the exact registration location of the virtual model using a discriminative tracking algorithm. However, in real applications, the AR surgical system technology has very high registration accuracy and stability.
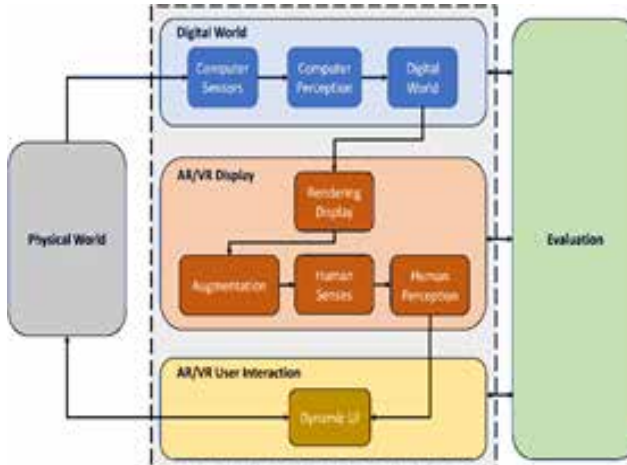
Figure 2: Medical AR example

AR system utilization

AR systems cannot be realized simply by modeling and reconstructing the digital world based on the physical world. The AR system must convert this internal representation into valuable enhancement messages that can be communicated to the user. This is achieved by presenting the augmented digital world in a way that users can understand. Rendering and display in AR is not limited to creating images to display on a screen. In addition to visual representations, audio or tactile representations can also be included. An important advantage of such programs is that they allow easy manipulation of digital objects and the ability to identify and explore spatial relationships in three-dimensional space. For example, from an anatomical perspective, this allows complex branching neural and vascular pathways to be studied in isolation, but these structures lose shape when separated from the surrounding tissue that supports them. This is difficult with conventional cadavers because of the loss of It also makes it easier to learn the names of different anatomical structures,

as you can select areas/structures of interest and access various other information about them. In education, knowledge retention is difficult. Medical students often learn intricate anatomy and structures from texts or illustrations. In certain more resource-rich educational institutions, however, students may also get the opportunity to dissect real cadavers. However, because it is difficult to visualize the 3D interaction between components based on 2D materials, the paper-based learning materials may lead to misunderstandings. Real-world cadavers, which are valuable teaching materials, are scarce and subject to stringent storage regulations due to health and safety regulations.

Since some institutions have little to no equipment and spaces designated for the new technologies, augmented reality has been introduced to the educational sector to create a learning experience that facilitates with industrial systems that are expensive and complex to acquire. Along with different learning theories like constructivism, social cognitive theory, creates connections, and activity theory, there are several aspects and interactions of augmented reality that are significant for application in educational settings. This work's primary contribution is the creation and implementation of a methodology for creating augmented reality mobile applications that incorporate graphic, abstract, and tangible levels as a part of a macro learning procedure. This allows for the creation of a novel teaching-learning approach, the test of the created augmented reality mobile application, and the experiential storyboard (it's important to note that we are the first to establish this new idea). According to an experiential storyboard, the user must first go through the sensation of manipulating a real or virtual object while receiving instructions in plain language. Following that, a storyboard is created that encompasses every aspect of the user experience and serves as the starting point for the highly anticipated mobile application software development process.

It is important to note that the criteria utilized in the abstract level of planning heavily rely on the graphical aspects that have been defined at this point [6]. Hardware, software, and design components that must be employed prior to, during, and following the practice, software, or project's planning and execution are referred to as requirements. These specifications are

essential to guaranteeing the outstanding performance, design, and visualization of the application. The experiential storyboard that results from all of the orders and actions required to complete the procedure set forth for the mechatronic prototype will be the level's output.

This research aims to offer a framework for subjective quality assessment and examine current approaches for evaluating Augmented Reality (AR) visualization. Since the advent of these technologies, methodologies have been developed to evaluate the quality of AR systems. Most of the current approaches borrow from the domains in which they are applied, such as psychophysics, ethnography, usability, ergonomics, or usability. Different techniques are used in each field to examine various aspects of AR quality, including tracking jitter or loss, hardware constraints, perceptual problems, and feedback concerns, to mention a few. Augmented reality (AR) systems are multifaceted experiences that include audio, visual perception, haptic feedback, visual perception, and other multimodal interactions.

When compared to more conventional forms of guidance, such paper-based instructions, many augmented reality apps have favorable outcomes in terms of task performances and user cognitive effort. The most noticeable benefit of employing AR systems is the reduction of mental workload. Additionally, the AR frequently enhances task performance. On a LEGO assembly assignment, evaluated the effectiveness of AR training against manual training. The completion time and error rate for both genders of participants have improved, according to the data. used the learning curve of a truck assembly task to illustrate the advantages of AR in terms of completion time and accuracy.

Figure 3: Mixed realities in medicine

AR technology brought up the possibility of using these technologies for patient education toward the conclusion of his talk. Thanks to technological advancements, they and their loved ones may now make more informed decisions about their medical care by having a greater understanding of their ailments. Many sectors are interested in adopting and utilizing augmented reality (AR) technology as they have become more widely available. The health and medical fields are one area in particular that is actively interested in AR. Although augmented reality (AR) and health has been the subject of numerous studies, there is a wide range in the conceptualization of AR and the application of AR in these studies.

FEATURES OF THE PROJECT

Through the provision of an interactive and personalized means of obtaining financial services and information, augmented reality in banking improves the client experience. Envision a future in which banking is not limited to physical locations or even the screen of your smartphone. Augmented reality provides perceptually rich experiences and is used to improve natural environments or situations. Advanced augmented reality technologies (such as object identification, computer vision, and AR camera integration with smartphone apps) enable users to interact with and manipulate their immediate environment digitally. The actual world has information about its things and surroundings superimposed on it. This data may be digital in nature. Any artificial experience that enhances the reality that already exists is known as augmented reality.

In contrast to virtual reality (VR), augmented reality (AR) adds virtual things to the real world, whereas VR just involves parts of the surrounding environment being "real." Conversely, the virtual reality environment is entirely computer-generated and virtual. Augmented reality games are a good way to see how AR superimposes objects onto the actual world. With users may conceal messages in actual settings through an augmented reality game application. AR technology makes it possible for users to conceal messages anywhere in the world. There are a lot of purposes for these applications in the world, like artistic expression and advocacy.

With the help of technology, the actual world may be expanded with items and digital content like text and photos thanks to augmented reality (AR), which blends virtual aspects with real-world data. The user interacts with virtual things integrated into the real world minimally since their attention is still on the physical environment.

Figure 4: Role of augmented reality

Manufacturing applications stand to gain significantly from augmented reality in the future. AR, for instance, is helping in a number of sectors, including worker training, where virtual experiences and digital twins may help employees comprehend and react to critical events in an immersive setting.

AR reality, also known as cross-reality or extended reality is a technology that lets users overlay real-world data on what they can see. Specialized headsets or wearable technology along with a display and AR software provide this experience. This technology is currently widely employed in industry and has been used for a long time in military settings. With the use of wearable technology, assisted reality solutions enable a multitude of tasks, such as maintenance and inspection, by giving the operator access to all the necessary information.

While both augmented reality and assisted reality have applications in the industrial sector, they are two distinct technologies. AR brings computer-generated digital content into the real world to create an interactive experience, whereas AR offers pertinent virtual aspects within a real context. While augmented reality (AR) and augmented reality (AR) are both extended reality solutions, assisted reality is a more useful tool for remote

access and is still more applicable in some sophisticated industrial applications. Either way, both can raise the processes' quality standards and provide significant advantages in production environments. One of the most intriguing developments in digital health technology today is augmented reality and virtual reality, which has the potential to dramatically transform the medical field for both patients and doctors.

Both virtual reality and augmented reality in healthcare profoundly change how we perceive things. But augmented reality is not the same as its most well-known "relative," virtual reality (VR), which creates a 3D world and fully removes the user from reality by having them wear closed VR headsets. Instead, augmented reality allows the user to remain in their current reality while adding virtual information to it. Put more simply, augmented reality adds a new level of complexity to medicine and healthcare. Although augmented reality and virtual reality will both have a significant impact on healthcare and medicine in the future, augmented reality is distinct in two ways: it allows users to retain their sense of reality while presenting information to them as quickly as possible. Because of these unique qualities, augmented reality has the potential to revolutionize medicine in the future. In the case of augmented reality, the rise in data and technical advancements has naturally led to the application of technology in healthcare and medicine.

COMPARISON TABLE

Table 1

Paper Title	Author	Year	Notable Findings
Analysing AR and VR application	Mohammed Jaboob, Abdullah M. Al- Ansi	Oct. 2019	Challenges faces implementatio n of AR and VR include high cost,
Augmented Reality, Virtual Reality and their effect on learning style in the creative design process	Tilanka Chandra-sekera, Oklahoa	Nov.2020	AR can be thought of as overlaying of the virtual over the physical environment.

Augmented Reality, Virtual Reality and their effect on learning style in the creative design process			
Comparative research of AR technology	Tushar Goel, Jonathan Y. Goh and J. Christian Gerdes	Oct. 2020	The research on evaluation of these two technologies and putting forward optimization program based on the user experience is quite unwonted.

Virtual reality has been widely applied in learning settings. AR technology is increasingly being adopted for mainstream application as it becomes more widely available. AR is the overlaying of the virtual over the real world, whereas VR is typically understood as an immersive three-dimensional computer-generated environment. Virtual reality (VR) is a computer-generated three-dimensional environment that can imitate the actual world or function as a fantasy setting. Virtual environments may accommodate the senses of hearing, touch, smell, and even taste, even though most of them are designed to appeal to the visual sense. VR is frequently utilized as a research, teaching, and entertainment tool. Virtual environments present a plethora of alternatives and opportunities for doing study, particularly in the field of human behavior.
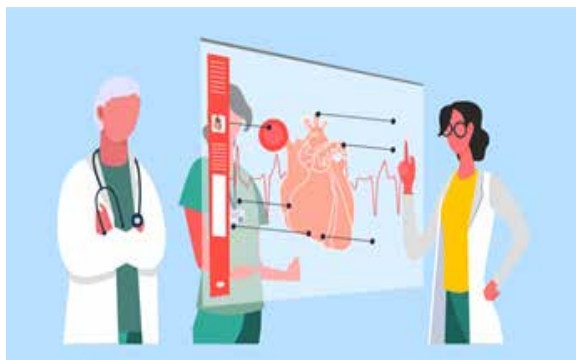
Figure 5: AR trends and prediction

Since its introduction, augmented and virtual reality has made a significant impact on the world last year. In addition to touching the emotions of smartphone users, these technologies attracted the interest of both established and up-and-coming businesses, prompting business owners and marketers to consider investing in the creation of AR and VR apps.

Leaders of AR VR development companies and VR AR developers, however, will be eager to talk about the possibilities of working together in the future. They will investigate how sophisticated machine learning algorithms and other AI approaches may help computers and other devices comprehend and effectively visualize data. Healthcare and medical professionals can now "swipe" between all three technologies within the same application thanks to their merger. Professionals benefit from increased productivity and efficiency as well as the opportunity to enjoy the advantages of several use cases concurrently. While augmented and virtual reality will continue to permeate a variety of markets and corporate operations, including gaming, commerce, and entertainment, education is the one sector that will see the most significant expansion in the years to come.

CONCLUSION

The application and future directions of augmented reality in medical technology, including wearable computers and AR gadgets, are covered in this study. It provides researchers interested in creating augmented reality apps for medical use with a foundation and an overview of current technology. Although there is a promising trend in the use of AR, the field of medicine is still in its infancy and has not yet seen widespread adoption in clinical practice, despite extensive study in the area.

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Artificial Intelligence in Ophthalmic Disease Screening

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ABSTRACT

Artificial intelligence has significantly advanced in the field of ophthalmology, particularly in the prevention of vision loss associated with various eye ailments. Rapid progress has been observed in the development of artificial intelligence applications dedicated to preserving vision in the face of ocular diseases. These applications leverage computer programs to perform tasks while emulating human cognitive processes, frequently employing machine learning techniques within the realm of ophthalmology. The integration of digital methods such as fundus photography, and optical coherence tomography has further fueled the potential of artificial intelligence in ophthalmology. Conditions affecting vision, including, age-related macular degeneration, diabetic retinopathy, glaucoma, and cataracts, have been targeted by artificial intelligence interventions. This paper focuses on how early detection of ophthalmic diseases using artificial intelligence is.

KEYWORDS : *Artificial intelligence, Eye disease screening, Diabetic retinopathy, Diabetic macular edema, Glaucoma, Cataract.*

INTRODUCTION

Artificial intelligence (AI) uses computational methods to perform multiple operations. Synthesizing this information using AI technologies helps in early analysis of data leading to early conclusion [1]. AI is divided into three classes' i.e AI performing theoretical task which acts likes human. Second is narrow general intelligence which works like human but in narrow range and third is artificial super intelligence which advance and works in all activities [2].

Ophthalmic disease screening refers to the process of identifying individuals who may be at risk of developing eye diseases or conditions, with the goal of early detection, intervention, and treatment. This screening is crucial for preserving vision and preventing vision loss, as many eye diseases are asymptomatic in the early stages but can lead to irreversible damage if left untreated. Here are some key aspects and methods of ophthalmic disease screening:

Importance of Screening

Regular ophthalmic disease screening is essential for maintaining eye health, especially as many eye diseases, such as glaucoma, diabetic retinopathy, and age-related macular degeneration, progress slowly and may not present symptoms until irreversible damage has occurred. Early detection through screening allows for timely intervention and treatment, which can help preserve vision and prevent or slow down the progression of eye diseases.

Risk Factors

Screening programs often target individuals with specific risk factors for eye diseases, such as age, family history, medical conditions (e.g., diabetes), lifestyle factors (e.g., smoking), and occupational hazards (e.g., prolonged screen time or exposure to UV radiation). Understanding these risk factors helps healthcare providers identify individuals who may benefit from ophthalmic disease screening and tailor screening protocols to their needs.

Screening Methods

Visual Acuity Testing: Visual acuity testing using an eye chart (e.g., Snellen chart) is a simple and commonly used screening method to assess central vision and detect refractive errors such as myopia, hyperopia, and astigmatism.

Intraocular Pressure Measurement: Elevated intraocular pressure is a key risk factor for glaucoma. Screening for glaucoma often involves measuring intraocular pressure using tonometry, such as applanation tonometry or non-contact tonometry.

Ophthalmoscopy: Direct or indirect ophthalmoscopy allows healthcare providers to examine the back of the eye, including the optic nerve head, retina, and blood vessels, for signs of retinal diseases, such as diabetic retinopathy, hypertensive retinopathy, and age-related macular degeneration.

Optical Coherence Tomography (OCT): OCT imaging provides high-resolution cross-sectional images of the retina, allowing for the early detection and monitoring of retinal conditions, including macular edema, macular holes, and vitreoretinal interface disorders.

Fundus Photography: Fundus photography involves capturing images of the retina using specialized cameras. It is useful for documenting retinal findings, monitoring disease progression, and facilitating telemedicine-based screening programs.

Automated Visual Field Testing: Automated perimetry assesses the sensitivity of peripheral vision and is commonly used to screen for and monitor glaucoma and other visual field defects.

Retinal Screening Programs: Population-based retinal screening programs, particularly for diabetic retinopathy, aim to identify individuals with diabetes who are at risk of vision loss due to diabetic eye disease. These programs often utilize digital retinal imaging and telemedicine platforms for remote interpretation and management of retinal images.

Frequency of Screening

The frequency of ophthalmic disease screening depends on various factors, including age, risk factors, and the presence of underlying medical conditions. For example, individuals with diabetes may require annual diabetic retinopathy screening, while older adults may undergo regular comprehensive eye exams to monitor for age-related eye diseases.

Integration of Technology

Advances in technology, such as telemedicine, artificial intelligence, and mobile health applications, have enabled innovative approaches to ophthalmic disease screening, including remote monitoring, automated image analysis, and patient education. These technological tools have the potential to enhance the accessibility, efficiency, and cost-effectiveness of ophthalmic disease screening programs, particularly in underserved and remote populations.

Ophthalmic disease screening plays a critical role in the early detection and management of eye diseases, ultimately preserving vision and improving patients' quality of life. By utilizing appropriate screening methods and targeting high-risk populations, healthcare providers can effectively identify individuals at risk of eye diseases and implement timely interventions to prevent vision loss.

AI-ML technologies continuously helping in medical domain in early detection of disease with the help of natural language processing or using machine learning analyzing data for data science or using image preprocessing techniques to get more clarity on images for further analysis [3]. Detection of ophthalmic disease screening using deep learning focuses on two ways, first is use of appropriate convolutional neural network consisting of multiple layers and the extracting features as per disease requirements and other way is opting artificial neural network which are based on self-learning pattern [4]. In the modern age of clinical diagnostics and treatments, there's a need for smart tools to handle medical data safely and effectively. AI is being used in many different areas of medicine to meet this demand. This paper survey's application of AI-ML in leading eye diseases where early diagnosis is extremely important such as Diabetic Retinopathy (DR), Diabetic Macular Edema (DME), Age related macular degeneration (AMD), glaucoma and cataracts.

Imaging modalities used in Opthalmic Disease Screening

In clinical diagnosis and tailoring personalized treatments for eye diseases, medical imaging plays a crucial role. This technology offers detailed insights into both anatomical and functional changes with high resolution. In recent times, there has been swift progress in imaging techniques, paralleled by advancements in therapeutic approaches [4].

* **Fundus Photography** is a usual eye-imaging method where special cameras capture enlarged pictures of the retina. These detailed images help in keeping track, diagnosing, and planning treatments for eye problems. Many studies have explored using AI technology along with Fundus Photography for diagnosing, grading, and monitoring eye diseases. It is widely used in detection of Diabetic Retinopathy [5]. Fig. 1 shows the fundus photocopy of a retinal image taken from IDRiD dataset [6].

Figure 1 Typical Fundus Image of human retina suffering from DR

* **Optical Coherence Tomography (OCT)** is photographic techniques used in detection of DME and AMD. OCT uses optical images without touching or invading the eye. It gives a lot of information about the shape of the retina and helps diagnose different macular diseases. About thirty million OCT procedures are done each year in eye care, a number similar to other medical imaging like MRI or CT scans. OCT algorithms can be split into tasks: classifying things and segmenting or separating them. When using proper segmentation,

a DL algorithm can pick out and outline the structures or problem areas in OCT scans. Then, it gives the sizes of these abnormal regions, like their surface areas or volumes. Fig. 2 shows the OCT retinal image [7] [8].
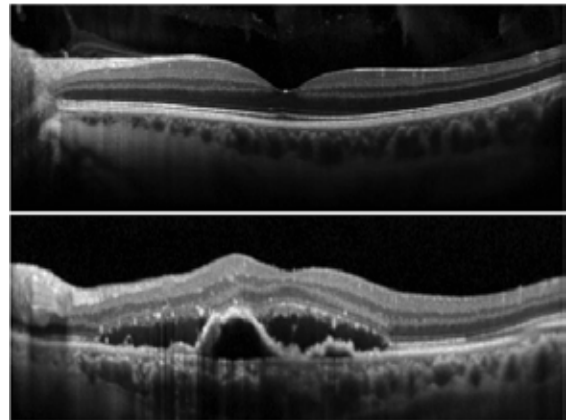
Figure 2:Typical OCT Image of human retina 1st line image of normal retina and 2nd line image with AMD retina

Table 1: Publicly available datsets of fundus and OCT images

Imaging Modalitiy	Dataset	Objectives
Fundus	APTOS-kaggle [7]	DR
Fundus	IDRiD [6]	DR,DME, segmentation of blood vessels, optic disc
Fundus	MESSIDOR [8]	DR,DME
OCT	Fang et al. [9]	AMD
OCT	Farsie et al. [10]	AMD
OCT	Kermany et. Al [11]	DR,AMD
Fundus	HRF [12]	Glaucoma
Fundus	Xu et al. [13]	Cataract

DIABETIC RETINOPATHY (DR)

DR, a common eye issue linked to type 1 diabetes, is the main complication for those with long-term diabetes, often leading to vision loss. It starts with subtle signs like neuro-degeneration and tiny blood vessel issues, progressing to more apparent symptoms in later stages. While AI systems like EyeArt and Bosch DR are used

for screening, more research is needed to improve their accuracy. Spotting and treating diabetic retinopathy early is crucial to prevent vision loss in people with diabetes. [14].

DIABETIC MACULAR EDEMA (DME)

DME, a kind of diabetic retinopathy, happens due to high blood sugar affecting the eyes, leading to changes in the retinal blood vessels, inflammation, and lack of blood supply. Because the macula is at the center of the retina and vital for sharp vision, increased leakage or fluid can seriously reduce central vision. DME can show up at any point in diabetic retinopathy, making it crucial to identify and treat it early. But early signs are hard to notice, and patients might not realize them, causing permanent vision issues by the time they seek medical help [14].

AGE RELATED MACULAR DEGRADATION (AMD)

As we get older, there's a chance we might develop age-related macular degeneration, a lasting eye problem causing central vision loss [14]. Drusen, a key feature, comes in two types – hard and soft, seen inside or outside the retinal epithelium. AI can identify AMD at early stage by spotting drusen or fluids automatically in OCT images. AI applications show better accuracy, predicting visual acuity and the need for treatment [15].

AI assessment aligns with manual evaluation, crucial for managing and monitoring this condition while saving on screening costs. OCT, a vital tool, is essential for detecting AMD, especially the wet type needing anti-VEGF treatment.VGG16, Inception V3, MobileNet showcasing the potential of AI in improving early detection and treatment [16] [17].

GLAUCOMA

Glaucoma is a condition where the pressure inside the eye increases due to fluid blockage, causing damage to the optic nerve and ranking as the second leading cause of vision loss worldwide. OCT is used to assess glaucoma by automatically measuring the thickness of retinal nerve fiber and ganglion cell layers through artificial intelligence segmentation [18].

Recent studies show that AI techniques can accurately and quickly detect glaucoma. In 2022,a technique considering risk factors and structural data, training three DL models to calculate cup surface area—an essential parameter for future glaucoma detection. While artificial intelligence makes identifying glaucoma patients easier, it has limitations, requiring a lot of data for model training, making it challenging and time-consuming. Further studies are needed to prove its clinical usefulness [19].

CATARACT

Cataracts are the top reason for vision problems and blindness all around the world. In recent times, scientists have made a lot of progress in creating advanced machine learning methods to automatically classify and grade cataracts. Artificial intelligence is revolutionizing cataract detection by utilizing advanced algorithms to analyse medical images, such as eye scans. These AI systems enhance the accuracy and efficiency of cataract diagnosis, allowing for early detection and timely intervention. [15].

CONCLUSION

Medical imaging has gone from being a supportive test to the primary method for diagnosing diseases in modern medicine. Advanced models show that machine learning can effectively learn from complex images with high accuracy, even with a small dataset. AI has the potential to revolutionize disease diagnosis by helping experts classify challenging images and quickly review large quantities of them. Compared to human evaluations, AI excels in integrating information, processing data, and providing fast diagnoses. Collaborative efforts between clinicians, engineers, and designers may eventually enhance the speed and accuracy of diagnosing and referring ophthalmic diseases.

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Collection of Objects on the basis of Similarity and Dissimilarity in Clusters

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INTRODUCTION

Cluster examination, based on a few criteria, offers information into critical, viable or both categories (clusters) based on shared common characteristics. In inquire about, clustering and classification have been utilized to analyze information, within the field of machine learning. Diverse strategies of clustering incorporate Dividing (K-means), Various leveled (AGNES), Density-based (DBSCAN), Grid-based (STING), Delicate clustering (FANNY), Model-based (SOM) and Outfit clustering. Challenges and issues in clustering emerge from expansive datasets, distortion of comes about and efficiency/performance of clustering calculations, which is fundamental for choosing clustering calculations. In this paper, application of information clustering in see of the characteristics of the distinctive clustering methods that make them superior suited or one-sided when connected to a few sorts of information, such as dubious information, interactive media information, chart information, organic information, stream information, content information, time arrangement information, categorical information and enormous information. The reasonableness of the accessible clustering calculations to distinctive application regions was displayed. I. Presentation It is fundamentally a sort of unsupervised learning strategy. An unsupervised learning strategy could be a strategy in which we draw references from datasets comprising of input information without named reactions. By and large, it is utilized as a prepare to discover significant structure, illustrative fundamental forms, generative highlights, and groupings inborn in a set of illustrations.

1) Clustering : Clustering is the assignment of isolating the populace or information focuses into a number of bunches such that information focuses in the same bunches are more comparative to other information focuses within the same gather and different to the information focuses in other bunches. It is fundamentally a collection of objects on the premise of closeness and disparity between them.

2) For example The information focuses within the chart underneath clustered together can be classified into one single group. Ready to recognize the clusters, and we will distinguish that there are 3 clusters within the underneath picture. It isn't essential for clusters to be round as delineated underneath: A. A. Why Clustering? Clustering is exceptionally much vital because it decides the inherent gathering among the unlabelled information show. There are no criteria for great clustering. It depends on the client, and what criteria they may utilize which fulfill their require. For occurrence, we may well be fascinated by finding agents for homogeneous bunches (information diminishment), finding "natural clusters" and portraying their obscure properties ("natural" information sorts), in finding useful and reasonable groupings ("useful" information classes) or in finding unordinary information objects (exception location). This calculation must make a few suspicions that constitute the closeness of focuses and each presumption make diverse and similarly substantial clusters.

Clustering Strategies: • Density-Based Strategies: These strategies consider the clusters as the thick locale having some likenesses and contrasts from the

lower dense region of the space. These methods have great precision and the capacity to blend two clusters. Case DBSCAN (Density-Based Spatial Clustering of Applications with Clamor), OPTICS (Requesting Focuses to Distinguish Clustering Structure), etc. • Various leveled Based Strategies: The clusters formed in this strategy shape a tree-type structure based on the chain of command. Modern clusters are shaped utilizing the previously formed one. It is partitioned into two category • Agglomerative (bottom-up approach) • Divisive (top-down approach) Cases Remedy (Clustering Utilizing Agents), BIRCH (Adjusted Iterative Lessening Clustering and utilizing Chains of command), etc. • Dividing Strategies: These strategies segment the objects into k clusters and each segment shapes one cluster. This strategy is utilized to optimize an objective model closeness work such as when the remove may be a major parameter case K-means, CLARANS (Clustering Expansive Applications based upon Randomized Look), etc. • Grid-based Strategies: In this strategy, the information space is defined into a limited number of cells that frame a grid-like structure. All the clustering operations done on these frameworks are quick and autonomous of the number of data objects illustration STING (Factual Information Grid), wave cluster, CLIQUE (CLustering In Journey), etc. Clustering Calculations: K-means clustering calculation – It is the easiest unsupervised learning calculation that understands clustering issue. K-means calculation allotments n perceptions into k clusters where each perception has a place to the cluster with the closest cruel serving as a prototype of the cluster.

B. List of Popular Machine Learning Calculation Here may be a list of the Top 10 Most prevalent Machine Learning Calculations.

1. Direct Relapse Direct relapse could be a straightforward calculation utilized to outline the direct relationship between input highlights and a nonstop target variable. It works by fitting a line to the data and then using the line to foresee modern values.

2. Calculated Relapse Calculated relapse is an expansion of straight relapse that's used for classification errands to gauge the probability that an occasion belongs to a particular course.

3. SVM (Back Vector Machine) SVMs are administered learning calculations that can perform classification and relapse assignments. It finds a hyperplane that best isolates classes in highlight space.

4. KNN (K-nearest Neighbour) KNN could be a non-parametric strategy that can be utilized for classification as well as regression. It works by distinguishing the k most comparable information focuses to a modern information point and at that point anticipating the name of the unused information point utilizing the names of those information focuses.

5. Choice Tree Choice trees are a type of directed learning method that can be used for classification as well as relapse. It works by segmenting the data into littler and littler bunches until each group can be classified or anticipated with tall degree of precision.

6. Arbitrary Timberland Irregular timberlands are a sort of ensemble learning strategy that utilizes a set of choice trees to create expectations by conglomerating expectations from individual trees. It improves the accuracy and versatility of single choice trees. It can be utilized for both classification and relapse assignments.

7. Naive Bayes Naive Bayes is a probabilistic classifier based on Bayes' hypothesis that's utilized for classification assignments. It works by accepting that the highlights of a information point are free of each other.

8. PCA (Vital Component Analysis) PCA could be a dimensionality diminishment method utilized to change information into a lower-dimensional space whereas holding as much variance as conceivable. It works by finding the directions in the information that contain the foremost variety, and then projecting the information onto those bearings.

9. Apriori calculations Apriori calculation could be a conventional information mining technique for affiliation rules mining in value-based databases or datasets. It is outlined to reveal joins and designs between things that routinely co-occur in exchanges. Apriori recognizes visit itemsets, which

are bunches of things that show up together in exchanges with a given least bolster level.

10. K-Means Clustering K-Means clustering is an unsupervised learning approach that can be utilized to bunch together information focuses. It works by finding k clusters in the information so that the data points in each cluster are as comparable to each other as doable whereas remaining as unmistakable as conceivable from the information points.

Applications

1. Social Arrange Examination: Clustering is used to identify communities or bunches inside social systems, which can offer assistance in understanding social behavior, impact, and patterns.

2. Cybersecurity: Clustering is utilized to bunch comparable patterns of network activity or framework behavior, which can help in detecting and preventing cyberattacks.

3. Climate Examination: Clustering is used to gather comparable designs of climate information, such as temperature, precipitation, and wind, which can offer assistance in understanding climate change and its affect on the environment.

4. Sports Analysis: Clustering is utilized to gather comparable designs of player or group execution information, which can offer assistance in analyzing player or group qualities and weaknesses and making vital choices.

5. Wrongdoing analysis: Clustering is utilized to gather comparable designs of crime data, such as area, time, and sort, which can help in identifying wrongdoing hotspots, foreseeing future wrongdoing patterns, and progressing wrongdoing avoidance techniques.

6. Therapeutic determination: Clustering is used to group patients with comparative side effects or illnesses, which makes a difference in making precise analyze and distinguishing viable medications.

7. Extortion location: Clustering is used to identify suspicious designs or inconsistencies in budgetary exchanges, which can help in detecting extortion or other money related wrongdoings.

8. Activity investigation: Clustering is utilized to bunch comparable designs of activity information, such as crest hours, courses, and speeds, which can offer assistance in moving forward transportation arranging and infrastructure.

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Differential Transform Method for Two Dimensional Differential Equations

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ABSTRACT

In this investigation, we undertake a comprehensive analysis of solutions for various systems of PDE through the application of the Differential Transformation Method. The outcomes obtained from the DTM are systematically compared with results derived from alternative numerical methods. The DTM proves to be a powerful tool, offering swift solutions to both ordinary and partial differential equations through uncomplicated computer commands and codes. The introductory chapter establishes a foundational understanding of the Differential Transformation Method, presenting its fundamental definition and key properties.

Overall, this study contributes to the exploration of efficient numerical methodologies, emphasizing the accessibility and simplicity afforded by the DTM.

KEYWORDS : *DTM, PDE.*

INTRODUCTION

The Differential Transform Method (DTM) is a numerical approach developed to solve differential equations. Zhou initially introduced it, and its primary purpose involved solving linear and nonlinear IVP related to electric circuit analysis [6].

The Differential Transform Method (DTM) offers a rapid approach for calculating precise values of the nth derivative of the function at a specific point, considering both known and unknown boundary conditions.. In contrast to conventional high-order Taylor series methods that require symbolic computation of derivatives, the DTM generates an analytical solution represented as a polynomial.

This methodology diverges from the conventional Taylor series approach, which becomes computationally cumbersome for substantial orders. The DTM operates as an iterative technique, enabling the analytical derivation of Taylor series solutions for differential equations.. Various applications of the DTM are as follows,

APPLICATION OF DTM METHOD

DTM can be applied to analyze and solve mechanical engineering problems involving vibrations, heat

conduction, and fluid flow. DTM can be used to study the behavior of structures under various loading conditions, helping to analyze stresses and deformations.

It is applicable to electrical circuits, providing solutions for problems related to circuit analysis, electromagnetic fields, and signal processing and employed to analyze and solve problems related to heat conduction, convection, and radiation in various materials and systems.

DTM can be used in fluid dynamics to study the behavior of fluids, including the analysis of flow patterns, pressure distribution, and heat transfer in different fluid systems.

DTM has been applied to model and analyze biological systems, such as drug release from pharmaceutical formulations or the diffusion of substances in biological tissues.

DTM can be utilized in the analysis and design of control systems, providing solutions to differential equations governing the dynamics of the system

DTM can be applied to model and solve problems related to chemical reactions, transport phenomena, and other processes in chemical engineering.

DTM has found applications in mathematical biology, helping to model and analyze population dynamics, spread of diseases, and other biological phenomena.

DTM can be used to model economic and financial systems, providing solutions to differential equations that describe the dynamics of these systems.

DTM has been applied to study environmental processes, such as groundwater flow, air pollution dispersion, and diffusion of contaminants.

Differential transform method

Definition 1. If a function (t) is analytical with respect to t in the domain of interest Ω, then

$$P(k) = \frac{1}{k!}\left(\frac{d^k p(t)}{dt^k}\right) \qquad (1)$$

is the transformed function of u(t).

The differential inverse transforms of the set $\{U(k)\}_{k=0}^n$ is defined by

$$p(t) = \sum_{k=0}^{\infty} P(k)t^k$$

Substituting (1) into (2), we get

$$p(t) = \sum_{k=0}^{\infty} \frac{1}{k!}\left[\frac{d^k p(t)}{dt^k}\right]_{t=0} t^k$$

The above equation indicates that differential transform method is based on the concept of Taylor series expansion, but it does not involve the symbolic evaluation of derivatives.[6][1]

The following table shows the basic operations of the transform functions:

Functions	Differential transform
$\alpha x(t) \pm \beta y(t)$	$\alpha X(k) \pm \beta Y(k)$
$x(t)z(t)$	$\sum_{r=0}^{k} X(k)Z(k-r)$
$\frac{d}{dt}x(t)$	$(k+1)X(k+1)$
t^n	$\delta(k-n) = \begin{cases} 1 & k=n \\ 0 & k \neq 0 \end{cases}$
$t^n x(t)$	$X(k-n)$
$e^{\mu t}$	$\frac{\mu^k}{k!}$
$sin(\omega t + \alpha)$	$\frac{\omega^k}{k!} sin\left(\frac{\pi k}{2} + \alpha\right)$
$cos(\omega t + \alpha)$	$\frac{\omega^k}{k!} cos\left(\frac{\pi k}{2} + \alpha\right)$

In this, we have applied differential transform method to system of Ordinary differential equations. The general ODE and PDE equations have checked by MAPLE software

1)Consider following system of linear DE,

$$\frac{dx}{dt} = 2x - 3y$$

$$\frac{dy}{dt} = y - 2x;$$

with conditions x(0)= 8,y(0)= 3
We solve above equations with MAPLE

MAPLE CODE

```
X[0] := 8; Y[0] := 3;
F1:=proc(k)optionsoperator,arrow;
(k + 1) * X[k + 1] = 2* X[k] - 3*Y[k] end proc;
F2 := proc(k)optionsoperator,arrow; (k + 1)*Y[k +
1] = Y[k] - 2*X[k]end proc;
for i from 0 to 10 do
 eq1[i] := F1(i);
eq2[i] := F2(i);
 solve({eq1[i], eq2[i]}, {X[i + 1], Y[i + 1]});
assign(solve({eq1[i], eq2[i]},{X[i + 1], Y[i + 1]}));
end do;
x := sum(X[k1]*t^k1, k1 = 0 .. 10);
y := sum(Y[k1]*t^k1, k1 = 0 .. 10);
```

We get,

$$x = 8 + 7t + \frac{53}{2}t^2 + \frac{187}{6}t^3 + \frac{773}{24}t^4 + \frac{3067}{120}t^5 + \frac{12293}{720}t^6 + \frac{7021}{720}t^7 + \frac{196613}{40320}t^8 + \frac{786427}{362880}t^9 + \frac{3145733}{3628800}t^{10}$$

$$y = 3 - 13t - \frac{27}{2}t^2 - \frac{133}{6}t^3 - \frac{169}{8}t^4 - \frac{2053}{120}t^5 - \frac{2729}{240}t^6 - \frac{32773}{5040}t^7 - \frac{14563}{4480}t^8 - \frac{74889}{51840}t^9 + \frac{699049}{1209600}t^{10}$$
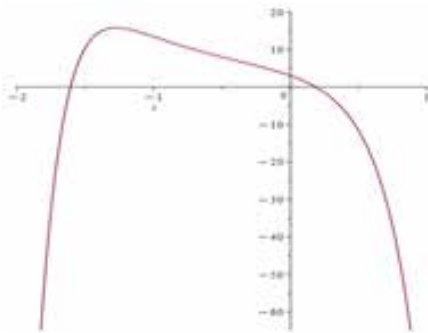
Example 2:

Consider following system of linear DE,

$$\frac{dx}{dt} = y + e^t$$

$$\frac{dy}{dt} = \sin t - x$$

With conditions x(0)= 1, y(0) = 0.

MAPLE CODE

```
X[0] := 1; Y[0] := 0;
F1 :=proc( k)optionsoperator,arrow;(k + 1)*X[k +
1] = 1/k! + Y[k]end proc;
F2 := proc(k) options oprator,arrow; (k + 1)*Y[k +
1] = sin(1/2*k*Pi)/k! - X[k]end proc;
for i from 0 to 9 do
    eq1 := F1(i);
    eq2 := F2(i);
    sol := solve({eq1, eq2}, {X[i + 1], Y[i + 1]});
    X[i + 1] := rhs(sol[1]);
    Y[i + 1] := rhs(sol[2]);
end do;
x := add(X[k1]*t^k1, k1 = 0 .. 10);
y := add(Y[k1]*t^k1, k1 = 0 .. 10);
```

We get,

$$x = 1 + t + \frac{1}{6}t^3 + \frac{1}{24}t^4 - \frac{1}{120}t^5 + \frac{1}{1680}t^7 + \frac{1}{40320}t^8 - \frac{1}{120960}t^9$$

$$y = -t - \frac{1}{12}t^4 - \frac{1}{120}t^5 + \frac{1}{360}t^6 - \frac{1}{10080}t^8 - \frac{1}{362880}t^9 - \frac{1}{907200}t^{10}$$

CONCLUSION

This research demonstrates the applicability of the DTM in effectively solving various systems of ordinary and partial differential equations using simple MAPLE Code. The outcomes presented in illustrative examples reveal that the solutions derived using DTM align with those obtained through other established methods. Furthermore, the adaptability of the DTM method to various computer programs is emphasized, owing to its reliance on straightforward operations. These attributes collectively highlight DTM as a readily applicable and efficient approach for tackling diverse types of ODE and PDE.

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Duty Monitor "Monitoring System using NFC"

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ABSTRACT

Duty Monitor is a project aiming to develop an NFC tracker framework to screen the area of representatives in the working environment. Every worker will be given a cell phone with an implanted NFC tag, and certain areas will be set apart with an NFC peruser. This system will help organizations increase their working environment performance and allow administration to quickly locate staff when needed. The project includes designing, implementing, and deploying devices such as an NFC peruser, NFC labels, GUI, and an information base.

KEYWORDS : *IoT, GUI, Tracking system, NFC.*

INTRODUCTION

Location and staff tracking systems using NFC (Near Field Communication) tags have gained significant attention due to the growing need for efficient management, enhanced security, and streamlined operations within organizations. This technology leverages the capabilities of tags to enable the real-time tracking and monitoring of employees' movements, attendance, and access control.

Personnel tracking systems using NFC bolster workplace security by ensuring that only authorized personnel can access certain areas of the organization. Unauthorized access is detected and can trigger alerts, enhancing overall safety. Traditional attendance systems often involve manual data entry and paperwork, leading to errors and inefficiencies. These tags enable real-time monitoring of officers, making it easier to locate staff during emergencies or in large facilities. This is invaluable for evacuations or responding to urgent situations. This can help enhance productivity by identifying bottlenecks in processes and promoting accountability. Admin can assess where staff spend their time and allocate resources more effectively.

Objectives

The objectives of this project are to solve the problems of monitoring police officers' duties and their presence at the workplace. As it is time-consuming and rigorous to get the exact location of staff. In anadvancing nation like India, various most recent innovations have been grown like NFC, remote, Bluetooth, robots, etc. In this manner, these advancements can be utilized to guarantee the representative time in/out and to follow the area of the staff at explicit areas at work during work hours. This framework additionally facilitates the organization to screen their work force promptly from the record in the data set other than building a powerful framework that consequently records and updates the area of the faculty continuously. It will permit its boss to see changes when they happen, instead of trusting that updates will be noticeable at a future time.

Albeit Close to handle correspondence (NFC) is one of

the programmed distinguishing proof advances more stylish these days. There is a wide innovative work in this space attempting to exploit this innovation, and before long numerous new applications and examination regions will keep on showing up. This unexpected interest in NFC likewise achieves a few worries, for the most part about the security and protection of the people who work with or use labels in their regular day to day existence.

Problem Definition

Sometimes the cops or employees do not follow their duty and it affects the law and order of society. If an officer moves away from their assigned post without proper authorization, then it is harmful for security. Manually it is not possible, so we come up with a solution that is Tracking police officers deployed to bandobast duty (security duty) remotely using NFC (Near Field Communication) technology to ensure they stay at their assigned posts. It will enhance the productivity and efficiency of the officers and also save the time of administration.
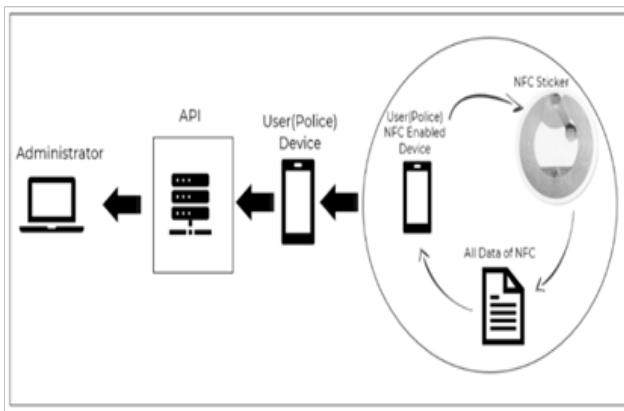
Fig. 1. NFC Architecture

Scope of the Project

The project's scope is broken down into four primary components: users, functionality, operability of the system, and users of development tools. Employees To help the administrator keep track of the registered personnel, users are able to register and update their information in the system. Because they can add, edit, delete, view, and search people in the system in addition to looking up personnel locations, administrators are the most essential users in this system.

Proposed Solution

NFC Check-In/Check-Out System:

- Equip each police officer with an NFC-enabled badge or card.
- Install NFC readers at strategic locations at assigned posts.
- Officers must tap their NFC badge on the reader when they arrive at their post (check-in) and when they leave (check-out).

Attendance Recording:

- Integrate the NFC data with a centralized attendance recording system.
- This system should log the time and location of each check-in and check-out, ensuring real-time tracking.

Geotagged Image capture:

- Require personnel to take geotagged images with their smartphone's assigned posts when they check in at their assigned posts.
- Implemented a system that automatically uploads these images to a secure server.
- Admin can view these images to verify the personnel's presence at the assigned location.

REVIEW OF LITERATURE

Survey of Existing System

In one review, the coordination of LBSs with NFC innovation is performed to follow clients' way of behaving and to further develop client encounters. Urban communities like Frankfurt and Oulu are instances of labeled conditions empowering cell phones to recover area explicit information from accessible labels. The labels might be appended to leave meters, transport stops, streetlights, or a few different areas; and may make a foundation for clients to look for data about the nearby administrations. Subsequent to tending to such models, the creators offer the making of an area based versatile Wiki. In addition, constant area information might upgrade person to person communication, where the proposed LocaTag framework utilizes texting devices, area information, and NFC innovation.

In another review, an NFC registration framework is introduced, which benefits from Suggested Area Based Administrations (ILBS), cell phones, and NFC labels. To empower a particular activity, the client needs to genuinely be at a particular area, permitting more close collaboration. Benefits of the suggested NFC registration administration concerning manual registrations (i.e., Facebook, Foursquare, etc) are introduced in a similar report.

Limitations on existing system

• The current system is unable to capture live photos on duty.

• The system can not work without an internet connection or saving data.

• Existing systems are costly and hard to maintain.

ANALYSIS MODELLING

Flowchart
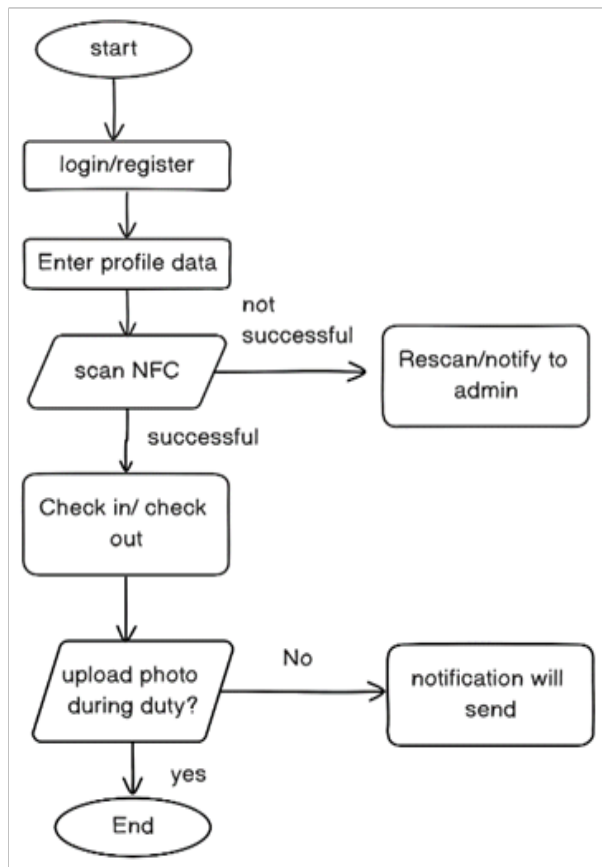
Fig. 2. Flow Diagram

ER Diagram
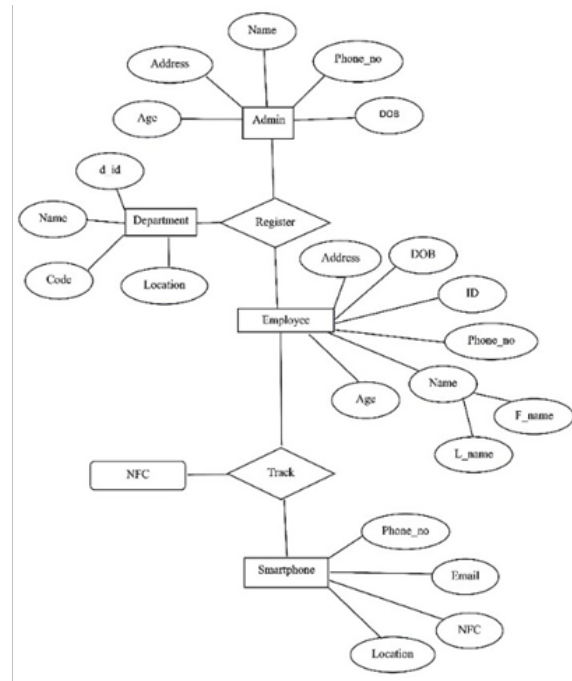
Fig. 3. Er Diagram

CONCLUSION

In conclusion, utilizing NFC technology to implement a police officer tracking system can offer numerous benefits to administration, including enhanced security, increased efficiency, and simplified access control. At last, the outcome of an Obligation Screen framework relies upon cautious preparation, clear correspondence, and a pledge to adjusting the benefits of further developed effectiveness and security with the insurance of official's protection and information. When executed mindfully and dependably, NFC¬-Based on the Obligation Screen can be an important resource for organization and organizations.

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Understanding the Foundations and Implications of Explainable Artificial Intelligence

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ABSTRACT

Explainable Artificial Intelligence (XAI) is gaining increasing attention as machine learning models become more complex and pervasive in various domains. This research paper aims to provide an in-depth exploration of the concept of Explainable AI, its significance, and the various approaches employed to achieve transparency and interpretability in machine learning models. The paper also delves into the challenges associated with XAI and its potential impact on diverse applications. Through a comprehensive review of existing literature and case studies, this paper aims to contribute to a better understanding of XAI and its role in shaping the future of artificial intelligence systems.

KEYWORDS : *Explainable artificial intelligence, XAI, Interpretability, Machine learning, Model explainability, Trust in AI.*

INTRODUCTION

Over the past decade, there has been remarkable and continuous advancement in the field of Artificial Intelligence (AI). This progress has led to a widespread adoption of AI algorithms, particularly machine learning (ML) algorithms, to tackle a myriad of problems, including those that were previously considered challenging. The success in solving complex issues is undeniably significant; however, it has given rise to a noteworthy concern – the escalating complexity of AI models and the prevalent use of black-box models lacking transparency.

The deployment of intricate AI models, especially those operating as black boxes, poses challenges in terms of understanding their decision-making processes. While these models demonstrate exceptional accuracy, their lack of transparency raises concerns, particularly in critical and sensitive domains such as healthcare and security. In these domains, where precision is vital, the opaqueness of AI models becomes a barrier to meeting additional criteria beyond accuracy.

Recognizing this challenge, it is imperative to explore and implement solutions that enhance the transparency and interpretability of AI models. The goal is to strike a balance between the impressive capabilities of these advanced models and the need for a clear understanding of their inner workings. By addressing the issue of model opacity, there is a potential to broaden the application of AI systems in critical sectors, ensuring that they not only deliver high accuracy but also adhere to the stringent requirements of transparency and interpretability essential in fields where human lives and security are at stake. Explainable Artificial Intelligence (XAI) stands as a proposed remedy to propel the evolution toward a more transparent AI landscape, aiming to eliminate potential constraints on the adoption of AI within critical domains [1,2]. In a broad context, as outlined by [3], XAI is committed to the development of elucidate techniques that empower end-users, enabling

them to comprehend, trust, and effectively manage the complexities inherent in the new era of AI systems. The historical roots of the imperative for explanations can be traced back to the early endeavors in elucidating expert systems and Bayesian networks [4]. However, it is the advent of Deep Learning (DL) that has elevated XAI to a vibrant and dynamic research sphere. The intricate nature of DL models underscores the need for innovative approaches to enhance transparency, thus underscoring the pivotal role of XAI in navigating the contemporary landscape of artificial intelligence [5].

OVERVIEW OF THE GROWING COMPLEXITY OF MACHINE LEARNING MODELS

The intricacy of machine learning models has experienced a consistent rise in recent years, propelled by various factors:

- Increased Availability of Data: The surge in data availability, facilitated by enhanced data storage and processing capabilities, has been instrumental. This has led to the development of models with a higher number of parameters and layers, enabling them to discern and encapsulate more intricate relationships within the data.

- Advances in Computing Power: The evolution of specialized hardware, such as GPUs and TPUs, has empowered the training of larger and more intricate models. This progress has paved the way for techniques like deep learning, which demands substantial computational power for its intricate operations.

- Improved Algorithms: The continual development of sophisticated algorithms for machine learning has contributed significantly. These newer algorithms involve more intricate mathematical operations and necessitate meticulous tuning of hyperparameters to optimize model performance.

This trend towards increasing complexity has both benefits and drawbacks. On the one hand, more complex models can achieve higher accuracy on a wider range of tasks. For example, deep learning models have revolutionized fields like computer vision and natural language processing.

On the other hand, complex models can be more difficult to train and interpret. They can also be more prone to overfitting, which is when a model memorizes the training data too well and does not perform well on new data.

Here are some of the specific ways in which machine learning models are becoming more complex:

- Increasing number of parameters: The number of parameters in a machine learning model is a measure of its complexity. More complex models typically have more parameters, which allows them to capture more complex relationships in the data.

- Deeper architectures: Deep learning models are composed of multiple layers of neurons. Deeper models have more layers, which allows them to extract more complex features from the data.

- More complex activation functions: Activation functions are used to introduce non-linearity into a model. More complex activation functions can allow models to learn more complex relationships.

- Ensemble methods: Ensemble methods combine multiple models to improve accuracy. More complex ensemble methods can use more models and more complex techniques for combining their predictions.

The trend towards increasing complexity is likely to continue in the future. However, it is important to remember that complexity is not always the best solution.

The need for transparency and interpretability in AI

The growing complexity of AI systems, as you rightly pointed out, raises a crucial concern: the need for transparency and interpretability. These concepts are intertwined and essential for building trust and ensuring responsible development of AI.

Transparency refers to the openness and understanding of an AI system's workings. It involves understanding:

- Data used to train the model: Knowing the sources and characteristics of data helps identify potential biases and ensure fairness.

- Algorithms and decision-making process: Demystifying the model's logic helps assess its

validity and avoid "black box" situations where decisions appear arbitrary.

- Impact and potential risks: Understanding the consequences of AI deployment is crucial for mitigating potential harms and ensuring responsible use.

- Interpretability goes beyond transparency, focusing on making the reasons behind an AI's decision understandable to humans.

- Explaining individual predictions: Providing insights into why a specific output was generated for a given input.

- Identifying key factors: Highlighting the most significant features that influenced the decision-making process.

- Understanding overall model behavior: Uncovering general trends and patterns in how the model operates.

Why are these concepts so crucial?

- Building trust: Transparency and interpretability foster trust between users and AI systems, especially in high-stakes applications like healthcare or finance. Understanding how decisions are made allows for better acceptance and cooperation.

- Identifying and mitigating bias: AI models can inherit biases present in their training data. Transparency and interpretability help expose these biases and enable developers to take corrective measures.

- Ensuring accountability: When decisions can be explained, developers and stakeholders can be held accountable for the outcomes, promoting responsible development and preventing misuse.

- Improving model development: Understanding the reasoning behind a model's performance allows developers to improve its accuracy and effectiveness by identifying weaknesses and areas for refinement.

Challenges in achieving transparency and interpretability

- Complexity of models: Highly complex models

can be inherently difficult to interpret, making it challenging to explain their reasoning in a human-understandable way.

- Trade-off with performance: Achieving high levels of transparency and interpretability can sometimes come at the cost of decreased performance or accuracy.

- Limited resources: Developing and implementing explainable AI techniques can require significant resources and expertise, posing a challenge for smaller teams or organizations.

Despite these challenges, the need for transparency and interpretability is undeniable. As AI becomes increasingly integrated into our lives, ensuring responsible development and building trust with the technology are paramount. Ongoing research and development in explainable AI techniques hold the promise of making AI systems more transparent and interpretable, paving the way for a future where AI benefits everyone.

EXPLAINABLE AI: CONCEPT AND SIGNIFICANCE

Explainable Artificial Intelligence (XAI) encompasses a set of methodologies and techniques within the realm of artificial intelligence, aimed at ensuring that the outcomes generated by a solution are comprehensible and interpretable by human beings. This stands in stark contrast to the inherent "black box" nature associated with certain AI models, notably deep learning models. The central objective of XAI is to mitigate the opacity prevalent in some AI systems, offering transparency, understanding, and justifiability to the decisions and operations executed by these models. Through the integration of XAI principles, the aim is to bridge the gap between complex AI processes and human interpretability, fostering trust and facilitating informed interactions with artificial intelligence applications.

Achieving explainability in artificial intelligence (AI) is crucial for building trust, ensuring accountability, and facilitating the adoption of AI systems in various domains. Several approaches have been developed to make AI models more interpretable and understandable.

Here are some key approaches to achieving explain ability in artificial intelligence:

Model-Agnostic Approaches

LIME (Local Interpretable Model-agnostic Explanations): LIME generates locally faithful explanations by perturbing input data and observing the impact on model predictions. It creates interpretable surrogate models to approximate the behavior of the black-box model in specific instances.

SHAP (SHapley Additive exPlanations): SHAP values allocate contributions of each feature to a model's output. By computing Shapley values from cooperative game theory, SHAP provides a consistent and theoretically grounded way to attribute predictions to input features.

Interpretable Model Architectures

Decision Trees and Rule-Based Models: Decision trees represent a series of decision rules, making them inherently interpretable. Rule-based models, such as decision lists, provide explicit rules for making predictions, enhancing transparency.

Linear Models: Linear models are naturally interpretable, as the contribution of each feature is directly proportional to its weight. Regularized linear models, like LASSO or Ridge regression, can improve interpretability by selecting relevant features.

Post-hoc Interpretability Techniques

Layer-wise Relevance Propagation (LRP): LRP attributes relevance to each input feature, helping to understand the contribution of different features in deep neural networks. It is particularly useful for interpreting complex models like neural networks.

Feature Importance Techniques: Methods like permutation importance or tree-based feature importance provide insights into the significance of each feature in making predictions.

CHALLENGES IN EXPLAINABLE AI

Explainable Artificial Intelligence (XAI) faces several challenges that need to be addressed for its effective implementation. Here are some key challenges in the field of XAI:

Complexity of Models

- Deep Learning Models: The complexity of deep learning models, with their numerous parameters and intricate architectures, poses challenges in providing interpretable explanations. Understanding the inner workings of these models is inherently difficult.

- Ensemble Models: The use of ensemble models and complex ensemble techniques can further increase the complexity, making it challenging to explain the collective decision-making process.

Accuracy-Interpretability Trade-off

- Balancing Accuracy and Interpretability: There is often a trade-off between the accuracy of a model and its interpretability. Simplifying models for better interpretability may lead to a loss of accuracy, and vice versa.

- User-Specific Requirements: Different users may have varying requirements for accuracy and interpretability. Striking the right balance that satisfies diverse user needs is a challenge.

Lack of Standardization

- Diverse XAI Methods: There is a lack of standardized methods for explaining AI models. Different XAI techniques may yield varied explanations, making it challenging to establish a universally accepted approach.

- Evaluation Metrics: The absence of standardized evaluation metrics hinders the objective assessment of the effectiveness of different explanation techniques.

User Understanding and Trust

- User Comprehension: Presenting complex technical explanations to non-expert users can be challenging. Ensuring that explanations are conveyed in a format understandable to end-users is crucial.

- Building Trust: While the goal is to build trust through transparency, poorly designed or misleading explanations may lead to skepticism or mistrust in AI systems.

Dynamic and Evolving Models

- Model Changes over Time: In applications where models evolve or adapt over time, providing consistent and reliable explanations becomes challenging. Changes in model architecture or training data distribution may impact interpretability.

- Streaming Data: Real-time and streaming data introduce challenges in providing on-the-fly explanations for dynamic and continuously evolving models.

Scalability and Resource Intensiveness

- Computational Resources: Some XAI methods can be computationally intensive, making them less scalable for large and complex models. This poses challenges in deploying interpretable models in resource-constrained environments.

- Real-time Explanations: Providing real-time explanations for fast-paced decision-making scenarios requires efficient and low-latency XAI methods.

Privacy Concerns

- Sensitive Data Exposure: Explanations that reveal too much about the underlying data may raise privacy concerns, especially in healthcare and other sensitive domains.

- Adversarial Attacks: Some XAI methods may be susceptible to adversarial attacks aimed at manipulating or misleading the explanations, compromising the reliability of the system.

Cultural and Contextual Variations

- Cultural Differences: The understanding and acceptance of explanations may vary across different cultures, adding a layer of complexity to the design of universally effective explanation strategies.

- Context Dependency: The effectiveness of explanations can be highly context-dependent, requiring tailored approaches for diverse application scenarios.

Legal and Regulatory Compliance

- Interpreting Regulations: Navigating complex legal and regulatory landscapes surrounding AI, which may require interpretable and accountable models, can be challenging. Compliance with evolving regulations poses an ongoing challenge for XAI deployment.

APPLICATIONS OF EXPLAINABLE AI

The applications of Explainable AI include Healthcare Diagnostics, Finance and Risk Assessment, Legal and Compliance, Autonomous Vehicles, Human Resources and Hiring, Predictive Policing, Customer Service Chabot, Biomedical Research, Education and Personalized Learning, Cyber security, etc.

EMERGING TRENDS IN XAI

Explainable Artificial Intelligence (XAI) is a dynamic field that continues to evolve, driven by advancements in research, technology, and the increasing need for transparency in AI systems. Here are some emerging trends in XAI:

Hybrid Approaches:

o Combining Techniques: Hybrid approaches involve combining multiple XAI techniques to leverage their strengths. Integrating model-agnostic methods with model-specific ones, or combining post-hoc interpretability with inherently interpretable model architectures, is becoming more prevalent.

Human-Centric Design:

o User-Centered Explanations: Recognizing the importance of end-user comprehension, there's a trend toward developing explanations that are tailored to the cognitive abilities and preferences of users. This involves more user-centric design of explanations, ensuring that they are intuitive and accessible.

o Interactive Interfaces: Incorporating interactive elements in XAI interfaces, allowing users to explore and interact with explanations dynamically. This enables a more engaging and educational experience for users.

Ethical and Fairness Considerations

o   Bias Mitigation: Addressing bias and fairness concerns in XAI is gaining attention. Researchers are exploring ways to incorporate fairness metrics and considerations into explanation methods to mitigate biases and ensure fair and equitable outcomes.

o   Ethical Guidelines: Establishing ethical guidelines for XAI development and deployment to ensure responsible practices. This includes addressing ethical considerations related to privacy, security, and the potential societal impact of AI decisions.

Explanations for Deep Learning Models

o   Advancements in Neural Network Interpretability: As deep learning models continue to dominate various domains, there is a focus on developing more effective methods for interpreting and explaining their decisions. This includes improving techniques like layer-wise relevance propagation and attention mechanisms.

Certifiable Explanations

o   Certifiability and Robustness: Ensuring that explanations are certifiable and robust against adversarial attacks. This involves developing methods that provide explanations with guarantees about their accuracy and reliability, even in the presence of adversarial inputs.

Real-time Explainability

o   Real-time Explanations: The demand for real-time explainability is increasing, especially in applications where immediate understanding of AI decisions is crucial, such as autonomous systems, healthcare emergencies, and financial transactions.

o   Streaming Data Interpretability: Addressing the challenges of explaining AI decisions in scenarios where data is continuously streaming, requiring on-the-fly interpretability for dynamic and evolving situations.

Standardization and Benchmarks

o   Developing Standards: Efforts are underway to establish standards for evaluating and benchmarking XAI methods. This involves creating standardized datasets, evaluation metrics, and benchmarks to facilitate fair and comprehensive comparisons between different explanation techniques.

Legal and Regulatory Compliance

o   Alignment with Regulations: As regulatory frameworks around AI continue to evolve, XAI methods are adapting to ensure compliance. Explainability is becoming an integral part of meeting legal requirements, especially in sectors with stringent regulations.

Explainability in Reinforcement Learning

o   Interpreting Reinforcement Learning Agents: With the growing use of reinforcement learning in AI applications, there's an increased focus on developing methods to interpret and explain the decision-making process of reinforcement learning agents.

Global Collaboration and Open Research

o   Open-Source Initiatives: Increased collaboration and open-source initiatives in the XAI community. The sharing of datasets, code, and models facilitates collective progress and the development of more effective and widely applicable explanation methods.

These trends indicate the ongoing evolution of Explainable AI, reflecting a commitment to making AI systems more transparent, interpretable, and accountable in diverse application domains. As research and development in XAI continues, it is expected that these trends will shape the future landscape of explainability in artificial intelligence.

IMPLICATIONS FOR FUTURE AI SYSTEMS

The implications for future AI systems are vast and multifaceted, encompassing both opportunities and challenges. Here are key considerations that may shape the trajectory of AI in the future:

Increased Integration in Diverse Domains

o   Widespread Adoption: AI systems a re likely to become more deeply integrated into various domains, including healthcare, finance, manufacturing, education, and more.

o   Cross-Domain Applications: The development of AI models capable of handling cross-domain tasks may lead to more versatile and adaptable systems.

Advancements in Explainable AI (XAI)

o   Enhanced Transparency: Continued research and development in Explainable AI (XAI) will likely result in more transparent and interpretable AI models.

o   Ethical and Trustworthy AI: The integration of XAI will contribute to addressing ethical concerns, fostering trust, and ensuring responsible AI deployment, particularly in critical domains.

Continued Evolution of Deep Learning

o   Advanced Architectures: Deep learning architectures are likely to evolve, leading to more sophisticated models capable of capturing intricate patterns and representations in data.

o   Improved Training Techniques: Advances in training techniques, regularization methods, and transfer learning may contribute to overcoming challenges associated with deep learning, such as overfitting.

Ethical and Regulatory Frameworks

o   Emphasis on Ethics: There will likely be an increased emphasis on ethical considerations in AI development, including fairness, accountability, transparency, and mitigation of biases.

o   Stricter Regulations: Governments and international bodies may introduce and enforce stricter regulations to govern the development and deployment of AI systems, addressing potential risks and ensuring responsible practices.

Human-AI Collaboration

o   Enhanced Collaboration: Future AI systems may focus on enhancing collaboration between humans and machines, creating synergies that leverage the strengths of both.

o   Explainable Decision Support: AI systems may act as more transparent decision-support tools, providing explanations and insights to human users, fostering a collaborative decision-making process.

AI in Edge Computing and IoT

o   Decentralized Processing: The integration of AI into edge devices and the Internet of Things (IoT) is likely to increase, enabling decentralized processing and real-time decision-making.

o   Efficiency and Low Latency: AI algorithms running on edge devices may contribute to efficiency gains, reduced latency, and improved overall system performance.

Interdisciplinary Research and Collaboration

o   Convergence with Other Technologies: AI is likely to converge with other emerging technologies such as blockchain, quantum computing, and biotechnology, leading to interdisciplinary research and innovative applications.

o   Addressing Global Challenges: Collaborative efforts may harness the power of AI to address global challenges, including climate change, healthcare crisis, and resource management.

AI in Creativity and Innovation

o   Creative Applications: AI systems may play a more significant role in creative fields, contributing to the generation of art, music, literature, and other forms of content.

o   Innovation Acceleration: AI-driven innovation may accelerate, transforming industries and creating new possibilities for problem-solving and product development.

Continuous Learning and Adaptation

o   Lifelong Learning: AI systems may evolve towards continuous learning, adapting to changing environments, and acquiring new knowledge throughout their operational lifetimes.

o   Adaptive Intelligence: The development of more adaptive and context-aware AI systems may enhance their performance across diverse and dynamic scenarios.

Robustness and Security

o   Resilience Against Adversarial Attacks: Future AI systems may incorporate enhanced security

measures and robustness against adversarial attacks, ensuring their reliability in real-world applications.

o Data Privacy Preservation: Advances in privacy-preserving techniques may be integrated into AI systems to protect sensitive information and address privacy concerns.

In navigating these potential future developments, it is crucial for stakeholders, including researchers, policymakers, and industry leaders, to collaborate on establishing ethical guidelines, regulatory frameworks, and educational initiatives that promote responsible AI development and deployment. Additionally, on-going research in foundational AI technologies, explain ability, and ethical considerations will play a pivotal role in shaping the future landscape of AI systems.

CONCLUSION

This research paper aims to provide a comprehensive overview of Explainable Artificial Intelligence, its methodologies, challenges, applications, emerging trends in Explainable AI and Implications for future AI systems. This will encourage the researchers to develop new techniques for XAI in various domains. This is precisely why the integration of interactive systems providing explanations and feedback holds paramount significance. These systems play a pivotal role in objectively and empirically showcasing to users and decision-makers that AI systems are reliable and can be trusted.

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Review on the Integration of Electric Vehicles and Renewable Energy in Power System

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ABSTRACT

The increasing number of electric vehicles, or EVs, is a big step in the direction of ecologically friendly and sustainable transportation options. The administration and regulation of power systems is made more difficult by the increased use of EVs. The key to overcoming these obstacles appears to be integrating Renewable Energy Sources (RESs) into the network architecture. The integration of EVs and RESs into power grids is thoroughly reviewed in this research. According to a bibliographic analysis, IEEE Access is the journal that has the biggest influence in this area. In order to improve the classification of literature, the paper offers an analytical synopsis of each contribution. The literature is further divided into two categories: heuristic and mathematical algorithms. Two popular formulations of these algorithms are particle swarm optimisation and mixed integer linear programming. Interestingly, the most popular platform is MATLAB/Simulink, and the main optimisation tool is CPLEX.

KEYWORDS : *Electric vehicle, Literature review, Renewable energy sources, Power systems.*

INTRODUCTION

The advancement of human civilization has been greatly aided by the efficient use of energy. During the pre-industrial age, the main sources of energy were wood combustion for purposes like cooking, heating, and metal smelting, as well as labour from humans and animals. When coal became the primary energy source at the start of the industrial revolution, a significant change occurred. The development of steam engines, improved transportation systems, and mechanisation of several industries were all made possible by coal. Fossil fuel exploration and use have been major forces behind technical innovation and economic prosperity during the past century [1].However, the use of fossil fuels, which include coal, oil, and natural gas, results in significant costs that go beyond what is often included in market estimates. These costs are related to public health, ecological deterioration, and climate change; in academic discourse, these costs are referred to as externalities. Earth's ecosystems are altered by this occurrence, which also puts the environment and human populations at danger for health problems. Interestingly, market pricing frequently do not account for these external expenses, underscoring the necessity of a thorough reevaluation of the actual cost and effects of using fossil fuels.

To solve the issues raised by the greenhouse effect and meet the growing demand for electricity, researchers' attention has switched in recent decades towards new methods of producing electricity. Renewable energy is currently expanding at a very quick pace, with solar photovoltaic (PV) and wind power being the most popular options. The grid-connected photovoltaic (PV) system has grown significantly as of 2021, becoming the fastest-growing renewable energy technology with a total capacity of 843.09 GW [2]. Concurrently, wind energy has been crucial in forming the renewable energy scene, greatly augmenting the continuous initiatives to switch to more ecologically friendly and sustainable ways of producing power.

Related Work

Many innovative technology have been included into power systems in a coordinated attempt to further reduce emissions in light of the current situation. Achieving carbon neutrality and guaranteeing a dependable and economical energy supply require the integration of renewable and ecologically sustainable energy sources. Along with the development of crucial infrastructure and governance, the ongoing shift to a sustainable and environmentally friendly energy system necessitates an expedited process and a revolutionary strategy in important industries, most notably transportation [3]. The popularity of electric cars (EVs) is rising as a result of its ecologically friendly features. According to a recent report, by 2023, the market for electric vehicles is expected to produce $457.60 billion in sales. Additionally, the research projects a sales volume by 2027, there will be 16.21 million electric cars [4]. This highlights how important electric vehicles (EVs) are becoming as a key element of a larger plan to achieve a more sustainable and emission-free future in the transportation industry.

Reducing the energy consumption per unit of distance in cars is one of the most important ways to improve their energy efficiency and hence lower the greenhouse gas emissions linked to road travel. The introduction of novel vehicle technologies and the improvement of current ones can lead to the elevation of vehicle efficiency [5]. The study of [6] provides an extensive assessment of modern energy storage technologies made for use in automobiles. The theory, design, and foundations of electric vehicles (EVs) have been the subject of much writing [7–11], which emphasises the importance of fully comprehending and optimising the major systems and parts that contribute to the overall efficiency of the vehicle. As the drive for environmentally friendly mobility grows, continued study and developments in car technology are essential function in resolving the environmental issues raised by motor vehicle use.

Renewable Energy Sources

In order to transform conventional energy from coal and energy from renewable sources into electrical energy, a complex network of components is called a power system [12]. The phrase "renewable energy sources" refers to energy that comes from resources that have the ability to spontaneously replenish themselves over a human lifetime. Hydropower, wind, solar photovoltaic (PV), natural gas, and biofuels are a few examples of renewable energy sources. Electricity generation, as well as heating, cooling, and transportation, are frequently accomplished using these renewable energy sources. Reducing the environmental effect of conventional energy generation and encouraging sustainability are two key benefits of using a variety of renewable energy sources. This highlights how versatile renewable energy is in satisfying different energy needs across different sectors.

The percentage of total power capacity attributable to various energy sources has gradually increased over the last ten years, especially with the steady rise in wind and solar photovoltaic (PV) penetration. It is anticipated that this trend would persist in the upcoming years [13]. Interestingly, solar and wind PV have become the most popular renewable energy sources, especially when combined with electric vehicles (EVs). This integration emphasises a societal shift towards a more sustainable and integrated energy ecosystem by highlighting the relationship between advances in environmentally friendly transportation solutions and sustainable energy generation.

Electric Vehicles

An electric vehicle (EV) is a term used to describe a vehicle that runs on electricity. Experts have been investigating electric vehicles as a form of transportation since the 19th century, so the idea is not new. Many academics and engineers have studied the development of electric vehicles (EVs) in great detail, with a combination of environmental and economic issues influencing the field's evolution. The development of electric vehicles has been greatly influenced by a number of crucial occasions, some of which are noted below [14].

- 1832: Robert Anderson created the first primitive EV.

- 1901: Edison tackles the issue of EV batteries; Ferdinand Porsche created the first hybrid EV.

- 1968: Oil crises lead to a resurgent interest in EVs.

- 1971: NASA's lunar rover was the first electric vehicle utilized for Moon exploration.

- 1974: Many companies started to design and produce EVs.

- 1990: New regulation for electromobility.

- 1997: Toyota Prius was the first mass-produced hybrid EV.

- 2010: Nissan Leaf was the first mass-produced full electric EV; Chevy Volt was the first mass-produced plug-in hybrid EV.

- 2013: Cost reduction for EV batteries.

- 2014: Massive production of EVs from different companies.

- 2022: Global sales of electric vehicles increased by about 60%, surpassing 10 million for the first time.

Table 1. The top five corporations with the highest sales of plug-in hybrid and full electric vehicles in the year 2022.

Plug-In Hybrid Electric Vehicles		Full Electric Vehicles	
EV Company	EV Sales	EV Company	EV Sales
BYD	1,857,549	Tesla	1,314,330
Tesla	1,314,330	BYD	913,052
Volkswagen	831,844	SAIC	671,725
SAIC	724,911	Volkswagen	571,067
Geely-Volvo	606,114	Geely-Volvo	383,936

Three different types of electric vehicles are currently offered on the market [19]:

HEVs, or hybrid electric vehicles: These cars have an electric motor in addition to a petrol engine. When the car is travelling slowly or stops completely, like in traffic, the electric motor helps with propulsion.

Hybrid electric vehicles that can also be charged from an electrical outlet are known as plug-in hybrid electric vehicles, or PHEVs for short. With the ability to drive entirely on electricity and the advantages of an internal combustion engine, this dual power source offers versatility.

Fully electric vehicles (FEVs): These types of vehicles get their energy only from electric motors and batteries. There is no internal combustion in them engine, with all propulsion provided by electricity. Typically, charging an electric vehicle (EV) involves connecting it into an outlet or charging station.

Research Gaps for Future Discussion

- Power System Demand

- Insufficient Capacity of Charging Infrastructure

- Smart Energy Management Systems

- Integration of Other RESs

- Resiliency and Adaptability of Power Systems

- Wireless Charging

- Environmental Impact of RESs' Integration

CONCLUSIONS

This study looks into how EVs and RESs can be integrated into energy systems. The evaluation includes a thorough compilation of 175 literary works related to literary studies that have been released in the last fifteen years. According to the total number of papers published in each publication, a bibliographic study revealed that IEEE Access, Energy, and IEEE Transactions on Smart Grid had the greatest impact. The kind of EVs and/or RESs, as well as how EVs and RESs are integrated into power systems with a concentrate on the following topics: emissions, EV aggregators, parking spaces and charging stations, EV batteries and battery energy storage systems, control strategies for integrating RESs with EVs, and the financial effects of such integration. After concentrating on the formulation and implementation specifics, it can be said that most published research articles have presented a formulation that is backed by both mathematical methods and heuristic software. Considered the most well-known heuristic algorithm is particle swarm optimisation, and the most well-known mathematical approach is mixed integer linear programming. CPLEX was the main optimisation tool, while MATLAB/Simulink was used for a significant amount of the studies' execution. To improve the integration of RESs into electrical networks in conjunction with electromobility, there are also a number of research areas that need to be further investigated.

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Economical Home Automation System using Mesh Networking through ESPNOW Protocol

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ABSTRACT

The rapid development of Internet of Things (IoT) technology has ushered in a new era of smart homes with promises of greater efficiency, convenience, and security. This study explores a new method of home automation using the ESP-NOW protocol, a low-power, high-throughput communication protocol developed by Espressif Systems for their ESP32 microcontrollers. Using a network of ESP32 devices strategically placed around a home, our recommended home automation system enables real-time environmental monitoring and control over numerous appliances. These devices establish an effective and decentralized wireless mesh network by leveraging the ESP-NOW protocol for smooth communication. The proposed paper addresses the growing demand for trustworthy and affordably priced home automation system.

KEYWORDS : *ESP32, EspNow protocol, DHT11, PIR, MQ9 gas sensor, Arduino Cloud IOT, IFTTT.*

INTRODUCTION

Modern living is entering a transformational era thanks to the Internet of Things (IoT) rapidly developing capabilities that smart houses are now a real thing, offering improved security, convenience, and efficiency. The notion of home automation has enthralled homeowners by offering the chance to manage and observe multiple facets of their living areas with unparalleled convenience. With the use of the ESP-NOW protocol, we hope to fully realize the promise of home automation through the course of this project. The proposed paper aims to create a cost-effective home automation system using ESPNOW protocol.

The proposed paper focuses on resolving the internet dependence that is a basic problem with conventional home automation systems. Every smart device in most conventional setups is connected to the internet, which raises the complexity and cost of these systems. On the other hand, we provide a method that drastically lowers the requirement for numerous devices to be online. This reduces the total cost of home automation while also streamlining operations. The thoughtful placement of ESP32 devices in residential areas is essential for fulfilling the effective utilization of the system. These devices are the core of our system; they keep an eye on the weather and regulate a wide range of appliances. ESP-NOW allows these devices to exchange data easily and create a dependable, decentralized wireless mesh network.

As we go deeper into the details, we will also examine the ESP-NOW protocol's nuances, dissect its essential components, and highlight its numerous uses in the field of home automation. Whether you are an enthusiast for technology or just looking for an affordable, useful

enhancement for your living area, this project aims to fulfil your home automation aspirations. It emphasizes how ESP-NOW can democratize home automation and is ideally suited to the ever-changing needs of modern houses.

LITERATURE SURVEY

J. Cujilema, G. Hidalgo, D. Hernandez-Rojas, and J. Cartuche, in their research paper, "Secure Home Automation System based on ESP-NOW Mesh Network, MQTT and Home Assistant Platform" presented at IEEE LATIN AMERICA TRANSACTIONS proposed study presents a secure home automation system using ESP-NOW mesh network and MQTT integration with Home Assistant, offering fast and stable performance in controlling IoT devices while addressing security challenges.[1]

Mochamad Fajar Wicaksono, Myrna Dwi Rahmatya, in their research paper, "IoT for Residential Monitoring Using ESP8266 and ESP-NOW Protocol" presented at Jurnal Ilmiah Teknik Elektro Komputer dan Informatika (JITEKI) proposed study introduces a residential monitoring system combining IoT and the ESP-NOW protocol. It enables homeowners and security personnel to unify house status through web and Android applications, providing notifications for intrusions, gas leaks, or fire detection.[2]

Roberto Pashic, Ivo Kuzmanov Kokan Atanasovski, in their research paper, "Espressif Esp32 Development Board in Wi-Fi Station Communication Mode" presented at Temel-ij, proposed study explores the capabilities of the ESP-NOW communication protocol on the ESP32 development board from Espressif. It addresses challenges in data acquisition from sensor nodes in areas lacking local wireless networks.[3]

Koushik M S, Alfred S, Srinivasan M , Dr. Sreenivasa Setty, Lavanya R, in their research paper, "Design and Development of Wireless Sensor Network based data logger with ESP-NOW protocol" presented at 2021 6th International Conference for Convergence in Technology (I2CT) proposed study introduces a cost-effective Wireless Sensor Network (WSN) data logger system utilizing ESP-NOW protocol for precise data collection in the agricultural sector.[4]

Neha Malik, Yogita Bodwade, in their research paper, "Literature Review on Home Automation System" presented at International Journal of Advanced Research in Computer and Communication Engineering proposed study deals with discussion of different intelligent home automation systems and technologies from a various features standpoint.[5]

Aleksey V. Zinkevich, in their research paper, "ESP8266 Microcontroller Application in Wireless Synchronization Tasks" presented at 2021 International Conference on Industrial Engineering, Applications and Manufacturing (ICIEAM) proposed study explores the utilization of ESP8266 microcontrollers in wireless synchronization tasks, investigating the UDP protocol and the ESP-NOW protocol.[6]

From the literature survey it was observed that major work was done on showcasing the theoretical representation of the ESPNOW protocol using different networking techniques in the field of IOT. The proposed paper focuses on the practical implementation of the ESPNOW protocol for home automation at a reasonable cost using the mesh networking approach. In addition, it records additional data, including the temperature and humidity within the home, motion detection for home security, and gas detection for gas leaks.

TECHNICAL DESCRIPTION

Fig 1. Block Diagram of ESPNOW Home Automation

The figure 1 outlines the architecture of the proposed home automation system utilizing the ESP-NOW protocol. It features a single Master controller, namely the ESP32, which interfaces with the Server application responsible for dispatching commands to control household appliances. Furthermore, the system allows for the connection of up to 5 additional ESP32 boards

to the Master controller. Each ESP32 board, designated as a Slave, is equipped with a suite of sensors including PIR (Passive Infrared Receiver), gas sensor, and temperature sensors. These sensors collectively provide real-time data.

In this implementation, the HC-SR501 PIR sensor serves to detect, human presence strategically positioned on both the right and left sides at the front of the house. Operating at a 5V voltage requirement, this sensor triggers a HIGH-value output signal upon detecting motion, thus alerting potential intruders. Meanwhile, the DHT11 sensor monitors temperature and humidity levels, while gas sensors, specifically the MQ2 module, are deployed to detect gas leaks within the household environment. Directly interfaced with the ESP32, the MQ-2 module operates at a 5V voltage and is situated in the kitchen, capable of identifying gas leakages and providing digital output values indicative of potential hazards. One ESP32 (Slave) integrates with the electrical appliances, connecting and controlling all household appliances.

The Master controller connects to the Slave board through the ESP-NOW Protocol. Only the Master controller connects to the internet, reducing the load on the WiFi server. Appliance triggers and sensor output are displayed on the Arduino Cloud IOT Website (for setup) and the Android Application (for display). All system setup, including threshold settings, GUI (Graphical User Interface), and appliance trigger switches (Virtual Switch), is performed through the Arduino Cloud IOT Website. The Arduino Cloud IOT Android Application aids in triggering home appliances and displaying sensor output.

Since, the previous method needed a networking device for every 12 automated switches; with the aid of the suggested system, we may minimize the number of networking devices. The proposed system supports 14 switches on a particular node (ESP32), and only a single node (Controller) will be connected to the networking device. By using the proposed system, greater number of devices will be connected to a single networking device i.e. a system consisting of 5 nodes (ESP32) can operate 70 appliances at a time. Additionally, it contains several vital security elements that are crucial for homes, such a gas sensor, PIR sensor, and DTH11 sensor, which serve

to protect and alert the user about the circumstances in the home.

RESULT

Table 1: Logical Representation of the proposed system (Electric Appliances)

Switches Toggled	LED status	Switches	Programming logic
Switch is pressed on (High)	LED On	Input to ESP32 = 1	Input programming logic = 'A'
Switch is pressed off (Low)	LED Off	Input to ESP32 = 0	Input programming logic = 'a'

The Arduino cloud IOT Android Application receives the input signal (1/0) from the mobile application, and then forwards it to the linked ESP32. Signals are delivered in analog form, or voltages, from the controller board to the assigned relay board. Through a mobile application, input is provided as digital 1 for turning on an LED and digital 0 for turning off an LED. The input then further changed to analog form i.e. in form of voltages.

Table 2: Output for Motion Detection (PIR Sensor)

Cases	Output on Android application	Digital Signal (1/0)	Analog Value (In Volts)
Case1: Movement Detected	Alert Message popup	1(High)	4.89
Case2: No Movement	No Alert Message	0(Low)	0.05

Fig 2. Dashboard for sensor

Fig 3. Dashboard for appliance control

For DTH11 temperature and humidity sesnor, the electrical resistance between two electrodes is measured by the DHT11 to identify water vapor. A moisture-holding substrate with electrodes attached to its surface serves as the humidity sensor component. The substrate releases ions upon absorbing water vapor, hence enhancing the conductivity between the electrodes. Relative humidity affects the resistance difference between the two electrodes in a proportionate way. The resistance between the electrodes reduces with increasing relative humidity and increases with decreasing relative humidity. The following expression helps in calculating the relative humidity.

RH= (ρw/ρs) × 100%

RH: Relative Humidity.

ρw: Density of water vapor.

ρs: Density of water vapor at saturation.

CONCLUSION

In the ever-evolving landscape of smart homes and automation, our project has shed light on the transformative potential of the ESP-NOW protocol. By implementing this low-power, high throughput communication protocol, we have demonstrated how home automation can be both cost effective and efficient. The proposed paper focuses on the system featuring a master controller connected to a network of ESP32 devices through ESPNOW, exemplifies a paradigm shift in how we envision and realize smart living spaces. The advantages are numerous, with the most noteworthy being reduced the networking components resulting in cost effectiveness.

Furthermore, the proposed system for advocating open-standard protocols like ESP-NOW aligns perfectly with the evolving needs of modern households. It democratizes home automation, making it accessible and affordable to a broader audience. The use of ESP-NOW protocol minimizes Wi-Fi usage, making it ideal for power-efficient and non-congested data exchange in IoT and home automation applications. This paves the way for a more sustainable and user-friendly future in smart living.

As we conclude this exploration, we envision a world where ESP-NOW empowers homeowners to take control of their living spaces with unmatched ease and affordability. Whether you are a tech enthusiast or simply seeking a practical upgrade for your home, the potential of ESP-NOW in home automation holds the promise of transforming your dreams into reality. This proposed system marks the beginning of what is possible in the realm of home automation, and we look forward to witnessing the continued evolution and innovation in this exciting field.

FUTURE SCOPE

- Voice Control: Enhanced voice recognition and natural language processing capabilities can make voice assistants more intuitive and responsive within ESP-NOW home automation systems, improving user experience. Voice control can become a primary interface for managing devices and executing commands, making the system more accessible and user-friendly.

- Smart Cities Integration: Expanding the scope beyond individual homes, ESP-NOW-based automation could be applied to larger smart city initiatives. This includes intelligent street lighting, waste management, and public transportation. By integrating ESP-NOW into the broader smart city infrastructure, municipalities can enhance efficiency, reduce energy consumption, and improve the quality of life for urban residents.

- Machine Learning and AI Integration: Integrating machine learning and artificial intelligence algorithms into ESP-NOW-based systems can enable predictive and adaptive automation. Smart homes could learn from user behaviour and environmental data to optimize energy usage and enhance convenience. AI could analyse historical

data and user preferences to anticipate needs, making the automation system more proactive and user-centric.

- Customization and Personalization: Future systems may offer even more granular control and customization options, allowing users to create highly personalized automation scenarios to suit their lifestyles and preferences. Personalization can extend to device behaviour, scheduling, and responses to different environmental conditions. Users can tailor their smart homes to reflect their unique needs and preferences, creating a truly customized living space.

The fellow researchers can work on the proposed future scopes and not limited to for further improvisation of the proposed system.

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Comparative Evaluation of IDS using Machine Learning

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ABSTRACT

Intrusion Detection System (IDS) are essential security measures that protect computer networks from unauthorized access and potential threats. Traditional IDS rely on signature- based detection methods, which may not be effective against newly emerging threats. In contrast, Machine Learning (ML)-based IDS can adapt and learn from the changing network environment and detect new and unknown threats. This paper presents a performance evaluation of Intrusion Detection Systems that utilize Machine Learning Techniques The performance evaluation of IDS using ML is carried out on several metrics, including detection accuracy, false positives, and false negatives. The evaluation also includes a comparison of the different ML algorithms used for IDS. The results of the evaluation show that ML-based IDS outperforms traditional signature-based IDS and that certain ML algorithms are more effective than others in detecting network attacks. The paper concludes by discussing the future research directions in IDS using ML.

KEYWORDS : *Intrusion detection system, Machine learning, Random forest algorithm, Decision tree algorithm, K-Neighbor classifier algorithm, DoS, Probe, R2L attack.*

INTRODUCTION

IDS stands for Intrusion Detection System. It is a type of security software or device that checks a network or system for malicious activity The main goal of an IDS is to identify suspicious activity, such as unauthorized access attempts, malware infections, and data exfiltration, and alert security personnel so they can investigate and respond to the incident.

An IDS typically works by analyzing network traffic and compares them against a set of predefined rules or patterns. If the IDS detects any activity that matches the rules or patterns, it generates an alert or logs the event for further analysis. There are several types of IDSs, including host-based IDSs (HIDS), which monitor activity on a single host or endpoint, and network-based IDSs (NIDS), which monitor network traffic for signs of malicious activity. Some IDSs also use machine learning algorithms to identify and classify new and unknown threats, making them more effective at detecting advanced and evolving threats.

The objective of a comparative evaluation of intrusion detection systems (IDS) using machine learning (ML) algorithms is to assess and compare the performance of different IDSs in detecting and classifying various types of network attacks. The evaluation typically involves training and testing different IDSs on the same dataset, which contains both normal and attack traffic. Metrics parameters such as accuracy, precision, recall, F1-score and area under the curve (AUC) are used to evaluate the performance of each IDS. [1-2]

Moreover, the evaluation of IDSs using ML algorithms can also help in identifying the limitations of each IDS, the types of attacks they are effective against, and the false positives and false negatives generated by each IDS. This information can be used to improve the accuracy and reliability of IDSs and develop better defenses against various network attacks.

The performance evaluation of an Intrusion Detection System (IDS) using Machine Learning (ML) involves assessing the ability of the IDS to accurately detect and classify various types of network traffic and events, such as malicious attacks or unauthorized access attempts. [3]

There are several metrics used to evaluate the performance of IDS using ML, including:

a) Detection rate: This measures the percentage of attacks or anomalous events that are correctly detected by the IDS.

b) False positive rate: This measures the percentage of normal or benign events that are incorrectly classified as attacks or anomalies.

c) Precision: These are measures of the accuracy and completeness of the IDS's detections. Precision measures how correctly attacks are identified out of all detections

d) Recall measures the proportion of all attacks that are correctly identified.

e) F1 score: This is a combination metric that considers both precision and recall in order to provide an overall assessment of the IDS's performance.

To evaluate the performance of an IDS using ML, a dataset of network traffic and events is typically used. The dataset is then used to train and test the ML model used by the IDS. The performance of the IDS is then evaluated using the metrics described above, and the results are used to refine and improve the ML model and the overall performance of the IDS.

MACHINE LEARNING ALGORITHMS

Random Forest Algorithm

Random Forest uses multiple decision trees to create a highly accurate model. Each decision tree in the forest is trained on a random subset of the training data and a random subset of the features in the input dataset. By doing this, each decision tree is forced to focus on different aspects of the data, reducing overfitting and improving generalization performance [4].

The advantages of Random Forest include:

a) High accuracy

b) Robustness to noise and outliers

c) Feature selection

d) Low risk of overfitting

Overall, Random Forest is a powerful and widely used algorithm that can be applied to both regression and classification problems. [5]

Decision Tree Algorithm

Decision tree algorithm is ML algorithm that can be used for both regression and classification tasks. It works by recursively splitting the input data into smaller subsets based on the values of different input features, until a stopping criterion is met. At each split, the algorithm selects the feature that provides the most information gain, which is a measure of how much the feature reduces the uncertainty in the target variable. The result of this is a tree-like structure where each node represents a feature, each edge represents a decision based on the value of the feature, and each leaf node represents a predicted value or class.

The advantages of Decision Tree include:

a) Easy to understand and interpret

b) Can handle both numerical and categorical data

c) Robust to outliers

d) Can be used for feature selection

Overall, Decision tree algorithm is a powerful and widely used algorithm that can be used for both regression and classification problems. However, it is prone to overfitting if the tree is too deep or the stopping criterion is too loose, and it may not generalize well to unseen data.

K-Neighbor Classifier Algorithm

The k-nearest neighbors (k-NN) algorithm is a type of supervised ML algorithm used for classification and regression analysis. It works by finding the k number of closest data points in the training dataset to a given data point in the test dataset, and then predicting the class or value of the test point based on the majority class or average value of its k nearest neighbors. [11]

The k-NN algorithm is simple to implement and works well on small datasets with a low number of features.

However, it can be computationally expensive and memory-intensive on large datasets with many features. Additionally, choosing an appropriate value for k can be challenging, and the algorithm may be sensitive to the choice of distance metric used.

Thus Machine Learning Methods for Network Intrusion Detection shows how the KDD dataset is useful for testing different classifiers. Here KDD pre- process phase is used to prepare fair experiments and fully randomized independent test data. (NIDS) is a computer software application that can detect and report network security problems by monitoring network or system activities for malicious or anomalous behaviour. [6-8]

PROCESS OF ML ALGORITHMS

IDS (Intrusion Detection System) is a security technology that helps identify potential security breaches in computer networks or systems. Fig.1 shows the procedure for ML algorithms. [9]
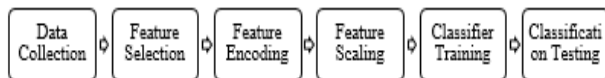
Fig.1-Procedure for ML Algorithms

a) Data collection is an essential part of IDS since it enables the system to analyze network traffic and identify anomalies or malicious activities. the effectiveness of an IDS system depends on the accuracy and completeness of the data collected. Therefore, it is crucial to choose the appropriate data collection method based on the network architecture and security requirements.

b) Data pre-processing is an essential step in IDS (Intrusion Detection System) since it involves preparing the raw data for analysis to identify potential security threats accurately. effective data pre-processing in IDS is essential for accurate and efficient threat detection, and it helps to ensure that the analysis produces meaningful results.

c) Classification testing in IDS (Intrusion Detection System) is an essential process that involves evaluating the performance of the IDS in identifying potential security threats accurately. The primary goal of classification testing is to determine the accuracy, sensitivity, and specificity of the IDS in detecting malicious network traffic. , classification testing is essential to ensure that IDS systems are effective in identifying potential security threats accurately, and it helps to ensure that the system produces meaningful results.

TYPES OF ATTACKS

Denial of Service (DoS)attack:

Denial of Service (DoS) attacks are a common type of attack that can be evaluated in the context of IDS using machine learning (ML) algorithms. DoS attacks are designed to overwhelm a network or system with a flood of requests or data, leading to a slowdown or shutdown of the targeted system.Here are some ways in which DoS attacks can be evaluated in the context of IDS using ML algorithms:

a) *Analyzing Network Traffic*: ML algorithms can be used to analyze network traffic patterns to detect and prevent DoS attacks. By analyzing the volume and frequency of network traffic, ML algorithms can identify patterns that are consistent with a DoS attack, such as a sudden surge in traffic from a particular source.

b) *Identifying Anomalies*: ML algorithms can also be used to identify anomalies in network traffic that may be indicative of a DoS attack. By analyzing the behavior of the network, ML algorithms can identify unusual patterns that may be the result of a DoS attack, such as a sudden increase in traffic from a particular IP address or a sudden increase in the number of failed login attempts.

c) *Classification Algorithms*: ML algorithms can also be used to classify different types of DoS attacks. By training a classification algorithm on a dataset of known DoS attacks, the algorithm can learn to identify patterns that are consistent with different types of DoS attacks, such as SYN floods or UDP floods

d) *Response to DoS Attacks*: ML algorithms can also be used to develop automated responses to DoS attacks. By monitoring network traffic in real-time, ML algorithms can detect and respond to DoS attacks in real-time, such as by blocking traffic

from a particular source or slowing down traffic to mitigate the impact of the attack.

Overall, evaluating the performance of an IDS in detecting and preventing DoS attacks using ML algorithms requires careful consideration of network traffic patterns and the development of effective automated responses to mitigate the impact of attacks Equations [10].

Remote-to-local (R2L)attack

R2L (Remote-to-Local) attacks are a common type of attack that can be evaluated in the context of IDS using machine learning (ML) algorithms. R2L attacks are designed to exploit vulnerabilities in network services to gain unauthorized access to a local system. Here are some ways in which R2L attacks can be evaluated in the context of IDS using ML algorithms:

a) *Protocol Analysis*: ML algorithms can be used to analyze network traffic at the protocol level to detect R2L attacks. By analyzing the traffic patterns of different network protocols, ML algorithms can identify anomalous traffic that may be indicative of an R2L attack, such as unusual login attempts or unexpected connections to network services.

b) *Feature Engineering*: ML algorithms can also be used to engineer features that are specific to R2L attacks. By identifying features that are indicative of an R2L attack, such as the number of failed login attempts or the types of network services accessed, ML algorithms can learn to identify patterns that are consistent with R2L attacks.

c) *Response to R2L Attacks*: ML algorithms can also be used to develop automated responses to R2L attacks. By monitoring network traffic in real-time, ML algorithms can detect and respond to R2L attacks in real-time, such as by blocking traffic from a particular source or disabling network services that are being targeted.

Overall, evaluating the performance of an IDS in detecting and preventing R2L attacks using ML algorithms requires careful consideration of network traffic patterns and the development of effective automated responses to mitigate the impact of attacks.

Probe Attack

A probe attack in IDS (Intrusion Detection System) is a type of attack where the attacker sends a series of small, targeted packets to a network or system to collect information about its vulnerabilities and weaknesses. The goal of a probe attack is to identify vulnerabilities in the target system that can be exploited in a subsequent attack. An IDS is a security tool designed to detect and prevent such attacks. IDSs use various methods to detect probe attacks, including signature-based detection and anomaly-based detection.

In signature-based detection, the IDS looks for specific patterns or signatures of known probe attacks in network traffic. If a signature match is found, the IDS will trigger an alert to notify the security team of the attack. In anomaly-based detection, the IDS monitors the network traffic for abnormal patterns of activity that deviate from the normal behavior of the system. Any significant deviation from the normal behavior can be flagged as a potential probe attack. In either case, the IDS is an important tool for detecting and preventing probe attacks, as it helps to identify and mitigate vulnerabilities before they can be exploited by an attacker[12-14].

SIMULATION RESULTS AND DISCUSSIONS

Simulations are carried on Jupyter Notebook. Evaluation of Dataset based on Various parameter for attacks like Denial of Service attack, Remote to Local attack, Probe attack are done using 3 algorithms like Random Forest, Decision Tree and K-Neighbor Classifier.

Denial of Service: For Denial of Service, K-Neighbor Classifier found to be better within other algorithms having an accuracy of 86.66%.

Table 1. Test Model Parameters of kdd dataset for DoS Attack

Parame-ter	Algorithm	Random Forest	Decision Tree	K-Neighbors Classifier
Accuracy (%)		85.1	81.65	83.5
Precision (%)		88	82	87
Recall (%)		83.5	82	87
F1 Score(%)		85	82	86
Support(%)		17169	17169	17169

Remote to Local: For Remote to Local, K-Neighbor Classifier found to be better within other algorithms having an accuracy of 78.69 %.

Table 2. Test Model Parameters of kdd dataset for R2L Attack

Parameter	Algorithm	Random Forest	Decision Tree	K-Neighbors Classifier
Accuracy (%)		77.9	78.2	78.69
Precision (%)		61	75	77
Recall (%)		78	78	79
F1 Score(%)		68	75	71
Support(%)		12456	12456	12456

Probe: For Probe Attack, K-Neighbor Classifier found to be better within other algorithms having an accuracy of 85.52 %.

Table 3. Test Model Parameters of kdd dataset for probe Attack

Parameter	Algorithm	Random Forest	Decision Tree	K-Neighbors Classifier
Accuracy (%)		82.05	80.17	85.52
Precision (%)		83	87	85
Recall (%)		88	80	86
F1 Score(%)		89	82	85
Support(%)		12132	12132	12132

CONCLUSION

After Evaluation of Dataset based on Various parameter for Denial of Service attack using 3 algorithms, it is found that K-Neighbor Classifier Algorithms have better Recall rate as well as F1-Score rate compare to other algorithms while Random Forest Algorithms have better Precision Rate. For Probe attack using 3 algorithms, it is found that Random Forest Algorithms have better Recall rate as well as F1-Score rate compare to other algorithms while Decision Tree Algorithms have better Precision Rate. For Remote to Local attack using 3 algorithms, it is found that K-Neighbor Classifier have better Precision rate as well as Recall rate compare to other algorithms while Decision Tree Algorithms have better F1-Score.Thus overall K-Neighbor Classifier Algorithm if found to have better accuracy compare to other algorithms.

Intrusion detection fits in with a layered defense approach and intrusion detection technology is still growing and improving. Massive changes are in store for both areas. Some of the areas within intrusion detection, in which substantial and beneficial progress is likely to occur. These areas include the continued reduction in reliance on signatures in intrusion detection, the growth of intrusion prevention, advances in data correlation and alert correlation methods, advances in source determination, inclusion of integrated forensics functionality in IDS., Greater use of honeypots.

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Development of a Smart Irrigation System with Soil Erosion Detection

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ABSTRACT

India is an agricultural country and agriculture is an important aspect of the Indian economy. To increase agricultural productivity, technology can be used in the process of irrigation. The use of technology can greatly reduce water waste while supplying the required volume of water and also help in more crop productivity to meet the commercial demand. Also, Soil Erosion is a serious concern that negatively affects agricultural production and raises water resource utilization issues. In any soil management system, controlling the sediment is important to improve water quality and soil quality. Our main purpose is to develop a smart irrigation system along with a soil erosion detector that can control the irrigation process and also help us to determine the amount the soil that is being eroded. By integrating soil erosion monitoring and irrigation management, our IoT-powered solution optimizes agricultural practices. It offers real- time monitoring of erosion levels, facilitates data-driven decision-making for irrigation, and enhances sustainability. This project enables an automated and efficient irrigation process which leads to an increase in crop productivity, thereby increasing supply and helping to bridge the demand-supply gap. Secondly, this proposed work provides real-time access to the data from the farm to the farmer from the sensors deployed across the farm, thereby helping them to make data-driven decisions. This system also enables proper water-resource management and thus reduces the wastage of water.

KEYWORDS : *Technology in irrigation, Crop productivity, Commercial demand, Soil erosion, Agriculture, soil management system, Smart irrigation system, IoT, Real-time monitoring, Data-driven decision making, Sustainability, Demand-supply gap, Water resource management.*

INTRODUCTION

India is an agricultural country and agriculture is an important aspect of the Indian economy. To increase agricultural productivity, technology can be used in the process of irrigation. Irrigation is considered as a main factor in any agricultural system. Technology can significantly help to supply the desired amount of water with less water wastage and also help in more crop productivity to meet the commercial demand. Also, Soil Erosion is a serious concern that negatively affects agricultural production and raises water resource utilization issues. In any soil management system, controlling the sediment is important to improve water quality and soil quality. So, our main purpose is to develop a smart irrigation system along with a soil erosion detector that can control the irrigation process and also help us to determine the amount the soil that is being eroded.

LITERATURE SURVEY

Smart irrigation systems have been proven to effectively manage the irrigation process in agriculture. Much

research has been conducted and new technologies have been developed for smart irrigation systems, and they are also been upgraded. Some of the key takeaways from the research papers we have studied are given below.

IoT in agriculture relies heavily on sensors. We have come across the various sensors that were used in the projects mentioned in the research papers for instance soil moisture sensor, temperature and humidity sensor, light sensor array, time of flight distance sensor, 3-axis accelerometer, rain sensor, sunlight sensor, etc.

Sensor data is collected and transmitted to a central system for data processing. In most of the systems, the data issent to a cloud-based platform where the entire data processing is carried out in the cloud itself and the decision-making is based on the logical implementation of the data. While some systems were also operated through web servers and Android interfaces. Also, some advanced systems operated through AIML where the data from sensors were processed through advanced machine learning algorithms to make the decision-making more advanced and efficient.

A system by S. V. Patel uses a node MCU and two sensors which are a soil moisture sensor and a humidity and temperature sensor. The data is collected from the farm by these two sensors and is processed by an analog-to-digital converter to convert the analog data into digital form. The processed data is then sent over the cloud through a GSM Module. The data is then fetched by another GSM Module located at the tube well which is further integrated by a relay module connected with an electric water pump [1].

Another system by K. Cagri Serdaroglu suggests automatic and enhanced irrigation through amachine-learning algorithm. This system also consists of a Node MCU integrated with a soil moisture sensor, a temperature and humidity sensor, and motors. Training data from the database is processed and trained by a machine learning algorithm. Based on the test data which is collected by the sensors in the farm and the training data, a decision is taken whether to switch on/off irrigation [2].

The system by S. Vaishali also showed a similar adaptation where Raspberry Pi was integrated with the sensors and water motor. The system was connected to the cloud and integrated with an Android mobile [3].

Similar adaptations of smart irrigation systems were given in various other research papers cited below.

PROPOSED SYSTEM

Our integrated solution combines smart soil erosion monitoring with advanced irrigation management through a cohesive and innovative approach. Leveraging IoT technology, wireless sensor networks, and data-driven decision-making, this system ensures efficient irrigation practices while addressing soil erosion concerns.

By integrating soil erosion monitoring and irrigation management, our IoT-powered solution optimizes agricultural practices. It offers real-time monitoring of erosion levels, facilitates data-driven decision-making for irrigation, and enhances sustainability.

This integrated system represents a significant step towards achieving efficient and eco-friendly farming practices in shared tube-well cultures, ultimately leading to increased productivity and resource conservation.

Our project consists of two systems: the first one to be installed at the farms as shown in Fig. 1 and the second one to be installed at the tube well as shown in Fig. 2. The farm system shown in Fig. 1 consists of group 1 sensors and group 2 sensors. Group 1 sensors include a soil moisture sensor and a temperature and humidity sensor. Group 2 sensor includes a light sensor array, a time-of-flight sensor for distance measurement, and a 3-axis accelerometer. The system is controlled by a microcontroller unit with a power supply interfaced with the GSM Module for communication purposes.

The tube well system shown in Fig. 2 consists of a GSM module to collect the data from the farm system interfaced by a microcontroller with a power supply, further connected by relay drivers to operate the pump. Sensor data is collected and sent to a cloud-based platform and the decision-making is based on the logical implementation of the data. In order to monitor the entire irrigation system and calculate amount of soil erosion,the farmer can visit a web server that contains the farm's data.

HARDWARE REQUIREMENTS

1. Microcontroller (STM32F411CEU6)

2. Analog to digital converter

3. Soil moisture sensor(REES52)

4. Temperature and humidity sensor(DHT-22)

5. Light sensor array

6. 3-axis accelerometer

7. Time of flight distance sensor

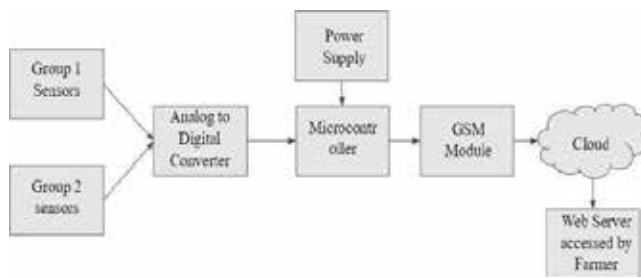8. GSM module(SIM800L)

9. Relay drivers

10. Pump

Fig. 1 Farm System
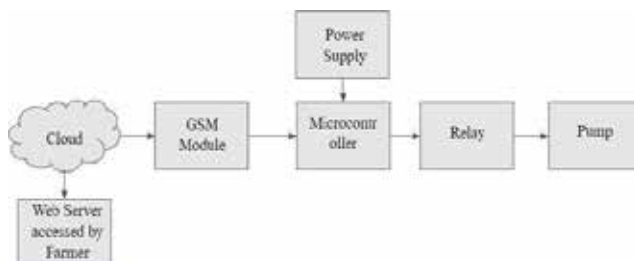
Fig. 2 Tubewell System

SOFTWARE INTEGRATION

Our software integration ensures smooth operations for both smart irrigation and erosion monitoring. A unified timer mechanism triggers data sensing and transmission at appropriate intervals for both systems. Software modules for initialization, network connectivity, synchronization, data sensing, and transmission are combined. Data is sent to the cloud via the shared GSM module, simplifying the data flow.

Fig. 3 shows the flowchart of the proposed system, i.e., Smart Irrigation System with Soil Erosion Detection.
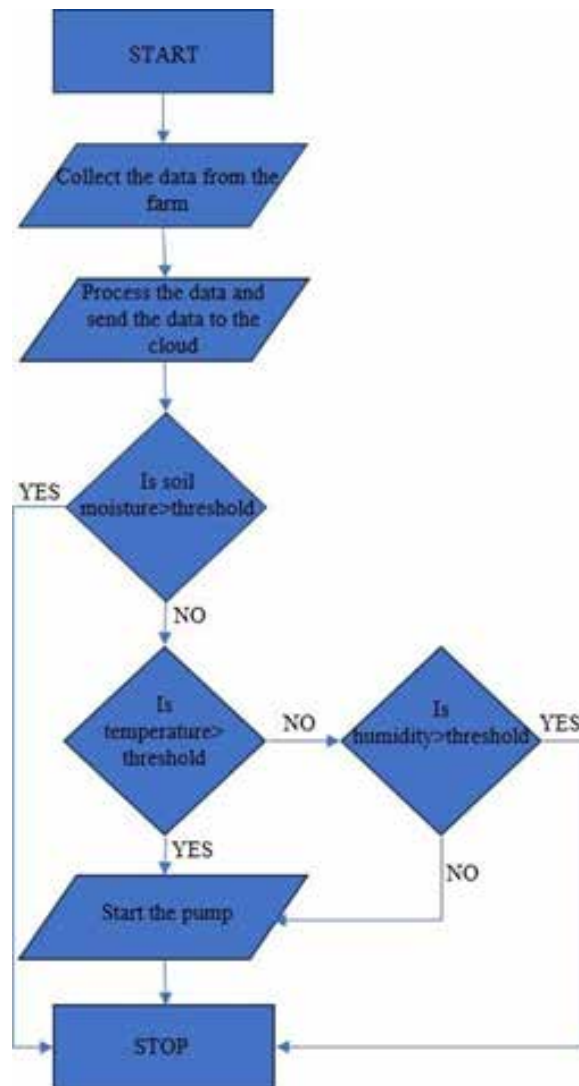
Fig. 3 Flowchart of the system

FUTURE SCOPE

The proposed system holds immense potential for agricultural purposes. It automates irrigation, thereby improving crop cultivation and farm management.

Finding balance between decreasing agricultural land and depleting natural resources is the major problem faced by modern day farmers. This system allows farmers to utilize sensors technology and data analytics for sustainable and effective farming.

With the world population increasing exponentially, this system helps to bridge the supply-demand. The proposed system slashes operational costs, boosts crop

yields, and optimizes resource utilization. It also ensures farmers' profitability and prioritizes environmental protection.

BENEFITS AND RESULTS

The benefits of our integrated solution are far-reaching:

1. Enhanced efficiency and productivity with process automation

2. Improved resource management

3. Data-driven decision-making

4. Monitoring Climate Conditions

5. Improved Data Collection for Enhanced Farming Efficiency

6. Optimized use of resources for sustainable farming

7. Reduced Wastage and Efficient Cost Management

CONCLUSION

Our integrated IoT-based smart irrigation and erosion monitoring system brings together the strengths of two projects for a comprehensive agricultural solution. By leveraging a shared GSM module and cloud platform, we provide farmers with a powerful tool to optimize irrigation, prevent erosion, and promote sustainable farming practices.

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Helmet Detection and Face Identification on Construction Site using CNN

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ABSTRACT

In developing country like India the construction industry is one of the largest sectors of employment in India, it is also the second most hazardous. Construction sites can be hazardous environments where workers are constantly exposed to various dangers, including head injuries from falling debris, moving equipment, or other types of accidents. However, despite the importance of wearing helmets, it is not uncommon for workers to forget to put them on or take them off at inappropriate times. This is where helmet detection technology comes in. By using computer vision and machine learning algorithms, it is now possible to detect whether workers are wearing helmets in real-time and alert them if they are not. Our application will help to detect whether the worker is wearing the helmet or not. This will reduce the chances of injuries on construction sites. Also, the application can mark attendance of worker by face detection to reduce manual effort of marking it.

KEYWORDS : Face detection, Helmet detection, Safety, Machine learning, You only live once (YOLO), Convolutional neural network (CNN).

INTRODUCTION

The construction Industry is India's second most dangerous business, accounting for about 38 fatal accidents daily while being one of the most employment-rich sectors. The top three work-related fatalities in the construction industry, according to a 2019 study by the Indian Institute of Technology (IIT) Delhi, include accidents, fatal electrocutions, and falling walls and scaffolding at building sites. According to a 2017 study conducted by academics from the National Institute of Technology Surat, about 25% of all workplace accident fatalities in India are related to the construction industry [1].

Currently, the most common method for checking if a worker is wearing safety equipment on a construction site is through manual inspection by supervisors or safety personnel. These personnel conduct regular checks of the site to ensure that workers are wearing helmets and other necessary safety gear. However, this method is time-consuming and may not be effective in detecting non-compliance with safety regulations in real-time. Some construction sites also use CCTV cameras to monitor worker behavior, including whether they are wearing helmets. However, this method also has limitations, such as the need for constant monitoring by human operators and the potential for privacy violations.

In recent years, some construction sites in India have started using IoT-based wearable devices, such as smart helmets or safety vests, to monitor worker behavior and ensure compliance with safety regulations [2]. These devices come equipped with sensors that detect whether the worker is wearing a helmet and alert supervisors or safety personnel in real-time if non-compliance is detected. This method can be expensive to use.

The project's objectives include designing and implementing a working prototype of the helmet detection system, testing its effectiveness in real-world conditions, and demonstrating its potential to enhance security and lower the possibility of injuries and fatalities on building sites.

LITERATURE SURVEY

One of the most dangerous sectors of the global economy is the construction industry. The safety threats that employees in this industry frequently face head injuries that resulting from falling objects, slips, and falls. The use of safety helmets is an essential measure to protect workers from head injuries on construction sites. However, some workers may fail to wear helmets, either due to ignorance or lack of enforcement. This non-compliance can result in serious accidents and even fatalities. Therefore, the implementation of a helmet detection system on construction sites can be crucial in promoting safety and reducing the risk of accidents. The system's primary goal is to identify workers on the construction site who are wearing or have not put on a helmet. Tested and compared various hand-crafted features such as HAAR and LBP classifiers, Histogram of Oriented Gradients, and Sequential Classifiers were the precision and efficacy of Neural Networks. [1][5].

You Only Look Once (YOLO) and region-based Convolutional Neural Networks (RCNN) have been determined as the Deep Learning models for helmet detection. To determine which of the two models is the better fit, metrics such as mean Average Precision (mAP), recall, precision, bagging, and boosting are used. At 97%, YOLO has the highest mAP success rate. [2].

The number of motorcycle accidents has increased dramatically over time in many different nations. Over 36 million individuals use two-wheelers in India and the U.S. For the sake of road safety, a mechanism for automatically detecting helmet wear must be developed. These kinds of systems can be created using the You Only Look Once (YOLO) concept and CNN-based models. [3]. The model training is crucial step in ML Algorithm, the training process for a YOLO model involves collecting and annotating data, pre-processing the data, configuring, and initializing the model, training,

and validating the model, evaluating its performance, and deploying it for real-world use. The quality and quantity of the data, as well as the configuration of the model and the training process, will have a significant impact on the accuracy, precision, reliability and recall of the final system [4].

IMPLEMENTATION

The project frontend is created using HTML and CSS. The main Machine Learning algorithm used here is YOLO for helmet detection. We have used Flask built-in library for person recognition. The python language is used as base language for backend programming. The LabelImg tool is used for labelling the images for training the model.

ML Algorithm YOLO V8

A well-liked object recognition approach in computer vision and deep learning is called YOLO (You Only Look Once). It is intended to instantly identify and categorize things contained within picture or video frames. It is used for object detection, image classification, and instance segmentation morphology tasks. YOLOv8 was developed by Ultralytics for Real-time Processing and Customization and Transfer Learning:

Data Preparation LabelImg

LabelImg is a graphical image annotation tool used for labeling objects in images. It is primarily used in the field of computer vision and machine learning for tasks such as object detection, image segmentation, and classification.

The main purpose of LabelImg is to allow users to draw bounding boxes around objects of interest within an image and assign labels to those bounding boxes. These annotations are typically used to train and evaluate machine learning models, particularly those that rely on supervised learning techniques.

Feature Engineering

Feature engineering aims to extract useful features from unprocessed picture data so that these features can be utilized to train ML algorithms and increase the system's accuracy. Here are some examples of potential features that could be extracted:

Context-based features: The context of the image, such as the location of the worker, the type of equipment being used, and the surrounding environment, can also provide useful information for identifying safety helmets. For example, the system can use contextual information to distinguish between workers who are wearing hard hats, which are not required to be detected by the system, and those who are not wearing any head protection.

Deep learning-based features: Deep learning techniques, such as convolutional neural networks (CNNs), can be used to instinctively learn core features from the images themselves, rather than relying on handcrafted features.

METHODOLOGY

Helmet Detection and Face Identification on Construction Site using CNN system designed to detect construction workers' helmets. The user may simply enter the path to a folder containing a collection of photographs, and the application will identify the individual and indicate whether the person is wearing a helmet. This prototype can recognize two to three people from a single photograph correctly.

The face detection of a person is done without model building which can be done with pre-trained face detection algorithms. These algorithms are already trained on a dataset of different face images and can accuratxely detect faces in new images. To use these algorithms, you will need to use a programming language such as Python and a library like OpenCV, which provides pre-built implementations of these algorithms. You can then load an image into your program and use the pre-trained algorithm to identify faces in the image. The algorithm will return the coordinates of the bounding box around each detected face.

Technology Stack

Frontend:

HTML: Hypertext Markup Language is a markup language used for creating the structure and content of web pages. It provides the basic building blocks such as text, images, links, and other elements that are displayed in web browsers. It is essential for creating the front end of a website or web application.

Backend

Python: It is a high-level programming language known for its simplicity and readability. It is widely used in various domains such as web development, data science, artificial intelligence, and more. Python provides different CNN (Convolutional Neural Networks) models along with libraries like TensorFlow or PyTorch to build, train, and deploy convolutional neural networks.

Flask: It is a lightweight web application framework for Python. It can be scaled up to complex applications and is made to be quick and easy to start using. Python code output is displayed on HTML pages using Flask.

Fig. 1. Block diagram

The block diagram shown in Fig. 4.1. represent below steps,

1. Collect and label a dataset of images that include people wearing and not wearing helmets. Use a labeling tool to annotate the helmet and non-helmet objects in each image.

2. Install YOLO and other necessary libraries.

3. Prepare the dataset in YOLO format. This involves creating a YAML file that defines the classes and paths to the training and validation images. An example YAML file is provided in the YOLO repository.

4. Train and test the model in Flask.

RESULTS

The model training is crucial step in ML Algorithm, the training process for a YOLO model involves collecting and annotating data, pre-processing the data, configuring, and initializing the model, training, and validating the model, evaluating its performance, and deploying it for real-world use. The quality and quantity of the data, as well as the configuration of the model and the training process, will have a significant impact

on the dependability and precision of the final system.

- This is the main page of the website where you can provide the path of folder for detection.
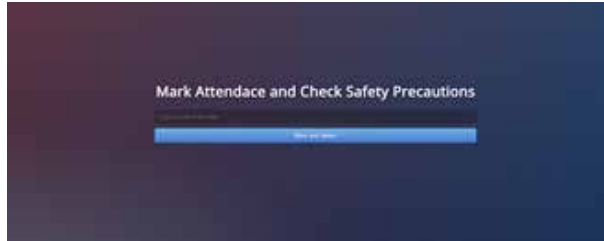

Fig. 2. Splash screen

- Here you can see we have given the folder path "c:\ construction_area \test1"
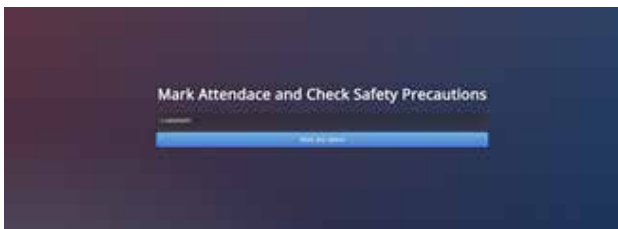

Fig. 3. Giving workers data to the model

- You can see below it sequentially takes images from folder, firstly it detects the person in image then it detects if person is wearing helmet or not.

Fig. 4. Helmet Detection and Face Identification

- It shows the output where in the first array it gives name of person in image and in second array in helmet is present or not.

Fig. 5. System Output
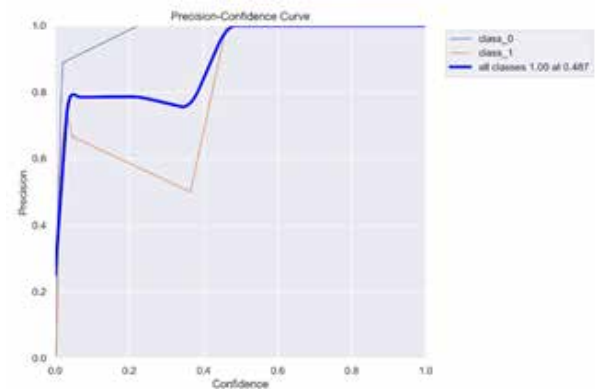
Fig. 6. Precision curve

1. Increase adherence to safety regulations: The main goal of a helmet detection system is to make sure that all employees are wearing safety helmets when they are on the job. This can lessen the likelihood of brain injury accidents and increase adherence to safety requirements.

2. Raise awareness of safety: By emphasizing the value of donning safety helmets, a helmet detection system can aid in the development of a safety culture among workers on construction sites. This may improve awareness of the dangers of non-compliance and motivate employees to put their safety first.

3. Lower the risk of injuries and deaths: A helmet detection system can assist in lowering the risk of injuries and death brought on by head injuries by identifying and warning users who are not in compliance. All employees may work in a safer atmosphere as a result of this.

4. Offer useful information for safety reporting and monitoring: A helmet detection system can offer useful information for safety reporting and monitoring. By using this data, the site's overall safety performance may be improved, patterns can be found, and remedial measures can be put in place.

5. Increase productivity: Since there is a lower chance of accidents resulting in injuries or absences from work, a safer workplace can boost output.

FUTURE SCOPE

It is important to note that the implementation of helmet detection systems is not a substitute for other safety measures, such as safety training and the provision of adequate safety equipment and infrastructure. Rather, it is a complementary measure that can enhance existing safety practices and promote a safer working environment for workers on construction sites. The current prototype can only detect a single person and say whether the person is wearing the helmet or not. We can use this prototype in future for improving the safety standard in construction industry which will minimize the accident-causing death, this prototype can be implemented for safety of multiple workers to avoid the accident, large volumes of data may be generated by helmet detection systems in the future. This data may be utilized for a variety of purposes, such as data analytics to discover safety trends and anticipate safety hazards, hence enabling proactive safety management on building sites.

Helmet detection systems could be integrated into mobile applications, allowing workers to receive real-time safety alerts, and enabling supervisors and safety personnel to monitor safety compliance remotely.

CONCLUSION

In conclusion, the implementation of helmet detection systems on building sites is a novel strategy that can enhance security and lower the likelihood of mishaps and fatalities. By encouraging adherence to safety rules and offering real-time monitoring of worker behavior, the system eventually improves the safety culture on construction sites.

The use of helmet detection devices can be quite advantageous for India, a nation with a high rate of fatalities and accidents on building sites. Our software will identify the individual and determine whether they are wearing a helmet. Furthermore, it has the ability to recognize faces and record attendance.

The system can supplement existing safety measures, such as safety regulations, safety training, and safety equipment, and provide a more comprehensive safety monitoring system on construction sites.

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Role Based Access Control in Healthcare : Review

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ABSTRACT

RBAC (Role-Based Access Control) is a crucial security model utilized in healthcare settings to regulate access to sensitive patient data based on the roles of users, such as physicians, patients, or applications. This approach ensures that access is granted only to authorized individuals or systems according to their designated roles. Protecting sensitive patient data from unauthorized access is paramount to prevent privacy breaches and medical identity theft. RBAC facilitates access control by granting permissions based on the roles of clients, making it particularly suitable for scenarios where access needs are determined primarily by role rather than specific attributes. In the context of healthcare systems, RBAC helps enforce strict access controls, ensuring that only authorized users with appropriate roles can access sensitive data. The SMART on FHIR framework complements RBAC by defining the functionality requested by client applications through scopes, which are declared by the Authorization Server. These scopes typically encompass three levels: patient, user, and system, delineating the extent of access and functionality granted to client applications within the healthcare ecosystem. This integration enhances security and control over data access, contributing to the overall protection of sensitive healthcare information. With the understanding of simplicity of RBAC and its limitations, various approaches proposed in combination with RBAC to overcome limitations like flexibility, privacy, and trust mechanism. The issue arises when the actual roles and access requirements in practice deviate from those specified in policy documents, even in subtle ways. Additionally, roles that were initially created as temporary solutions tend to persist over time. Comparative analysis is performed to understand RBAC in conjunction with other approaches.

KEYWORDS : RBAC, Healthcare access control, Secure access, Role, EHR.

INTRODUCTION

RBAC, or Role-Based Access Control, offers a structured framework for managing and overseeing access within systems. Through RBAC, administrators can track who accessed a system, the timing of access, any modifications enacted, and the authorizations in place. This level of oversight enables organizations to promptly address any emerging issues and facilitates compliance with regulatory standards such as HIPAA, SOX, SOC 2, and ISO 27001. These regulations often require network visibility to demonstrate adherence to privacy, security, and confidentiality standards when handling data and sensitive information. RBAC thus serves as a valuable tool for ensuring compliance and maintaining the integrity of organizational systems.

RBAC(Role Based Access Control), being a passive model, overlooks crucial factors such as current tasks being executed and time-bound permissions. Consequently, alternative design approaches for access control have been investigated to address these limitations.

RBAC, or Role-Based Access Control, operates by constraining user access to the essential levels necessary to execute a particular job or function. This approach

aids organizations in upholding security best practices such as the principle of least privilege . By adhering this RBAC reduces the likelihood of data breaches and data leakage by limiting user access to only what is required for their roles. In the event of a breach, RBAC mitigates the impact by minimizing the attack surface. Access to protected information remains restricted to the role that the attacker utilized as an entry point, thereby containing the potential damage and safeguarding sensitive data.

In various domains, including healthcare, Role-Based Access Control (RBAC) emerges as an ideal solution. RBAC aligns well with established management structures by providing clear and easily defined levels of access. Hospitals, in particular, widely utilize RBAC, making it one of the most common access control methods in healthcare settings.

Access management for cloud assets is an essential function for any organization that utilizes the cloud. RBAC facilitates oversight of anyone who approaches the Azure assets and what can be done with those assets and determines which areas can be approached. RBAC is an approval framework based on the ARM that facilitates fine-grained access management of Azure Assets[3].

RBAC, is indeed a static-based access control model in which access permissions are predetermined and assigned to users based on their roles. In RBAC systems, access rights are defined and managed according to predefined roles within the organization. Administrators may inadvertently overlook or intentionally decide to retain these roles, even when the individuals for whom they were established depart or change positions within the organization. Consequently, this phenomenon leads to "privilege creep" and disorder within the system, as unnecessary privileges accumulate over time, potentially compromising security and increasing the complexity of access management.

It's true that most modern and legacy databases leverage the RBAC model to enforce data access control. By assigning roles to users and granting permissions based on those roles, it helps ensure that users only have access to the data and functionalities necessary for their roles.

Furthermore, open-source access control frameworks like Apache Ranger and Sentry also adhere to the RBAC approach. These frameworks enable organizations to manage and enforce access control policies across various data platforms and applications in a consistent and scalable manner.

While RBAC provides a structured approach to access control, it does have limitations, particularly in dynamic environments where access requirements may change frequently. However, for many organizations, RBAC remains a fundamental and effective method for managing access to data and resources.

LITERATURE SURVEY

Authors Ivy Joy G. Mallare and Susan Pancho-Festin introduced a novel access control system that merges RBAC and TBAC features. They implemented this system in a healthcare setting, where both passive and active access controls are necessary. Their system aims to provide more precise access control suitable for intricate healthcare operations. Further research led them to realize the importance of integrating it into a workflow system, especially in environments where task failures could have severe consequences. They define workflow as comprising all components required to execute a process, including input information, involved user(s) or group(s), necessary objects, process steps, and output. Their model, termed W-TRBAC, applies roles and tasks within a medical workflow system [1].

The study by authors Ateeq Ur Rehman Butt and colleagues presents a trust mechanism designed for RBAC within Electronic Healthcare Systems (EHS) deployed in a cloud environment. This mechanism actively monitors and adapts to user behaviour, dynamically assigning roles based on observed actions. Utilizing SQL Server, they develop an Access Control (AC) module enabling administrators to configure functions and regulate access to different EHS modules. They employ a .NET-based framework to verify user trustworthiness. The proposed e-health framework aims to safeguard user data from external threats and unauthorized access, tackling challenges such as extended system response times, data security concerns, and ensuring genuine user identification and behaviour monitoring [2].

In their analysis, authors Abhijeet Thakare and

collaborators scrutinized the existing Azure RBAC model and identified several shortcomings. They observed that similar authentication and authorization techniques are applied to all user types, resulting in increased operational burden on the server side. Additionally, the Azure RBAC model struggles to efficiently handle dynamic situations, often creating numerous roles for each event. Consequently, it suffers from issues such as poor policy management, redundant role semantics, inadequate handling of dynamic scenarios, administrative overload, inefficiencies in managing individual security and rights, high system execution overhead, lack of support for work delegation, and scalability challenges for large organizations. To address these weaknesses, the authors propose the PARBAC(Priority Attribute Based RBAC) model, which aims to overcome these limitations and meet the requirements, particularly in extensive intradomain and distributed cloud computing settings. The PARBAC model introduces flexibility and enhances the performance of the existing access control model in the Azure IoT cloud by integrating simplified priority-based authentication and authorization mechanisms. Furthermore, it employs priority attributes instead of role terminology to categorize user privileges, reducing inefficiencies and ensuring consistent policy enforcement for individuals [3].

Yaira K. Rivera Sánchez and colleagues introduced RBAC security policies tailored for mobile computing within a cloud environment, integrated into FHIR (Fast Healthcare Interoperability Resources) to streamline information exchange between a mobile health (mHealth) application and multiple Electronic Health Records (EHRs) or Health Information Technology (HIT) systems. Their contribution includes an RBAC server interceptor designed to establish and enforce security measures on FHIR RESTful API services. This interceptor enables real-time validation checks to ascertain whether a user possesses the necessary permissions to invoke a FHIR RESTful API service on a specific resource, leveraging the server interceptor feature available in the HAPI FHIR library [4].

RBAC adaptations primarily concentrate on emergency access, authorization delegation, and interdomain topics. Despite the numerous limitations and tradeoffs

associated with RBAC, the significant number of articles proposing RBAC adaptations suggests that no author currently advocates for the complete replacement of RBAC in Healthcare Information Systems (HIS) environments. There isn't a clear indication of RBAC becoming obsolete for HIS use [5].

Emmanouil Georgakakis and colleagues introduce STEM-RBAC, a model that offers access control based on roles while incorporating location and time awareness. They also present a novel mechanism for facilitating controllable exception access during emergencies. In case of an emergency, users may be granted exception access to data up to a predefined level, based on emergency access attributes assigned to each role. Key components such as dependency on other roles, system time, user location, and role hierarchy play crucial roles in determining access grant or denial during emergencies. STEM-RBAC is positioned as a flexible solution for securing information systems in modern organizations, including hospitals or organizations implementing disaster recovery plans. The authors assert that STEM-RBAC is the first model to effectively address the need for providing emergency access in a solid and controlled manner [6].

In the paper titled "DRBAC-Healthchain (DRBAC-HC): Decentralized Role-Based Access Control Framework for Achieving Security and Privacy Using Blockchain in Healthcare System" authored by Avani Dadhania and Dr. Hiren Patel, a decentralized role-based access control (DRBAC) system for healthcare data is proposed, leveraging blockchain technology. The framework is designed in a decentralized manner to ensure the security and privacy of healthcare records. Access control policies are formulated using smart contracts to manage user authorization. The performance analysis of the system includes measurements of security against vulnerabilities [7].

Mahesh B Gunjal and Dr. Vijay R Sonawane proposed a secure data access strategy that incorporates several key components. The method involves encryption using AES 128, Role-Based Access Control (RBAC), and a cloud snapshot-based approach for forensic examination. Users can securely obtain their master and private keys from a middleware authority. Third-party authentication facilitates secure communication among

multiple parties. The study also introduces the concept of proxy keys, which are generated when a data holder revokes access for a specific end user. The system promptly expires any existing keys and generates new ones for shared users. These strategies enable the system to achieve the highest possible levels of security and privacy simultaneously [8].

Various RBAC models have been developed to incorporate context information into access control decisions. One such model is the temporal RBAC (T-RBAC) model, which extends traditional RBAC by restricting users to utilize role permissions only during specific temporal periods. Users' access to role permissions is governed by the specified time intervals, during which roles are either active or inactive. Additionally, the T-RBAC model supports role triggers, enabling control over the timing of action execution. In T-RBAC, conflicts between triggers and periodic activation/deactivation are resolved using priority mechanisms. Priority settings help determine which rules take precedence in situations where conflicts arise, ensuring that access control decisions align with the organization's security policies and requirements. By incorporating temporal aspects and trigger mechanisms, T-RBAC enhances the granularity and flexibility of access control in dynamic environments, enabling organizations to effectively manage access based on contextual factors such as time [9].

When it comes to managing access, the principle of "less is more" applies, as granting employees more access than necessary can pose security risks and lead to regulatory fines. Access provisioning should be based on a precise understanding of individuals' job roles and requirements. Legacy RBAC tools often rely on guesswork rather than unbiased, human-influenced enterprise data to assess access needs. Additionally, role-based systems with static access rights groups struggle to accommodate the dynamic nature of team composition and individual requirements in modern enterprises. Failing to separate individual access rights from role-based groups can result in overprovisioning. With the blurring line between internal and external environments in modern enterprises, as employees work remotely and partners require increased access, adopting a Zero Trust mindset becomes crucial—"trust nothing, verify everything." Zero Trust offers a dynamic

approach to implementing least privilege access in fluid business settings. RBAC offers privacy, security, and compliance benefits through the principle of least privilege.. AI-based RBAC presents an ideal solution for automating and realizing a Zero Trust architecture. ForgeRock's AI-powered Autonomous Identity system utilizes rich identity data from across the enterprise to automate intelligent access provisioning, proactively identifying access risks and streamlining access management organization-wide [10].

COMPARATIVE ANALYSIS

From the above survey we have compared various proposed RBAC strategies and summarized its prominent features and limitations into following table 1:

Table 1. Comparison of RBAC Strategies

SL no	Proposed Strategies	Prominent feature	Limitations
1	RBAC+ABAC [1]	Privacy, Security, Flexibilty, EHR compatibility	Cloud suitability
2	RBAC+Trust Mechanism[2]	Authorization, Security	Slow response time
3	PARBAC [3]	Privacy, Security, Flexibilty, Priority-based authentication and authorization	Dependence on external entities, System, additional processing time, Denial-of-Service and Unbalance Situation
4	RBAC into FHIR[4]	Real time user permissions	Generali-zation
5	STEM-RBAC[6]	Controllable exception access in case of an emergency	Time restrictions imposed on user, role cardinality constraints
6	DRBAC-HC [7]	Authorization , Privacy	Transaction cost

7	RBAC+ Multi-authority access[8]	Security and Privacy in untrusted environment, Encryption Decrytion time	Third Party reliance

From the above table 1 it is observed that most of the proposed system get benefits of RBAC and trying to overcome the limitations by combining different approach with RBAC. In order to provide trust mechanism with RBAC, the system may get slowdown in responding and also when trying to provide trust mechanism system has to compromise on third party reliance.

CONCLUSION

Access control is a critical component of healthcare security, which encompasses both physical and cybersecurity measures. Understanding the location of critical data and systems, as well as monitoring access by individuals, is essential for maintaining security standards. We have studied different approaches used with RBAC in healthcare. Each proposed system has tried to take benefit of simplicity of RBAC approach and used different approaches along with it to provide better security, privacy, authorization, flexibility, emergency access control and trust mechanism. Access control teams must consider various contextual factors when devising strategies to enhance hospital security. Role-based access control (RBAC) plays a significant role in detecting suspicious activities within healthcare environments. RBAC restricts access to controlled materials based on the roles and permissions assigned to authorized users. For example, only pharmacists may have access to a medicine dispensary, and electronic medical records should be accessible only to specific authorized employees. By implementing RBAC and other access control mechanisms, healthcare organizations can effectively manage access to sensitive information and resources, thereby enhancing security and minimizing the risk of unauthorized access and potential data breaches. However, achieving Zero Trust using manual RBAC processes and static data is challenging due to inherent limitations.

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Chatbot with Attention Mechanism

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ABSTRACT

Voice and chatbots are the new norm for human- machine interaction. The time when individuals relied solely on keyboards to perform tasks is long gone. Artificial intelli- gence and machine learning technologies are being improved or modified in part by the new ways that people are interacting with machines. The goal of this project was to use artificial intelligence techniques, such as natural language understanding, to create a chatbot that would help students apply online and get into a certain college or university. enabling people to communicate with the chatbot through natural language input and to train it with the right techniques so that it is prepared to respond. The finest feature is that a person or student can communicate with the chatbot for leisure. Users will be able to assist and steer users toward obtaining admission. Natural language processing methods, machine learning algorithms, and artificial intelligence e being used in numerous research projects to create conversational or dialogue agents. Handwritten rules have been the basis for chatbot architecture construction approaches in the past. In 2015, new techniques such as end-to- end trainable neural networks were released, coinciding with the rise of deep learning. More precisely, conversational modeling is dominated by the recurrent encoder-decoder model. This design works exceptionally well in the neural machine translation area, from whence it was adopted. Many of the chatbots that are available now were created with rule-based, retrieval-based, or basic machine learning algorithms, all of which produce subpar outcomes. Here, we employ an encoder-decoder that uses LSTM (Long-Short-Term-Memory) cells in conjunction with a recurrent neural network.

INTRODUCTION

A chatbot is computer program that imitates text or voice discussions with people by creating responses based on input provided to the model. Such software is designed to simulate human-to-human communication. They can perform a variety of tasks, such as personal assistant, product suggestion, and product inquiry. Lately, there has been a significant surge in interest regarding the application and implementation of dialogue generation systems. According to reports, the chatbot market is worth $ 430 million and is expected to grow at a yearly rate of 24.9%. A chat agent or virtual assistant is used by numerous large IT companies. Even if their primary func- tion is to answer questions, the fact that large organizations have adopted them has attracted attention from consumers and appears to hold promise for the development of more sophisticated conversational agent systems. This chatbot will attempt to communicate with people. An RNN with LSTM cells will be used to generate this model using the seq2seq architecture. Given that the primary drawback is that, in the case of a lengthy input, Sequence to Sequence by itself does not yield a satisfactory outcome. Therefore, we shall use the attention technique to solve this issue. It has been observed that attention models predict which word in a sentence is most essential and provide attention ratings. The attention model helps to preserve the information.

MOTIVATION

This essay outlines a plan to enhance the effectiveness of the college admissions process. To construct this chatbot, productivity chores must be completed effectively. A few foundational papers that we read helped to keep us motivated the whole way. The need for chatbots is growing daily, thus this one is an attempt

to streamline the admissions process and allow users to engage with it if they so choose. They can play around with this chatbot in their spare time. There are lonely persons who can relate to each other. Though it won't be able to respond to them exactly like a human would, this chatbot will try its best to converse with them and understand their emotions. There may be a need for a chatbot for this. A chatbot's intelligence is also growing. Chatbots are now capable of several tasks that they were not able to perform in the past. The fact that this topic is still being researched in the field served as inspiration. Numerous academics, including Yann LeCun and Andrew Ng, are presently conducting research in this area. They are our greatest source of inspiration, and we are most driven by their work.

LITERATURE SURVEY

Xiujun Li, et al. presented a model, made from end to end learning framework for task completion dialogue systems to tackle issues like earlier modules affecting downstream modules in task-completion dialogue system. Robustness, flexibility and reproducibility of this model is better than other version of models. Here, back propagation is used to train the weights of the LSTM model. The error from this model was found less compared to old the older version of models.

Yoshua Bengio et al proposed an architecture that addresses the issue that the use of a fixed length context vector is problematic for translating long sentences. The approach is to create a single neural network that can maximize the translation performance. They extended the basic encoder-decoder by letting a model (soft-) search for a set of input words, or their annotations generated by an encoder, when creating each target word. Their attempt to translate sentences from English to French was successful. But because the model cannot handle uncommon or unknown words, it cannot be applied widely.

Abonia Sojasingarayar talks about Seq2Seq AI chatbot. Instead of using simple rule-based techniques, the implementation was done with encoder and decoder attention mechanism. While decoding, it is better to decode the whole output sequence at the same time than decoding a word at each time step. Tensorflow V 1. 14. 0 is used to make seq2seq architecture. A special type of RNN (LSTM) is used here. When seq2seq is

used, we start to loose information as the length of the sequence gets larger and larger. To overcome this problem, attention mechanism is used in the paper. "Cornell movie subtitle corpus" is use as the dataset. In data prepossessing, End of string(EOS), Start of string (SOS) and Padding(PAD) are added in every sentence. The training phase is long, and it requires a lot of computational power. Finding optimal hyper parameters is also a hectic work. There are some disadvantages like, when user says, "Add 4 apples" and correct himself by saying, "I meant, 4 bananas" than the chatbot will add 4 apples and 4 bananas. Chatbot can't recognize human's correction.

Andrea Galassi et al. mentioned that attention models are everywhere in NLP applications. This paper tries to explain the architecture of attention model and the impact of attention model in various field. In this paper , it has been shown that attention model can classify which words/phrases are the most important one's by giving attention scores to them. To create a condensed representation of the data and to draw attention to the pertinent information, attention might be paid to various input components, various representations of the same data, or distinct attributes.

Anjana Tiha used cutting edge methods to construct an intelligent conversational model. She created this model using Google's Neural Machine Translation (NMT). The encoder and decoder used RNN with bi-directional LSTM. During training, Beam Search and Neural Attention Mechanism were used to maximize performance. Language modeling benefits greatly from the use of long short-term memory (LSTM), a kind of RNN. Another method included in the Seq2Seq module is Neural Attention Mechanism, which has become the industry standard due to its notable performance improvements in NLP tasks such as conversation production. Each hidden target in the neural attention mechanism compares to the source hidden state, creates an attention vector by scoring the comparison, and stores the attention vector in memory to select it above other candidates.

METHODOLOGY

- Due to LSTM cells, the outputs are complex or not good, we will additionally use Seq2Seq with attention mechanism. The benefit is it gives us
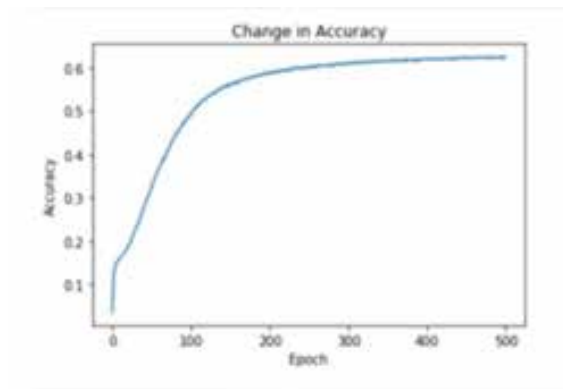
better results as attention mechanism is good for handling a long and complex sentence Because of encoder and decoder, the chatbot will be able to understand the complex sentences and will provide the answer to the user.

• THE ENCODER-DECODER MODEL The existence of a learning algorithm in the neural network-based method is the primary principle that sets it apart from rule- based techniques. After reading the source sentence and converting it into a rich fixed-length vector representation, a "encoder" RNN uses the initial hidden state to create the target sentence, which is then produced by a "decoder" RNN.

• RECURRENT NEURAL NETWORKS A recurrent neural network (RNN) is a type of neural network that uses recurrence to generate a sequence of hidden states, h = (h1,...,hn), from an input sequence of variable length, x = (x1,...,xn). Every time the network generates a hidden state hi, it takes two inputs, xi and hi1. Hi = f(Whi1 + Uxi) updates the hidden state hi at each step i.

• The Sequence to Sequence (SEQ2SEQ) method has become the de facto standard for machine translation and dialogue systems. It is made up of two Recurrent Neural Networks: an encoder and decoder. The encoder takes a sequence (sentence) as input and processes one symbol (word) at a time step. The goal of the method is to convert a set of symbols into a fixed-size feature vector that eliminates unnecessary symbols from the sequence while preserving the important ones. Data flow in the encoder along the time axis can be understood as the movement of local information from one end of the sequence to the other. The series can be summed up by taking into account the final secret state, which is influenced by every earlier hidden state. Since it embodies the sequence's intention, this state is known as the context or thinking vector. One symbol (word) at a time, the decoder constructs a new sequence based on the context. In this instance, the context and the previously created symbols have an impact on the decoder at every time step.

RESULT

We got a good average accuracy after 100 epoch and loss of our model got decreased after each epoch. Below is the training phase and testing of our model.

Fig. 1. Training

Fig. 2. Testing

Fig. 3. Real time answer
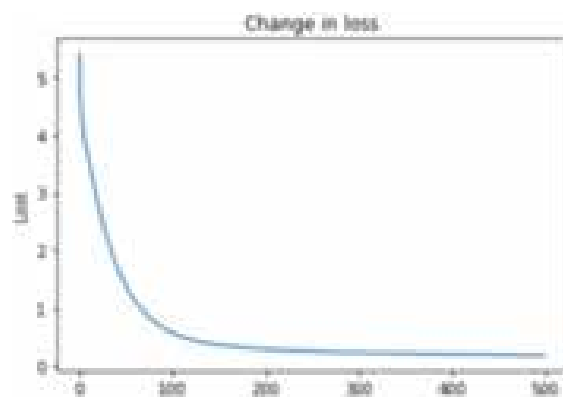
Fig. 4. Change in accuracy

Fig. 5. Change in loss

CONCLUSION

A number of architectures and methods for improving the encoder-decoder paradigm and creating more realistic and human-like conversational agents were presented and debated. Some of the characteristics of the existing chatbot models have also been criticized, and it has been demonstrated how and why a number of the methods are unsuitable for the purpose of modeling conversations. Using a collection of source utterances as a comparison point and automatic evaluation criteria, the training's effectiveness was examined. As further improvements to the cornel data are required to yield better outcomes in the future. In addition to the configurations covered in this study, we can experiment with various combinations of hyperparameters. The results of the training on the Cornell Movie Subtitle. Corpus indicate that the training settings still require refinement. We can experiment with other attention mechanisms, such as Luong. By utilizing a different, comparable dataset with the hyperparameters we attempted for the cornel data, we can additionally assess the quality of the dataset.

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Applications of Ring Theory: A Comprehensive Overview

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ABSTRACT

This paper provides an in-depth exploration of the diverse applications of ring theory across various fields of mathematics and beyond. Starting from the foundational concepts of rings, the paper examines specific examples and case studies where ring theory plays a crucial role in solving theoretical and practical problems.

KEYWORDS : *Reed-Solomon codes, Cryptography, Combinatorial optimization.*

INTRODUCTION

Ring theory, a cornerstone of abstract algebra, serves as a powerful framework for understanding algebraic structures beyond the familiar arithmetic of numbers. Rooted in the study of rings—algebraic structures equipped with two operations—ring theory explores the rich interplay between addition and multiplication, yielding insights that reverberate across diverse branches of mathematics and beyond. This paper aims to explore the breadth and depth of applications of ring theory, offering a comprehensive overview of its significance in contemporary mathematics and beyond. Through concrete examples, case studies, and interdisciplinary connections, we delve into the myriad ways in which ring theory shapes our understanding of algebraic structures and illuminates the mathematical fabric of the world around us.

APPLICATION

The applications of ring theory are as diverse as the fields of study it intersects with. From foundational mathematics to practical engineering and beyond, ring theory plays a vital role in solving theoretical problems and addressing real-world challenges. Here, we highlight some key applications of ring theory across various domains:

Coding Theory: In the realm of coding theory, which deals with the design of error-detecting and error-correcting codes, ring theory finds extensive application. One notable example is the use of polynomial rings over finite fields in the construction of Reed-Solomon codes. These codes are widely employed in applications such as data storage, satellite communication, and digital television.

Example

*Construction of Reed-Solomon code*s: Reed-Solomon codes are widely used in various communication systems, such as digital data storage (e.g., CDs, DVDs, and Blu-ray discs), satellite communication, and deep-space communication, due to their robust error-correction capabilities.

Reed-Solomon codes are constructed using polynomial rings over finite fields, which are fundamental concepts in ring theory. By leveraging the algebraic properties of polynomial rings over finite fields, Reed-Solomon codes offer efficient and reliable error-correction capabilities. The principles of ring theory underpin the construction and analysis of these codes, demonstrating the practical relevance of abstract algebra in the design of communication systems.[1]

Cryptography: Ring theory provides a mathematical framework for various cryptographic protocols and algorithms. For instance, rings of Gaussian integers, which form a subset of complex numbers, are utilized in cryptographic schemes for secure communication and

digital signatures. Additionally, rings of polynomials over finite fields are instrumental in certain cryptographic constructions, ensuring data confidentiality and integrity in modern communication systems.

Example: Elliptic Curve Cryptography (ECC): Elliptic curve cryptography is another cryptographic scheme that leverages algebraic structures, including rings, for secure communication and digital signatures. ECC operates over elliptic curves defined over finite fields, which form rings. The security of ECC relies on the difficulty of solving the elliptic curve discrete logarithm problem (ECDLP) within the finite field, which is a computationally hard problem. By exploiting the algebraic properties of elliptic curves, ECC offers strong security with smaller key sizes compared to traditional cryptographic algorithms.[2]

Algebraic Geometry: Rings serve as fundamental objects in algebraic geometry, where they represent the coordinate rings of algebraic varieties. Techniques from ring theory, such as ideals and modules, are instrumental in studying geometric properties of algebraic varieties and solving geometric problems. Algebraic geometry finds applications in diverse areas, including robotics, computer-aided design, and image processing.

Example: Coordinate Rings of Algebraic Varieties: In algebraic geometry, algebraic varieties are geometric objects defined as the common zero locus of a collection of polynomial equations. The coordinate ring of an algebraic variety captures the algebraic structure of the variety by encoding the polynomial equations that define it. The theory of affine varieties and coordinate rings, which are rings of polynomial functions on the variety, is deeply intertwined with ring theory. Concepts such as ideals, prime ideals, and quotient rings play a crucial role in understanding the geometric properties of algebraic varieties.[3]

Number Theory: Ring theory plays a pivotal role in algebraic number theory, a branch of number theory concerned with algebraic structures such as number fields and algebraic integers. Rings of algebraic integers, which are solutions to polynomial equations with integer coefficients, are studied using concepts from ring theory. Number theoretic results have applications in cryptography, coding theory, and cryptography.

Examples: Rings of Integers

Description: In algebraic number theory, mathematicians study number fields, which are extensions of the field of rational numbers by adjoining algebraic numbers. The ring of integers in such a number field plays a central role.

Connection to Ring Theory: The ring of integers is essentially a special case of a ring, and its properties are deeply tied to ring-theoretic concepts. For example, in a quadratic field, the ring of integers can be represented as a quadratic ring.[4]

Combinatorics and Graph Theory: Rings and ring-like structures are utilized in combinatorial problems and graph theory. Techniques from ring theory are applied to enumerate combinatorial objects, study graph colorings, and analyse properties of combinatorial structures. Combinatorial optimization problems arising in various domains, such as network design and scheduling, often involve algebraic structures that can be analysed using ring theory.

Example

Combinatorial Optimization: Ring theory is applied in combinatorial optimization problems, where the goal is to find the best solution from a finite set of possibilities. Rings of optimization problems are constructed using algebraic structures such as semi rings and Boolean rings. Techniques from ring theory, including the theory of modules and linear algebra over rings, are used to analyse optimization algorithms and their complexity. [5]

Physics: In theoretical physics, rings of operators on vector spaces play a crucial role in modelling physical systems and analysing their symmetries. These operator algebras, which are studied extensively in quantum mechanics and quantum field theory, are central to understanding the behaviour of particles, fields, and interactions in the quantum realm. Ring theory also finds applications in condensed matter physics, where algebraic structures are used to describe phase transitions and collective phenomena.

Example: Quantum Field Theory (QFT): In quantum field theory, which provides a framework for describing quantum interactions between particles, rings of

operators on Fock spaces are studied. Fock spaces, which represent states of multi-particle systems, are equipped with creation and annihilation operators that form rings. Ring theory is used to analyse symmetries, conservation laws, and scattering amplitudes in quantum field theories.[6]

CONCLUSION

The applications of ring theory are wide-ranging and profound, spanning disciplines and transcending traditional boundaries. As we continue to unravel the mysteries of the universe and harness the power of mathematics to address real-world problems, the enduring significance of ring theory as a cornerstone of abstract algebra remains indisputable.

In conclusion, this research paper has provided a comprehensive overview of the wide-ranging applications of ring theory across various disciplines.

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Deaf Helper (Sign Language Recognition)

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ABSTRACT

In this world, authorities have not given people with hearing loss any serious consideration. As a result, these individuals become alienated from their social surroundings and confused while selecting educational media to engage with. With the use of sign language recognition technology, this project aims to make it easier for those who are deaf or hard of hearing to be recognized and understood through their communication. It includes a number of features, including forums, customer service, interactive videos, sign language translation, registration, information, history, events, donations, and shops.

INTRODUCTION

Sign language is a visual language that conveys message through facial expressions, hand gestures, and body language. For those who have trouble hearing or speaking, sign language is quite beneficial. It describes how these motions are translated into words or alphabets of officially recognized languages. Therefore, an algorithm or model that translates sign language into words can aid in closing the communication gap that exists between the world and people who are hard of hearing or deaf.

This project's objective is to use the Python programming language to create a system that can recognize and understand motions used in sign language. This project is particularly useful for enabling communication and bridging the gap between hearing impaired individuals who use sign language and the broader create a computer vision-based solution that can capture real-time video input, detect hand gestures, and accurately translate them into corresponding text or spoken words. By leveraging machine learning and image processing techniques, the system can provide a means of communication for people who rely on sign language. Python, being a versatile and widely-used programming language, offers various libraries and frameworks that can assist in the implementation of a sign language recognition system. Some of the key libraries include OpenCV for image and video processing, scikit learn for machine learning tasks, and TensorFlow for deep learning models.

Data gathering, pre-processing, feature extraction, training a recognition model, and real-time inference are some of the processes that the project entails. The first step is to gather a dataset of sign language gestures, which may involve capturing video samples of different hand movements and poses. These videos will be annotated with corresponding labels to create a labelled dataset for training the model. Once the dataset is prepared, the next step is pre-processing, where the video frames are extracted and transformed into a suitable format for further analysis. This might involve resizing, normalization, and noise reduction techniques to enhance the quality of the input data. Feature extraction is a crucial step in sign language recognition.

It involves extracting meaningful features from the pre-processed video frames. These features can include hand shape, hand position, motion, and other relevant attributes. Convolutional neural networks (CNNs), the Scale-Invariant Feature Transform (SIFT), and the Histogram of Oriented Gradients (HOG) are a few methods that can be used for this. After feature extraction, the next stage is to train a recognition model

using machine learning or deep learning algorithms. To do this, divide the dataset into training and testing sets, choose a suitable technique (such as Convolutional Neural Networks, Random Forests, or Support Vector Machines), and optimizing the model parameters. To assess the model's performance and accuracy, it is trained using training data and tested using testing data. Finally, the trained model can be used for real-time inference on live video input. The system captures video frames from a webcam or any other video source, pre-process them, applies the trained model for gesture recognition, and translates the recognized gestures into text or spoken words.

LITERATURE SURVEY

1. Priyanka C Pankajakshan, Thilagavathi B, "Sign Language Recognition System", IEEE Sponsored 2nd International Conference on Innovations in Information Embedded and Communication System, 2015.

   The preferred means of communication for the deaf and those with hearing impairments worldwide is sign language. The effectiveness of sign language recognition in computer vision or other techniques might vary. It is said that sign language consists of a systematic set of movements, each of which has a distinct meaning.

2. Vibhu Gupta, Mansi Jain, Garima Aggarwal, "Sign Language to text for deaf or dumb", 12th International Conference on Cloud Computing, Data Science & Engineering (Confluence), 2022.

   In this study, a CNN-based approach to text conversion from sign language is proposed. The main focus of this paper's proposed scheme is on fingerspelling and the addition of emotion recognition to support the interpretation of the third component of sign language, or non-manual features. Convolutional neural networks are used to provide a real-time solution that makes sign language easy to understand for both Deaf and dumb people and normal people, effectively bridging the language barrier.

3. Citra Suardi, Anik Nur Handayani, Rosa Andrie Asmara, "Design of sign language recognition using E-CNN",2021 3rd East Indonesia Conference on Computer and Information Technology (EIConCIT), 2021.

   In order for the community to interact with the deaf, a bridge is necessary because the majority of people do not comprehend sign language. The use of image processing technology as a translator tool is one example of how technology that is still developing and trying to aid people can be a solution to build a communication bridge between the community and the deaf community.

4. Dimitrios Konstantinidis, Kosmas Dimitropoulos, "Sign Language recognition using image- based hand recognition techniques", 2016 Online International Conference on Green Engineering and Technologies (IC-GET), 2018.

   Sign language uses hand gestures as a means of nonverbal communication. The majority of persons who are deaf or dumb and struggle with speech or hearing utilize it to communicate with others or with normal people. Numerous developers worldwide have created a variety of sign language systems, however neither their flexibility nor affordability benefit the final users.

MODULES

There are two modules in the system:

Voice or text to Sign

Speak or send a text to in this module, the user provides input in the form of text or voice, which the system translates into sign language based on user commands. In this case, the user will input text or voice, and the system will process it. The dataset is queried to retrieve the photos or gifs.

Sign to Text

Sign to text in this module, the user will record the sign done by user. It predicts the letter and display in the text area. For the sign to text conversion there is CNN

algorithm is used in which the dataset is trained and act according to it.
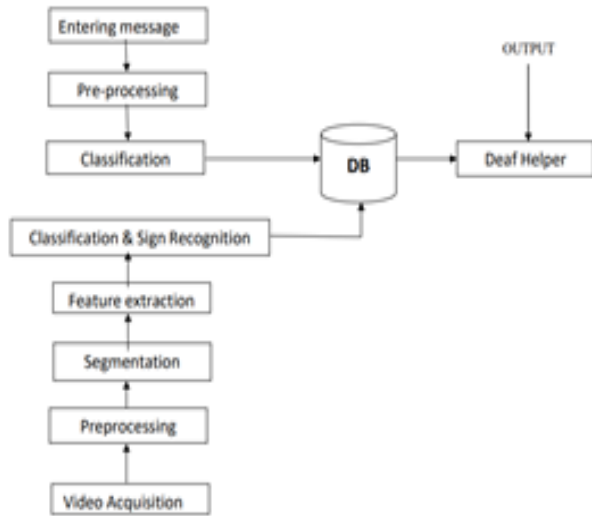
SYSTEM ARCHITECTURE

Fig. 1. System Architecture

METHODOLOGY / PLANNING OF WORK

There are several steps that can be followed in the methodology and planning of work for a sign language project:

1) Define the scope of the project: Clearly state the project's aims and objectives as well as any restrictions or limitations that must be taken into consideration. This will help to ensure that the project stays focused and on track.

2) Research and gather data: Conduct research to gather information about sign language and the needs of the target audience. This could involve reviewing existing literature, collecting data through surveys or interviews, or carrying out other forms of research as appropriate.

3) Develop a plan: Based on the findings from the research and data gathering phase, develop a detailed plan outlining the steps that need to be taken to complete the project. This should include a timeline, a budget, and a list of tasks and responsibilities.

RESULTS

Fig. 2. Front view of software

Fig. 3. Text to Sign translator

Fig. 4. Voice to text to Sign translator

Fig. 5. Hand Gestures

Fig. 6. Hand Gestures

CONCLUSION

By using advanced algorithms and machine learning techniques, these systems are able to accurately interpret and translate signed languages into written or spoken languages, allowing for easier communication between individuals with different modes of communication. The Sign Language Recognition project in Python aims to build a computer vision-based system that can understand and interpret sign language gestures. By leveraging Python's libraries and frameworks, along with machine learning and image processing techniques, this project can enable effective communication between the hearing-impaired community and the wider population.

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