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Editorial

Green Energy: Due to the rapid urban and industrial development, deforestation, forest fires, enormous increase in the use of diesel and petrol-based vehicles, the atmosphere is overloaded with carbon dioxide and other greenhouse gaseous emissions released from these sources. These accumulated gases above the earth's surface act like a blanket and trapping the heat. As a result, not only increasing the earth's temperature but also causing frequent storms, drought situations, sea water level rise, and extinction. If attempts are not been made to minimize the release of these monster gasses into the atmosphere, the global atmospheric temperature will go on increasing year on year. Recent reports indicate that this year alone several hundreds of people died due to heat wave in India and abroad. Hence, there is an urgent need to opt green technologies or sustainable technologies, to produce green energy. Green energy is also called as clean energy which does not release carbon emissions into the environment. Green energy is important because it provides a sustainable and environmentally friendly solution to our energy needs, reducing carbon footprint and mitigating the adverse effects of climate change.

Natural resources used to produce the green energy are sunlight, wind, water, tides, geothermal, biomass, etc. While producing the energy from these sources, no particulate or gaseous contaminants are added to the atmosphere unlike from the coal based thermal power plants. Geo-thermal and biomass plants release some air pollutants but much lower.

Some of the important benefits of green energy are to combat the climate change by producing significantly less greenhouse gas emissions, can potentially improve public health, leads to cleaner water and air, improves economic growth, more employment throughout in renewable energy industries, can bring down the prices of coal and natural gas, has lower maintenance requirements.

Few disadvantages of green energy are more expensive than traditional energy sources due to the cost of equipment and installation, some sources of renewable energy have geographic limitations and also depend on weather, atmospheric conditions to function, some sources require huge land. Hydroelectric power plants need enough rainfall to fill the dams, wind turbines require wind blowing atleast at a minimum wind speed, solar panels need skies to be clear and filled with enough sunshine. Despite all, require less maintenance and long-term benefits.

Green energy is not just an alternative - it's a necessity.

New Delhi **Editor**

30th April 2024

Contents

Review of Different Antenna Designs for Fifth Generation Applications

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ABSTRACT

In this review, an overview of current developments in the design of 5G antennas is presented. The sub-6 GHz frequency band techniques that are employed to improve efficiency, isolation and channel capacity are the main subject of the study. Putting up more antenna in a Multiple Input Multiple Output (MIMO) array can potentially lead to benefits such as efficiency increases of as much as 85% and improvements in capacity exceeding 50b/s/Hz in the sub-6 GHz band, according to research.. Antenna designs for millimetre wave frequencies are also explored, and a comparative study of the performance of several antennas is offered.

KEYWORDS *: Antenna, 5G, Mutual coupling, Isolation.*

INTRODUCTION

There is an increasing desire for faster data rates, enhanced efficiency, and greater flexibility when compared to fourth-generation (4G) networks, which is driving the transition to the fifth generation of mobile systems, which is known as 5G. Wideband, small, and able to handle MIMO systems are the requirements for antennas used in 5G networks. When compared to the lower-order MIMO systems that were utilised by 4G, the technology referred to as multiple input multiple output (MIMO) plays an essential part in 5G. This is because it improves data speeds, channel capacity, and spectral efficiency. However, the difficulty occurs when placing a high number of antennas inside the restricted area of mobile devices, which might lead to a reduction in MIMO performance [1]. To achieve optimal MIMO performance, it is imperative to strengthen the isolation between the various components of the antenna.

Spectrum that is being contemplated for use in 5G installations includes lower bands of frequency (sub-6 GHz) and higher bands. Bands such as 3.40 - 3.80 GHz are utilised by nations in Europe, the United Kingdom, and Germany. The range of frequency from 3.30 to 3.60 GHz is used in China and India. Several research studies have looked into the possibility of using the unlicensed 5150-5925 MHz band, which is located in the sub-6 GHz spectrum, as a viable band for fifth generation. The larger frequency bands for 5G adopts bands such as 24.25 - 27.50 GHz, 26.50 - 27.50 GHz, 26 GHz, 37-37.6 GHz, and 37.5-42.5 GHz, which are implemented by different nations. The 3.5 GHz band and the 26/28 GHz bands are both examples of pioneer bands that are now under consideration [2-3]. There is also the possibility that 5G might make use of frequencies that are higher than 60 GHz, including the ranges 53.30 - 66.5 GHz, 55.40 - 66.60 GHz, 56.60 - 64.80 GHz, 57.00 - 64.00 GHz, and 57.00 – 65.00 GHz [4].

SUB-6GHZ RANGE ANTENNA DESIGN

This article explores a variety of 5th-generation antenna designs operating in the sub-6 GHz band. The decoupling of the various antenna components is an essential step that must be taken in order to guarantee the correct operation of MIMO systems. Techniques like as parasitic elements and electromagnetic band gap structures have showed promise in improving isolation between elements. However, these techniques can also bring additional complexity and a loss of efficiency. Because space decoupling necessitates a literal separation in space between individual antenna parts, there is a cap on the total number of antennas that can be incorporated into mobile terminals. MIMO antenna arrays are a solution that has been suggested in [5] and [6] to overcome these difficulties.

An antenna array design is shown in [5] that is accomplished of decoupling components without the use of any further decoupling structures. The design has an Envelope Correlation Coefficient (ECC) that is < 0.05 dB, efficiency that is > 62%, and isolation that is greater than -17.5 dB. A circular isolator isolates the antenna components in [6]. Decoupling devices are unnecessary. The structure is 50 millimetres by 50 millimetres by 1.6 millimetres and operates at 3.40–3.80 gigahertz on a FR4 substrate. A diversity performance is demonstrated by the antenna, which has an ECC that is less than 0.08 and isolation that is less than -12 dB.

An ultra-wideband antenna was created in [7] to complete requirements for 5G wireless networks that call for large data transfer speeds. The antenna has a unique antipodal structure that looks like a windmill, and this shape enables it to behave wideband. The frequency range that the suggested antenna can cover is between 4 and 10 GHz, and its highest gain is 5 dBi. In addition, Antenna design has been improved to make it possible to increase the frequency range from 10 GHz all the way up to more than 150 GHz, which results in a fractional bandwidth of 175%. The total gain is still measured at 6.4 dBi, but the research does not look at an antenna array that has the same topology.

The range of frequencies in which an ultra-wideband 2x2 MIMO antennas is developed to operate is 2 GHz to 12 GHz [8]. This makes it possible for the antenna to span the whole sub-6 GHz band used by 5G. On a Rogers 5880 substrate, the antenna array design makes use of two asymmetric F structures that are connected by a compact defective ground. The mutual coupling is below 20 dB, the bandwidth is 143.2%, and the optimum gain is 4.8 db.

Massive MIMO is widely regarded as one of the most important technologies that will contribute to the development of 5G. In [9], a 10-element MIMO antenna array is constructed. This array operates at 3.45 GHz and is made of six monopoles with a length of 0.4 and four L-shaped slots with a length of 0.25. These two varieties of antennas are arranged in an alternating pattern on a substrate. The MIMO antenna array has a span of frequencies 3.30 - 3.60 GHz, an isolation of superior to -11 dB, and a channel capacity of 48-51 bps/Hz. It works in this frequency range.

4G / 5G ANTENNA DESIGN

A new design procedure in antenna design is the creation of antennas that work on both 4G as well as 5G bands at the same time. This section discusses a few of these designs.

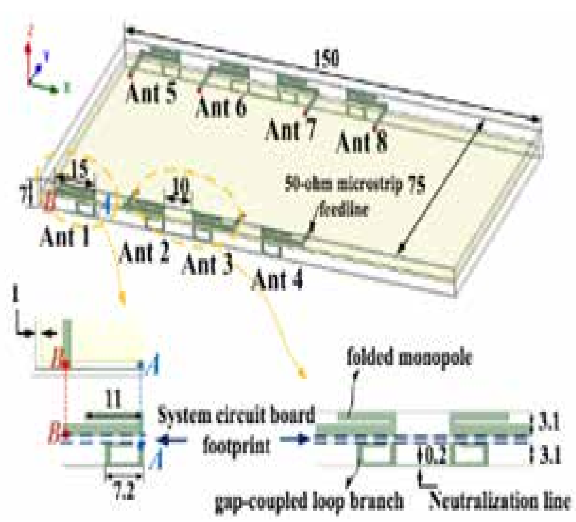

Fig.1 MIMO antenna array (Multiband) with neutralized lines [10]

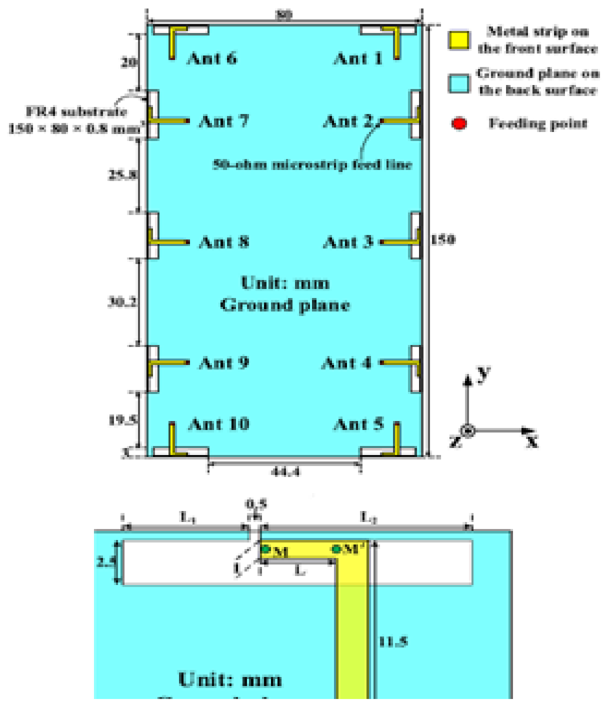

Fig.2 Mutltiband array with Ten elements [12]

The article [14] presents a proposal for a single ring slot multiband antenna that is suitable for use in 4G/5G smartphone applications. A metal rim that has a slot that is 2 mm wide is included in the framework. It is possible to adjust the configuration of the antenna so that it can cover the 4G frequencies (820 - 960 MHz and 1.710 – 2.690 GHz) by adding grounded stubs and a DC regulating circuit. A MIMO slot antenna arrangement is being proposed as the means by which the 5G frequency band (3.4-3.6 GHz) may be covered. A level of isolation more than -13 dB is displayed by the MIMO antenna array, and the envelope correlation coefficient is not greater than 0.1 dB[15] outlines the construction of a space-saving antenna that consists of a loop in the shape of a U and an inserted slot in the shape of a T with an open end. The 4G bands (790-990 MHz and (1700-2700 MHz) can be covered by this antenna, as can the 5G band (3.2-3.7 GHz), although it cannot create an antenna array.

An antenna array that is made up of eight monopole antennas is stated to cover the 5G band (3.40 - 3.60 GHz) in the publication [16]. The same paper describes the coverage of 4G frequencies (0.824-0.960 GHz and 1.710-2.690 GHz) utilizing a bent shorting out strip with a 6.8 nH chip inductor. A protruded ground plane provides upper band decoupling and lower band impedance matching.

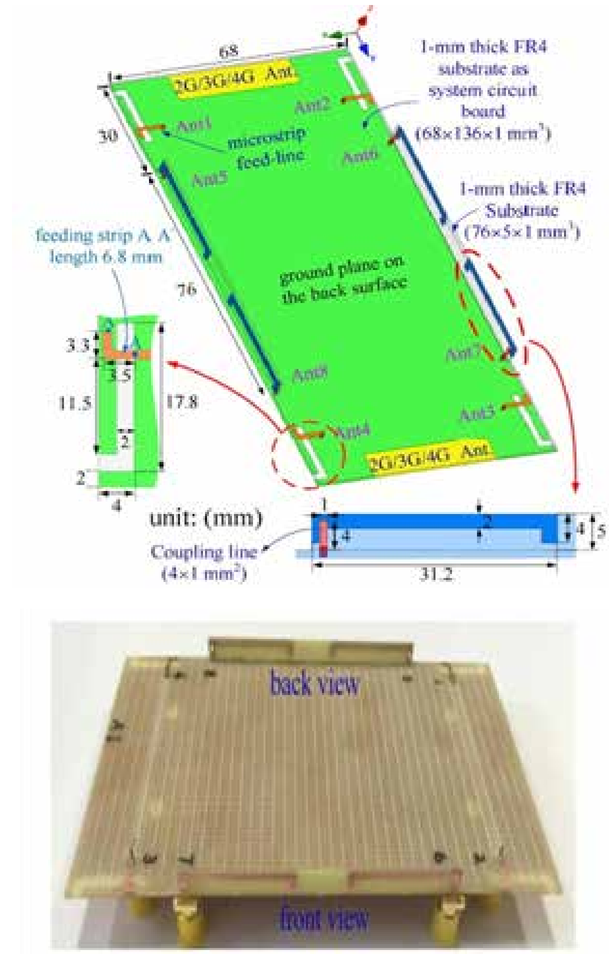

Fig.3 a) design and b) model of MIMO array [13]

The aforementioned reference [17] describes a multiband slot antenna array intended for use with the latest generation of 4G and 5G smartphones. The MIMO architecture may operate at frequencies ranging from 3.45 to 4 GHz, 2.5 to 2.7 GHz for the 4G band, and 4.93-5.73 GHz. By positioning the antennas such that they are in each of the each corner of the PCB, isolation levels of more than 17 dB may be achieved.

The information in Table 1 makes this abundantly clear, Antenna designs that do not include a decoupling component, such as those shown in [5] and [6], provide higher isolation and channel capacity. However, as shown in [10], [11], and [12], increasing the number of antenna components results in higher efficiency but poorer isolation by only 12 dB. The difficulty comes when attempting to fit more antennas into a smaller space, which results in mutual coupling between the antennas. Therefore, it is necessary to make a compromise between the amount of isolation and the total quantity of antennas.

Table 1 Parametric comparisons of various antenna systems

Ref. No.	Frequency Band (GHz)	No. of Element	Gain (dB)	Efficiency (%)	ECC	Isolation (dB)	Application
[5]	3.4-3.6	8	-	> 62	<0.05	> 17.5	5G in mobile handsets
[6]	3.4-3.8	4	>4	-	<0.08	>12	5G wireless communication application
[10]	3.4-3.6, 4.8, 5.1	8	-	41-72 and 40-85	<0.08 and 0.05	>11.5	5G mobile handset
[11]	3.4-3.8, 5.15-5.925	12	-	41-82 and 47-79	<0.15 and 0.1	>12	5G MIMO for mobile handsets
[12]	3.4-3.8, 5.15-5.925	10	-	42-65 and 62-82	<0.15 and 0.05	>11	Sub 6GHz MIMO smartphone

On the other hand, [13] and [14] demonstrate that using approaches that include dual polarisation can improve isolation, albeit at the expense of a minor decrease in efficiency. Dual-polarized antennas have the potential to increase isolation, but they typically result in a decrease in efficiency. In conclusion, references [14] and [16] outline the features of 4G/5G antenna designs; however, they do not give any more specifics.

CONCLUSION

We have included a complete evaluation of antennas with single element and MIMO for 5G wireless communication in this article that we hope you will find useful. Within the sub-6GHz frequency range, we have provided a rundown of how antennas function when configured in both single-band and multiband setups. In addition to that, we have gone through a few different antenna arrays that are able to operate in the millimeter wave region.

Recent developments in MIMO antennas operating in the sub-6GHz frequency band have mostly centred on improving the isolation between nearby antenna components in order to accommodate higher data rates. In order to accomplish this objective, a number of strategies, including neutralisation lines, slot lines, various types of polarisation, and the use of parasitic components, have been utilised. On the other hand, antennas intended for use in the millimetre wave range have been developed with the goal of maximizing gain.

In addition, we have carried out a comparative investigation of the performance of a number of different antenna designs operating in the sub-6GHz frequency band. It is interesting to note that our research has uncovered the fact that antenna designs may still maintain great isolation despite the absence of any decoupling structure, furthermore to high efficiency and channel capacity.

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Enhancing Diabetic Retinopathy Assessment: Non-Proliferative Stage Identification through Clahe and Data Agumentation Methods of Data Preprocessing

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ABSTRACT

Diabetic retinopathy (DR) is the predominant disease in India, characterized by occluded blood vessels in the retina that result in diverse symptoms, such as visual impairment and potential blindness. Nevertheless, there exist efficacious solutions. Adequate diagnosis, timely treatment, and essential skills can prevent over 50% of blindness occurrences. Diabetic retinopathy can result from various forms of diabetes, such as Gestational diabetes, Type 1 diabetes, and Prediabetes. Greater risk is associated with prolonged duration of diabetes. Diabetic retinopathy will impact over 50% of individuals diagnosed with the condition. The illness progresses through three primary stages: No Diabetic Retinopathy ,Proliferative Diabetic Retinopathy, and Non-Proliferative Diabetic Retinopathy. Ophthalmologists frequently employ fundus photography images to identify phases in their patients. Consequently, there exists a notable disparity across the various kinds of diabetic retinopathy (DR) in the collection of fundus images. The data preprocessing is done on IDRID dataset using CLAHE,Data Agumentation and Dimensionality Reduction methods.

This research article presents a comprehensive analysis of identifying several phases of DR by the utilization of advanced DL (Deep Learning) and ML (Machine Learning) techniques.

KEYWORDS *: PDR, NPDR, Machine learning, Deep learning, Fundus images, Convolution neural networks, Diabetic retinopathy.*

INTRODUCTION

Diabetes is a chronic condition that can lead to a person's death. In addition, as stated by the World Health Organization (WHO) [11], diabetes cases increased from 108 million in 1980 to over 400 million in 2014. A comparative analysis has been conducted on medical factors causing blindness in diabetic retinopathy (DR). The data confirms that the prevalence of DR is rising more rapidly in small and mid-income nations as compared to high-income countries. Identifying and detecting risks can help reduce the number of individuals requiring medical intervention. DR stage classification can be utilized to help society in the prevention of vision loss in people with DR, as per societal impact recommendations. Early identification of DR can prevent progression to the PDR stage, which is associated with vision loss and blindness. his study aims to categorize the various stages of visual impairment and offer therapies to halt its advancement when identified in its first phase. In terms of economic consequences, diabetes can result in financial losses due to the costs associated with drugs, ongoing blood sugar monitoring, the detection of retinal abnormalities, and other related expenses. In comparison to other countries, the economic status of individuals in nations such as India is less advantageous.

Types of Diabetes

sType 1: Type 1 Diabetes arises when an individual's immune system fails to generate insulin cells. Over 5% [12] of those diagnosed with diabetes suffer with type 1 diabetes. This stage of diabetes can occur at any age but is most prevalent in young adults and children.

Type 2: Your body exhibits insufficient insulin production [12] or inadequate cellular response. This form of diabetes is the most widespread. While primarily affecting adults, it can also pose a risk to youngsters.

Prediabetes: The blood glucose levels are elevated, surpassing the typical range, but they do not reach the threshold for diagnosing this particular form of diabetes..

Gestational: This condition is commonly found in pregnant women and typically resolves after delivery Women diagnosed with Gestational Diabetes are at a heightened risk of developing Type 2 diabetes.

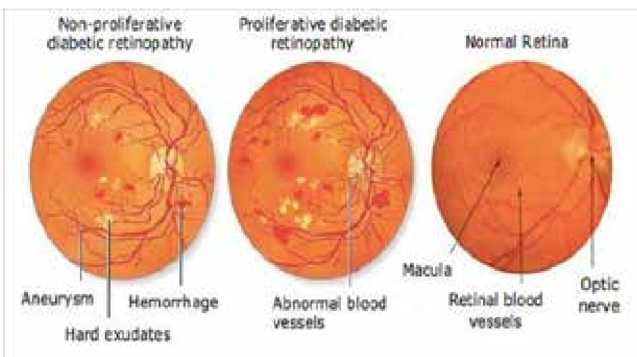

Figure 1. Stages of Diabetic Retinopathy[25]

The optic nerve governs the sense of sight. The extension refers to the continuation of your spinal cord and neural networks of the brain. The optic nerve conveys visual stimuli from the eyes to the brain. Your brain processes the sensory information to facilitate the sense of seeing. The macula, a region of the eye, is responsible for processing your visual perception, namely the objects and images that are directly in your line of sight. Having a clear vision is crucial. The region refers to the circular area located at the central part of your retina, at the back of your eye. The fovea centralis, a slight indentation in the neurosensory retina, exhibited the maximum visual acuity score, which quantifies the eyes' ability to perceive various details at a specific distance. The central region of the structure houses the macula's fovea, which governs the process of central vision.

An aneurysm is a localized dilation that occurs in an artery due to a constriction in the outermost layer of the blood vessel, typically at a point of branching. When fluid flows through a blood vessel that has become weakened, elevated blood pressure causes a small piece to protrude outside. Retinal hard exudates are frequently observed in individuals with diabetic retinopathy. Albumin and fibrinogen, lipid and protein compounds, can penetrate hard exudates resulting from abnormalities in the blood-retinal barrier. They are frequently observed in the plexiform layer in the retina's outer region.Hard exudates are unique yellow-white deposits that can be seen within the retina. They can appear as specks or large areas, eventually developing into circular rings.

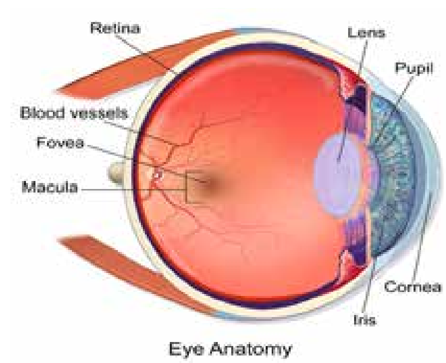

Figure 2. Eye Anatomy

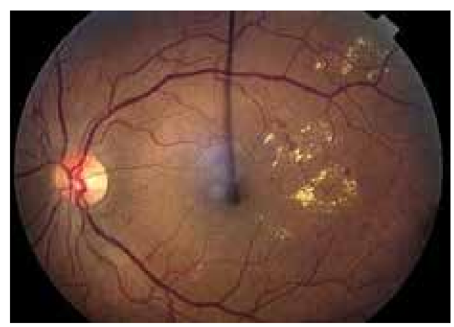

Figure 3. Hard exudates

Figure 4. Retinal hemorrhage[26]

Stages of Non-ProliferativeDiabetic Retinopathy

Mild

In the early stages of diabetic retinopathy (DR), the retinal blood vessels experience a loss of integrity. The blood arteries have little protuberances that periodically release blood into the retina. The retinal tissues possess the capacity for expansion, resulting in the development of white patches.

Moderate

In addition to hard exudates, cotton wool patches, and venous beading, certain patients may exhibit hemorrhages or macular holes in one to three retinal quadrants.

Severe

The blood circulation in the retina undergoes a significant decrease due to a greater blockage in its blood vessels. The regulatory board has authorized the commencement of angiogenesis in the retinal region.

LITERATURE REVIEW

Stephen Cahoon [1] emphasized the importance of discovery and diagnosis in effectively managing the symptoms and potentially slowing down the progression of certain diseases. Ophthalmologists utilize fundus photography as an economical and dependable diagnostic instrument. However, fundus photography datasets suffer from a significant discrepancy among the different classifications of Diabetic Retinopathy. This paper achieves the classification of Diabetic Retinopathy into three groups (mild, moderate, and severe) using a two-stage Deep Convolutional Neural Network with a fine-tuned ResNet-18 architecture [1]. The moderate DR was classified using a fine-tuned ResNet-50, while the severe DR was classified using a fine-tuned ResNet-50. The proposed architecture has a preprocessing stage encompassing data augmentation and image scaling.

The study by Pradeep Kumar Jena [2] found that researchers used the CLAHE approach [2] primarily on the green spectrum of the image. This method was chosen because it provides better visibility of bright lesions, which are more easily distinguishable in this specific channel. The present study presents a new asymmetric deep learning approach that employs characteristic analysis to identify the existence of diabetic retinopathy. The optic disc and blood vessels have been distinguished by employing asymmetrical deep learning features extracted by U-Net. Subsequently, an SVM and a CNN are employed to identify and categorize lesions linked to Diabetic Retinopathy. The lesions can be categorized into four distinct groups: hemorrhages, microaneurysms, exudates, and regular lesions. The suggested methodology has been assessed using two readily available retinal image datasets, namely MESSIDOR and APTOS. The specificity rates for detecting non-diabetic retinopathy in the APTOS and MESSIDOR datasets are 98.6% and 91.9%, respectively. The diagnostic accuracy ratings for exudate in these two datasets are 96.9% and 98.3%, respectively.

Yogesh Rajput [3] developed a method that can identify and describe lesions associated with non-proliferative diabetic retinopathy, regardless of their color. Identifying bright and dark illnesses can be accomplished by employing a multilayered perceptron, as detailed in reference [3]. This method depends on detecting exudates and cotton wool patches to diagnose brilliant disorders, while microaneurysms and hemorrhages are regarded as symptomatic of dark disorders. This discussion focuses on the multilayered perceptron algorithm, a methodology for categorizing diabetic retinopathy lesions. This system has an accuracy score of 0.99 and an actual positive rate of 96%.

As stated by Pooja Bidwai [4], Diabetic Retinopathy is a prevalent and significant cause of visual impairment worldwide. This condition occurs due to chronic diabetes accompanied by fluctuating blood glucose levels. The high occurrence of this issue among working-age individuals requires immediate intervention to reduce the possibility of future visual impairment. AI-based technologies have been utilized to implement diagnostic and evaluative methods for diabetic retinopathy in the early stages. Timely identification of visual abnormalities enables the implementation of appropriate therapies, hence mitigating the likelihood of ocular issues. The current, thorough inquiry explores many approaches for detecting diabetic retinopathy by analyzing indicators such as blood vessels, microaneurysms, exudates, macula, optic discs, and hemorrhages. Most trials utilize fundus photographs of the retina obtained using a fundus camera. The author asserts that this literature still needs to delve into utilizing sophisticated methodologies derived from the PRISMA [4] framework and artificial intelligence.

Victor's primary goal in this project is to apply several machine learning techniques to predict diabetes diagnosis. Furthermore, these models are evaluated to ascertain the most optimal model in this scenario by assessing their predictive accuracy and other performance measures, including precision, recall, and F1 score. The Random Forest model outperformed the other investigated models, having an accuracy rate of 82.26%.

The indicated individuals are Tokuda Yoshihiro, Hitoshi Tabuchi, and a source referenced as [6]. A fundus camera operated automatically and was explicitly used to record images of retinal hemorrhage. Meanwhile, a machine-learning technique, a deep convolutional neural network was deployed to identify and categorize cases of diabetic retinopathy. The study aimed to investigate the identification of moderate-to-severe non-proliferative diabetic retinopathy and the categorization of mild-to-severe NPDR. The calculated area under the curve values for identifying mild-or-worse diabetic retinopathy (DR) were 0.812, 0.888, and 0.884, respectively. However, the AUC values for detecting moderate or worse DR were 1.0, 1.0, and 1.0. An automated artificial intelligence system that solely relies on RH measurements can be utilized to identify DR, necessitating an ophthalmologist's intervention.

According to Mohamed M. Abdel Salam's biological system [7], the retinal microvascular network displays distinct multifractal properties, such as generalized dimensions, lacunarity, and singularity spectrum. This paper comprehensively explains a unique technique that utilizes multifractal geometry to diagnose diabetic retinopathy at an early stage. The initial phases of non-proliferative diabetic retinopathy can be detected by analyzing pictures acquired from macular optical coherence tomography angiography [7]. One way to accomplish this is by automating the process of solving problems and improving accuracy through supervised machine learning techniques, such as the SVM algorithm. The categorization technique attained a precision rate of 98.5%.

Table 1. Comparative Analysis

Sr. No	Name of Author	Dataset	Technique	Results
1	Stephen Cahoon (2022)	Kaggle APTOS	5 fold cross validation and 2 stage Deep Convolutional Neural Network	91% in the first stage, 90% and 80% in the second sub-stages
2	Pradeep Kumar Jena (2023)	APTOS and MESSIDOR	CNN with SVM, U-Net for segmentation	91.9% for MESSIDOR and 98.6% for the APTOS datasets
3	Yogesh Rajput (2022)	Collected from Neha Deshpande and Manoj Saswade	Multilayered perceptron	The true positive rate is 96%, the false positive rate is 0%, and the accuracy score is 0.99.
4	Pooja Bidwai,(2022)	---	PRISMA approach and artificial intelligence	78 research studies

		RFSS		
5	Victor Changa (2022)		RandomForest	accuracy of 82.26%.
6	Yoshihiro Tokuda Hitoshi Tabuchi (2022)	Department of Diabetology, Tsukazaki Hospital (Himeji City, Japan)	Deep convolutional neural network	AI based automatic diagnosis concentrating on RH can be used for diagnosing Diabetic Retinopathy
7	Mohamed M. Abdelsalam (2021)	Oph-thalmology Center in Mansoura University-Egypt	Support Vector Machine	
8	Tieyuan Liu, Yi Chen, Hongjie Shen (2021)	DIARETDB1 (DB1).	networkconvolution	convolution 92.0%, max-pooling 93.2%, ave-pooling 93.6%
9	Sunil S S(2021)	DRIDB0, DRIDB1, MESSIDOR, STARE and HRF.	therapeutic approach,deep learning	More effective results
10	Ebin P(2020)	Messidor,DIARETDB	Transfer Learning	Reuse Learning Techniques

DATA PREPROCESSING TECHNIQUES

Clahe Method

Histogram equalization is a method in image processing that improves the brightness of an image by reorganizing the pixel intensities to maximize the average intensity and level of detail. This technique modifies the frequency distribution of pixel values in an image to achieve a more uniform histogram. The uniform histogram guarantees that every pixel in the image has an equal chance of appearing, resulting in enhanced contrast and a consistently distributed image. The CLAHE form of Histogram Equalization is commonly employed in image processing applications to enhance visual contrast, even though it may magnify noise excessively. However, it still preserves the distinctive elements of the image. The primary goal of CLAHE is to restrict the application of Histogram Equalization to specific regions of the image rather than the entire image. CLAHE consists of two crucial stages: contrast augmentation and contrast limiting. In the initial phase, contrast is diminished by implementing a specific histogram equalization technique on every image region. After the histogram, applying a non-linear function diminishes the overall count of pixels with excessively high or excessively low intensities, hence decreasing the contrasting characteristics of the image. The clip limit parameter generates a non-linear function that specifies the amount of contrast to be used.

Fig. 5 Original Fundus Image

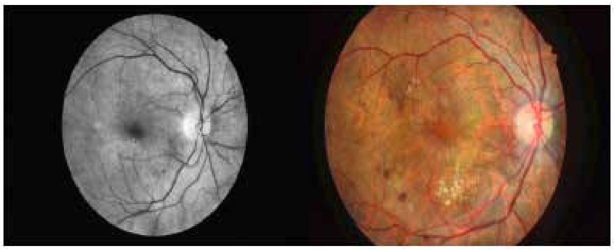

Fig. 6 Grey image after application the CLAHE method,Colored image after applying CLAHE method

We may discern the disparity between the two Fundus Images by referring to the provided figure. Figure 5 displays the Original Fundus image, which becomes more visually distinguishable after using the CLAHE data preprocessing procedure. Using grey-colored output enhances the visibility of hard exudates, microaneurysms, and blood vessels. The colored image output differentiates hard exudates and yellow-white deposits seen within the retina. The histogram displays the appearance of both the input and output fundus. The graph represents the relationship between the pixel values and the frequency of the fundus picture. Figure 7 exhibits an uneven distribution, but Figure 8 demonstrates an even frequency distribution for pixel values.

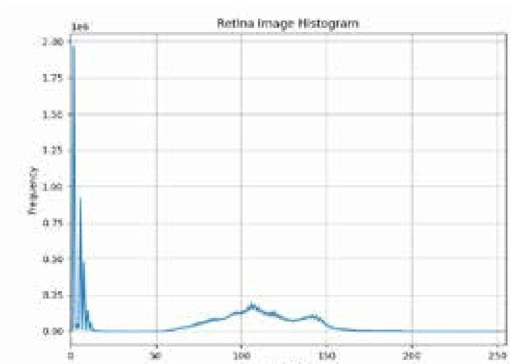

Fig .7 Histogram of Fundus Image

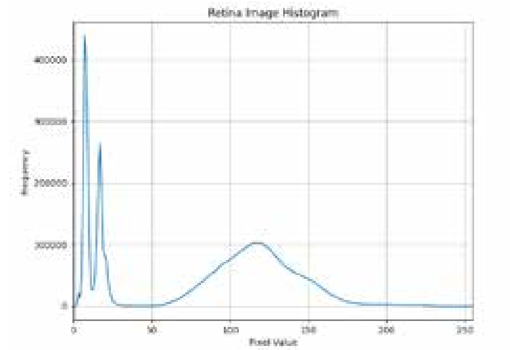

Fig .8 Histogram of Fundus Image after applying CLAHE

Data Augmentation

Data augmentation is a technique that involves artificially expanding the size of a dataset by creating more data points using the existing data. This involves making little modifications to existing data or utilizing machine learning models to create more data points inside the underlying structure of the original data, hence expanding the dataset. Data augmentation techniques are extensively employed in several advanced deep learning applications, including but not limited to object identification, picture classification, image recognition, natural language understanding, and semantic segmentation. Augmented data enhances the performance and outcomes of deep learning models by creating novel and varied cases for training datasets. Data augmentation techniques in data manipulation The often employed actions include rotation, shearing, zooming, cropping, flipping, and adjusting the brightness level.

Fig. 9 Data Agumentation on Original Fundus Image

4.CONCLUSION

Diabetic Retinopathy can be classified into different stages, namely, no DR, NPDR (mild, moderate, severe), and PDR. Ophthalmologists commonly utilize fundus photography images to detect various stages. Hence, the fundus image collection exhibits significant variation among all categories of Diabetic Retinopathy. This study proposal presents an innovative approach for categorizing various phases of diabetic Retinopathy (DR) by employing distinct image-enhancing techniques using CLAHE,Data Agumentation and Dimensionality Reduction methods . The results derived from the IDRID datasets will yield superior accuracy, sensitivity, and specificity levels.

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Study on Object Detection Algorithm

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ABSTRACT

There are many who are blind in this world, and they deal with a lot of difficulties in their daily lives. One of the most difficult things for the vision handicapped is moving about physically. Individuals who are completely blind or have impaired eyesight frequently struggle to navigate new settings on their own. The current research aims to construct an object detector that can identify items at a specific distance in order to detect them for visually impaired individuals and other commercial reasons. You Only Look Once (YOLO) is a deep learning model for object recognition.

KEYWORDS : *Voice control, Accessible interfaces, Automate website, Visually impaired, Blind people.*

INTRODUCTION

Artificial intelligence advances have led to the creation of numerous virtual assistants, including Microsoft Cortona, Google Assistant, and Siri on iPhones. Despite these developments, not much is being done to use these technologies to support the blind community. This project's goal is to assist blind individuals with daily tasks including recognizing the tangible items in front of them.

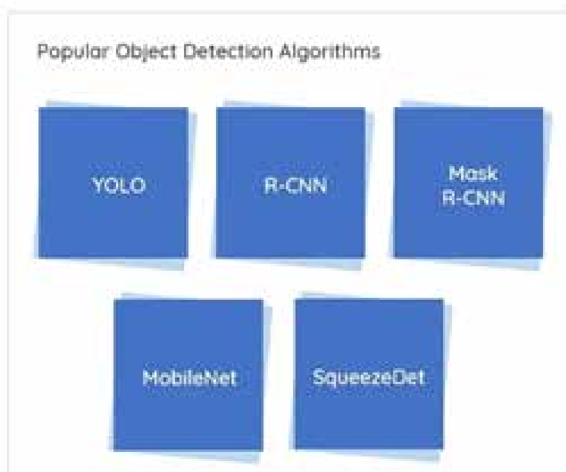
This project uses neural networks, a deep learning concept. Face detection and object detection are the models used in this project. The creation of virtual assistants for the blind has a number of difficulties, such as preserving a user-friendly interface, guaranteeing smooth interaction with current assistive technology, and continuously enhancing accuracy and responsiveness. The goal of ongoing innovation is to make them more user-friendly, adaptable, and essential for helping people with vision impairments live more independent lives.

Modules

The design flow of our present application is as follows. There are essentially three modules in it. They consist of:

1. Object Detection
2. Transcribing the identified item into Speech
3. Estimating Depth.

Object Detection:- The core of our project is the object detection module, which is the first one. In essence, it involves using datasets that the model has been trained on to identify close and distant objects.



R-CNN – Region-based Convolution Neural Networks

Object Detection:- The process of finding and classifying objects in an image can be achieved through various methods.[8] One deep learning approach is the use of regions with convolutional neural networks (R-CNN). R-CNN combines rectangular region proposals with convolutional neural network features.

Advantages:- Faster R-CNN is a type of R-CNN that works well for spotting objects in self-driving cars. It strikes a nice balance between how quickly it detects objects and how accurate it is.

Disadvantage:-One drawback of RCNN is its computational cost, as it requires region proposals and multiple stages of processing. Moreover, the original RCNN architecture may not be well-suited for sparse input data, such as LiDAR point clouds commonly used in 3D object detection scenarios.

Mask R-CNN

Mask R-CNN is a variant of R-CNN that offers high precision instance segmentation. However, it has some drawbacks. It also includes improved RoI Pooling for accurate fault location and achieves high accuracy in its results.

Advantages:-Mask R-CNN is a popular deep learning model that excels in high precision instance segmentation, which involves identifying and delineating individual objects within an image with great accuracy.

Disadvantages:-When applied to remote sensing images, Mask R-CNN may experience poor detection accuracy due to the large scale and different specifications of these images.

MobileNet

Mobile Net is a type of single-shot multi-box detection network commonly used for object detection tasks. It is implemented using the Cafe framework, which is a deep learning framework known for its efficiency and versatility. When Mobile Net is applied to an image, it generates a vector that contains the tracked object.

Advantages:-Mobile Nets are a type of convolution neural network that offer several advantages. This efficiency also translates into faster processing speeds compared to traditional convolution neural networks.

Disadvantages:-Mobile Nets, while optimized they are designed for specific purposes and may not be as adaptable as other network architectures.

SqueezeDet

SqueezeDet is a deep neural network that was introduced in 2016 for computer vision tasks, particularly in the field of autonomous driving. The main focus of SqueezeDet is to achieve real-time object detection in autonomous driving scenarios, where efficiency and speed are crucial.

Advantages:- Easy to implement, relatively speaking.

Disadvantages:-

- Computationally expensive.
- Multiple step pipeline.
- Requires feature engineering.

YOLOR

YOLOR is a recently introduced object detector in 2021. It is a novel algorithm that incorporates both implicit and explicit knowledge during model training. This unique approach allows YOLOR to learn a general representation that can be applied to multiple tasks.

Advantages:-YOLO (You Only Look Once) is a fast and accurate real-time object detection algorithm, outperforming other CNN-based detectors in speed and precision.

Disadvantages:-In the context of object detection, there are certain limitations and challenges associated with the use of grid cells and bounding box predictions. In this approach, each grid cell is responsible for predicting only two boxes and can assign only one class to those boxes.

YOLOv3-

YOLOv3(You Only Look Once, Version 3) is a top-tier real-time object detection algorithm using a deep convolutional neural network. Developed by Joseph Redman and Ali Farhadi, YOLOv3 is known for its accuracy and efficiency. It predicts class probabilities for a set number of object classes, usually 80 for the COCO dataset.

Advantages:- YOLOv3 is a top choice for object detection due to its speed, efficiency, high accuracy, and versatility in detecting objects across different settings and scenarios.

How to Use YOLOv3

To successfully use the YOLOv3 machine learning algorithm, the first step is to select a specific object detection project. Once project is decided, the following essential steps should be followed:

1. Data Collection: Gather a dataset of images or videos that contain the objects we want to detect.
2. Data Annotation: Annotate the dataset by labeling the objects of interest in each image or video frame. This step involves marking the bounding boxes around the objects and assigning corresponding class labels.
3. Model Training: Use the annotated dataset to train the YOLOv3 model.
4. Model Evaluation: Assess performance of the trained model by testing it on a separate set of images or videos that were not used during training. Evaluate metrics such as precision, recall, and accuracy to measure the model's effectiveness.
5. Fine-tuning and Optimization: Consider fine-tuning the model by adjusting hyper parameters or augmenting the dataset. This iterative process helps improve the model's accuracy and robustness.

Deployment

After achieving the desired performance, the YOLOv3 model can be used for real-time object detection in videos, live feeds, or images. Beginners can effectively utilize the YOLOv3 algorithm for object detection by following these steps and setting clear project objectives.

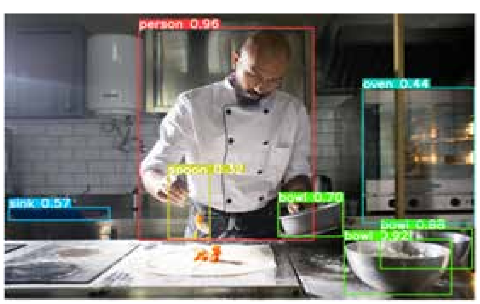


Fig 1. YOLOv3 Computer Vision Example in Restaurants

LITERATURE SURVEY

Vinayak Iyer et.al[1]:-Presents a modular strategy to increase visually impaired people's web-based accessibility. User can interact with and modify the system via speech-to-text and text-to-speech interfaces. The three modules' current implementation methods and system design are shown. The Wikipedia module responds to user queries in a timely and precise manner by using a BERT model on the SQuAD dataset.

Sulaiman Khan et.al [3]: In this paper, they discuss how, over the past ten years ,These applications include smart household and electrical appliances, smart navigation systems, smart tracking systems, smart healthcare equipment, smart urban management, and many more. The creation of navigation assistants for blind or visually impaired patients, which enable them to navigate interior and outdoor environments without the assistance of others, is among the most innovative applications.

Chinthaka Premachandra et.al[5]:-This study examines numerous intricate road crossings encountered during driving. They verified through experimentation that a 3DVC placed at a crossroads can capture images of the whole crossroads. Using the 3DVC images. High performance was shown by the developed algorithms in recognising and tracking moving objects in experiments conducted under various settings.

N. Sripriya et.al[2]:-In this paper, The created bot has shown to be effective at finding a variety of locations within a 50-kilometer radius, including restaurants, theatres, shopping centres, temples, mosques, and many more. The queries of the users intents. Most query intents are successfully identified, which facilitates effective dialogue management. Most significantly, the user feels comfortable because the speech interaction operates with little difficulty and in a fluid manner.

Kanchan Patil et.al[4]:- In this study, they introduced a wearable gadget that will assist those with visual impairments in performing tasks like reading and face recognition. The system's core component is a voice-over chat-bot, which will communicate with users by using voice commands. The picture is described in natural language using the image captioning methodology.

Pooja Singh et.al.[6]:-This study discusses the development of virtual personal assistants, or VAs. Speech to text synthesis is used to first translate the user's vocal commands into text. The device's next responsibility is to analyse the text that was transformed from speech. The device uses natural language processing (NLP) to process queries.

CONCLUSION

One of the most important steps towards promoting independence, accessibility, and inclusivity for those with visual impairments is the development of a virtual assistant for the blind. Many obstacles have been removed by this technology, enabling users to carry out a variety of tasks and obtain information with ease. Thanks to developments in natural language processing (NLP), speech recognition, and machine learning, virtual assistants that can comprehend, interpret, and reply to user inquiries have been made possible. More advanced and inclusive virtual assistants will be developed with ongoing integration of cutting-edge technologies and an emphasis on user feedback, eventually enabling visually impaired people to lead more independent and connected lives.

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Improving High-Resolution Image Reconstruction: Neural Network-based Feature Extraction from Single Low-Resolution Images

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ABSTRACT

Compared to low-resolution (LR) photographs, high-resolution (HR) images include more information. It is easier to recover an HR image from a series of low-resolution photographs than from a single high-resolution image. You can combine multiple LR images with different details to get an HR image. It is still more difficult to reconstruct HR images from a single, less detailed LR image. This study suggests a model that uses neural networks to extract features from a single image to improve the resolution. As a feature, the histogram of each sub-image is computed for both the LR and HR images. The features of the histogram of LR photos are learned using a back propagation neural network [BPNN]. The researchers ran a series of simulations using a collection of MRI pictures of the brain. They found that the neural network model they arrived at significantly reduced RMSE and PSNR.

***KEYWORDS** : Histogram, Artificial neural network, Enhancement technique, High resolution, MRI.*

INTRODUCTION

Enhancing image resolution has been a longstanding challenge in image processing and computational intelligence, driven by the constant demand for improved visual quality and finer details in various applications. This research paper seeks to make a substantive contribution to this field by exploring a novel approach—Histogram-Based Resolution Enhancement of an Image utilizing Artificial Neural Networks (ANN). The rationale behind this investigation stems from recognizing certain limitations inherent in conventional resolution enhancement methods. Many existing techniques often struggle to balance enhancing resolution and preserving essential image features, leading to suboptimal outcomes. In response to these challenges, the study proposes integrating histogram-based techniques, particularly drawing inspiration from histogram equalization, with the capabilities of artificial neural networks.

Histogram equalization, a widely utilized method for optimizing image contrast, is the foundation for this research. By leveraging the inherent strengths of histogram-based approaches, the goal is to address specific shortcomings related to resolution enhancement. Introducing artificial neural networks into this framework is intended to capitalize on their ability to discern complex patterns and relationships within data, which is particularly advantageous for understanding intricate image structures. The proposed methodology aims to enhance image resolution by meticulously combining the advantages of histogram-based techniques and the neural network's capacity for intricate feature extraction. The primary focus is achieving notable improvement in image clarity and detail without compromising the integrity of essential structural elements. Throughout this research, a comprehensive analysis will be conducted to assess the efficacy of the proposed approach. Quantitative evaluations, comparative studies, and benchmarking against established methods will be performed to thoroughly examine the novel Histogram-Based Resolution Enhancement with Artificial Neural Networks. By doing so, the research offers valuable insights and contributes to advancing computational image processing, pushing the boundaries of what can be achieved regarding image resolution enhancement.

The proposed FHE technique, rooted in fuzzy logic, aims to preserve image brightness and improve local contrast. The fuzzy histogram computation and strategic division into sub-histograms contribute to an effective and visually appealing contrast enhancement, overcoming the limitations of existing methods. This project explores FHE's qualitative and quantitative analyses using parameters like Average Information Contents (AIC) and Natural Image Quality Evaluator (NIQE) index, demonstrating its efficacy in eliminating washed-out appearances and adverse artifacts. In summary, the FHE algorithm presents a promising solution for Histogram-Based Resolution Enhancement of an Image, employing the power of fuzzy logic and neural networks to achieve superior contrast enhancement and local information preservation.

LITERATURE REVIEWS

In this research, any statistical method's classification performance can be greatly improved by boosting image quality during pre-processing. First, a three-stage better image enhancement method. Following image augmentation, employ a discrete wavelet transform to extract characteristics from an improved MR brain picture. These features are subsequently refined using color moments, encompassing skewness, standard deviation, and mean. At last, a state-of-the-art deep neural network (DNN) was used to classify the MRI scans of the human brain as either healthy or diseased. Compared to prior state-of-the-art methods, the approach's 95.8 percent is far better. The results supported the hypothesis on the function of picture enhancement in medical image classification, which also showed promise for enhancing the efficiency of other medical image analysis methods [1]. Images with a higher resolution (HR) contain more details than those with a lower resolution (LR). Compared to a single high-resolution image, a series of low-resolution photographs can more readily yield an HR image. Creating an HR image by duplicating many LR images, each with unique features, is possible. Using a single, less detailed LR image for HR image reconstruction is still not ideal. This study suggests a model that uses neural networks to extract features from a single image to improve the resolution. The histogram is computed for the smaller blocks comprising each LR and HR image. Learning LR image histogram characteristics is accomplished using a back propagation neural network, or BPNN. Results from simulating a dataset of brain MRI images demonstrate that the neural network model produced significantly enhances both the PSNR and RMSE.[2]

This research examines the impact of histogram-based image enhancement techniques on the five-category mammography classification system that uses convolutional neural networks in computer-aided diagnosis (CAD) software. Mammography histograms are improved by utilizing these processes by making more contrast with the image backdrop. To aid neural networks in their learning process, the contrast has been amplified to facilitate the differentiation of different tissue types. Using this method could increase the percentage of correctly labeled photos. A model was created to categorize various lesions using Deep Convolutional Neural Networks. The model's accuracy, as measured by mini-MIAS data, was 62%. The project aims to develop an updated method to be integrated into the CAD system to improve the current automatic mass and microcalcification classification and identification capabilities. Consequently, there would be a better chance of early disease detection, which is crucial because the chance of a cure improves to nearly 100% with early diagnosis [3]. Incorporating AI approaches into an image contrast enhancement algorithm has several potential uses beyond contemporary photography. It makes low-contrast photographs look better. Using the classifier to avoid data loss, this research primarily aims to provide a novel way to improve picture contrast that integrates AI with histogram equalization techniques. This method will give low-contrast photos a better contrast distribution. To improve low-contrast photos, this study suggests an ANN-based AHE method. The primary goals of this research are to (1) identify the specific issues with current digital picture contrast enhancement methods and (2) categorize digital image contrast levels as low or high, allowing one to decide whether or not to apply enhancement. ANN, with AHE, determines the image's contrast level before processing it for contrast enhancement. The suggested ANN-AHE algorithm is tested by comparing it to current methods in terms of performance metrics such as PSNR, MSE, Entropy, QI, QRCM, CQE, SSIM, and computational time. Image processing and the artificial neural network toolkit are utilized in MATLAB 2016a to simulate the suggested model.[4]

This research presents a GAN-based improvement strategy for improving underwater photos of poor quality. This research analyses low-quality image improvement algorithms to improve the quality of low-quality photographs by analyzing certain technological means and procedures. The goal is to achieve clear and natural images with all the features and structural information. The objective is to recover the initial scene data from low-resolution photos. The study topic for this method's effectiveness verification is an image database like DIARETDB0 or SID. Compared to other image enhancement approaches. The suggested approach would vastly enhance the article's suggested indicators if used [5]. One important aspect of underwater computer vision applications is improving the quality of underwater photographs. Scientists studying marine mammals, sunken ships, subaqueous research, crustaceans, and geological formations have all been interested in the undersea world. Problems, including water-type fluctuations, are inherent to the underwater environment and impact underwater photographs. The SDCNN is a suggested network based on deep learning. Training these three networks involved taking into account dehazing, edge sharpening, and color cast correction in real-world underwater photos. The experimental findings proved that the suggested strategy can improve the visual quality of underwater photographs. The technique employs a deep convolution neural network with conventional image enhancement methods.[6]

When it comes to breast cancer imaging, a low-contrast, low-quality natural image might not give enough information to identify malignant areas visually. The survival rate for breast cancer is on the rise due to advancements in identification and analysis. In contrast, breast cancer is still the most invasive malignancy affecting females. A hybrid approach called Genetic algorithm-based histogram equalization is proposed to enhance the visual quality of medical photographs. Improving visual contrast is as simple as using histogram equalization. An objective function exposed to harsh and easy restrictions is the ideal candidate for the Genetic algorithm in multiple constraint optimization issues. For data mining, this study proposes a genetic algorithm that uses an image enrichment strategy based on histogram equalization to separate information recommendations for breast cancer analysis and forecast. Researchers ran experiments on various medical photographs to test how well the suggested strategy worked and collected quantitative and qualitative data. Entropy is only one major criterion the suggested technique surpasses compared to state-of-the-art upgrading approaches. While preserving brightness and visual magnificence, the suggested approach advances contrast. The proposed method improves the quality of illness inspection and analysis. [7]

Every day, a mountain of multimedia data is created and sent across the internet; a considerable portion consists of photos. The quality of the image is affected by the time of capture, the illumination, and the sensor used. By adjusting the under- and over-exposed areas, image exposure correction aims to control the erroneous exposure settings of photos. Post-processing fills in the gaps when there is insufficient data in the raw image for those areas. For this task, a convolutional neural network relies on deep learning to anticipate the missing detail in underexposed photos. An encoder-decoder architecture similar to U-Net with skip connectivity forms the basis of the suggested coherent CNN architecture. Compared the network's performance to other deep learning-based methods and ran tests to understand its capabilities. In addition, it detailed research, its outcomes, and how the method could improve the under- or over-exposure photos. Even though the method is lightweight and simple, it produces respectable results that are competitive with state-of-the-art methods and do not introduce any qualitative distortion into the final image. A benchmark dataset to conduct experimental validation could compare the model's performance. The current state-of-the-art research outperformed with a PSNR of 19.372 and an SSIM of 0.835.[8]

This research suggests enhancing retinal fundus images (CNNs) to separate blood vessels optimally using convolutional neural networks. This research investigates powerful contrast enhancement methods using retinal fundus pictures' green and RGB channels. Compared to the enhanced green channel, the enhanced

RGB quality performs better in analyzing the simulation findings. This finding suggests that the RGB to green channel contrast enhancement choice is sufficient and successfully improves the fundus image quality. As a result, the segmentation accuracy of the CNN-based model will be enhanced by this enhanced contrast. On the DRIVE dataset, the suggested technique achieves a sensitivity of 70.92, a specificity of 98.20, and an area under the curve (AUC) of 97.56 during evaluation. The accuracy is 94.47.[9]

The suggested study involves using ROI classification to detect suspicious lesions in the breast. The method successfully uses visual inspection to segment the aberrant region of mammography pictures. The current categorization techniques often need to pre-process ROIs or undergo a feature selection process, leading to a massive and duplicated database. The suggested method employs a feature selection methodology before classification to improve classification efficiency while decreasing computation time. It takes much time to examine the entire breast area because breast tissue is so vast. The properties of the features retrieved from ROIs in CAD systems significantly impact the system's efficiency. In this case, the feature vector is very large after feature extraction; thus, a new hybrid optimum feature selection method is employed to minimize false-negative and true-negative rates when using FFBPNN to classify breast cancer. The primary goal of this research was to modify an existing CAD system to use mammography pictures in conjunction with experimental data on breast structure to identify and differentiate between normal and pathological breast lesions. Future research aims to achieve accurate cancer detection using massive databases.[10]

To address smart city security issues at night, a new Attention U-net network was developed that combines a self-attention gate with the standard U-net. This network can improve extreme low-light images, saving power consumption, resources, and the number of street lights needed to illuminate the surrounding area. Also, according to the suggested design, the network is an end-to-end network, so it can enhance low-light images using a single model. Findings pave the way for further investigation into image-processing jobs by expanding the suggested network into a pre-processing model.[11] To improve retinal images, this research uses the cycle-constraint adversarial network CycleGAN. The basic architecture incorporates CBAM to enhance detail representation and feature extraction. This approach overcomes the constraint of existing image improvement algorithms, which are limited to improving only one specific type. Deep learning technology is superior to more conventional approaches since it eliminates issues. The suggested method does not necessitate paired images to locate many paired low- or high-quality retinal images. Future research aims to fix flaws like bright spots and eyelash artifacts by collecting additional retinal images in clinics. To create a comprehensive system for diagnosing fundus diseases, intend to combine the classification network with the network that enhances retinal images.[12]

This research introduced a method known as CBIR-SMANN, which stands for CBIR-similarity measure via artificial neural network interpolation. After gathering datasets, the photos are resized and pre-processed with Gaussian filtering. Then, they are passed to the Hessian detector, which gathers the important spots. The features retrieved. For later use, the interpolated results are saved in a database. During the testing phase, the query image underwent pre-processing before being given into the similarity assessment function with its extracted features. In this way, ANN aids in retrieving comparable pictures from the repository. The CBIR-SMANN algorithm has been tested and validated in the Python program. At its lowest retrieval time of 980 ms, CBIR-SMANN had an impressive recall value of 78%. This proved that the proposed model was far better than its predecessors [13]. Based on the LSGAN architecture, this presented a new model for an image enhancement network that can be trained in either a supervised or unsupervised fashion in this research. The generator introduces an attention map network and MBCMHSA-Net, which uses U-Net as its backbone network in the network model. The discriminator is also part of the network model. Improving the contrast and brightness of images relies on the Attention Map Network, which also acts as a directing module for the central network. Image details are improved, and weights for significant characteristics are assigned using the MBCMHSA-Net. In addition, presented a new discriminator network that combines a fully connected neural network, a Transformer encoder, and a convolutional encoder to solve the issue of unstable training in standard neural network discriminators. This discriminator can better direct the generator's training according to the testing outcomes.[14]

This paper presents a two-stage framework that automatically boosts contrast, re-enhances, and denoises low-light images to achieve denoising. The suggested method applies to both known and unknown environments and devices, and both networks 8 in approach can be trained using a self-supervised methodology. Results from experiments conducted on various low-light data sets demonstrate that the strategy is competitive with other state-of-the-art approaches in terms of visual impact and subjective measures. To further increase real-time performance, the next studies will investigate ways to repair color deterioration, merge RED-Net with ICE-Net, and combine low-light picture enhancement with high-level jobs.[15]

METHODOLOGY

Contrast is a key component of image enhancement, raising quality. Over- or under-extraction of contrast, particularly at lower resolutions, is a common side effect of using traditional approaches like histogram equalization to improve images. To address the limitations of existing approaches, this study seeks to create a novel fuzzy inference system that can improve picture contrast. A histogram shows how the intensity of an image is distributed graphically. This metric only shows the total number of pixels for all intensity levels.

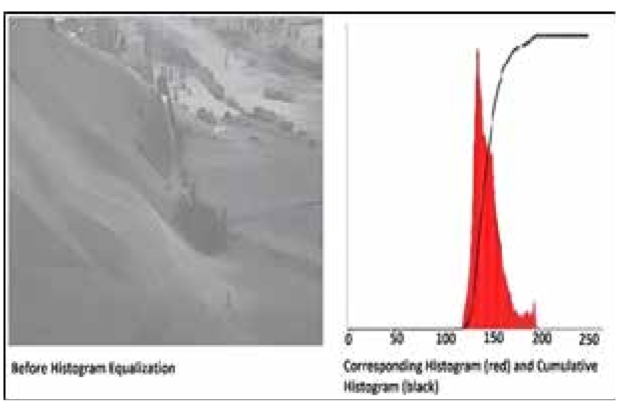

Fig. 1. Histogram and Cumulative Histogram

The tonal scale, with black on the left and white on the right, is represented by the X-axis in the above figure, while the Y-axis displays the number of pixels in an image. With more pixels, the peak at a given brightness level is higher; this is seen by the histogram, which shows the number of pixels for each brightness level (ranging from black to white).

Contrast Enhancement Technique

Astronomy, medical imaging, geophysical prospecting, and surveillance are just a few areas that rely on automated image contrast enhancement algorithms. More conventional approaches, such as gray-level transformation and histogram-based methods (such as histogram equalization), often suffer from the need for manual parameter selection, washed-out effects, and an inability to preserve edges and brightness. Recent studies advocate for adopting automatic methods, particularly emphasizing the effectiveness of approaches. GLG aims to achieve a uniform histogram by grouping components into gray-level bins, but fuzzy-based methods outperform its computational efficiency. Fuzzy logic, applied in image processing through fuzzification, modification of membership values, and defuzzification, offers superior performance. Fuzzy image enhancement algorithms leverage histogram modeling, employing fuzzy rules for pixel enhancement and rule-based smoothing. Notably, recent contributions introduce intensification operators and novel membership functions, such as the NINT operator, optimizing entropy for gray-level images. While these fuzzy-based techniques exhibit enhanced contrast, some challenges, including computational complexity, persist, emphasizing the need for continued exploration and refinement in automated contrast enhancement methodologies.

Gray-level transformation-based Techniques

Gray-level transformation-based techniques and piecewise-linear transformation are fundamental methods in image processing for enhancing contrast. Logarithm transformation expands the dynamic range of dark pixels, emphasizing details in shadowed regions. Power-law transformation, often called gamma correction, is applied to adjust image brightness, enhancing visualization by emphasizing specific intensity levels. Piecewise linear transformations involve segmenting the intensity levels into different regions and applying linear mapping to each segment, allowing fine-tuned contrast adjustments. These techniques play a crucial role in manipulating the distribution of pixel intensities, catering to diverse image enhancement requirements in fields such as medical imaging, photography, and scientific visualization.

Histogram-based Processing Technique

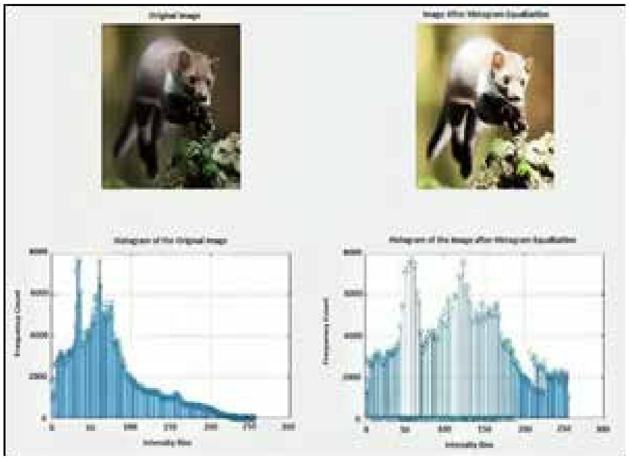

Fig. 2. Histogram Equalization (HE)

Histogram-based processing techniques are fundamental in image enhancement, with histogram equalization being a widely adopted method driven by the premise that a uniformly distributed grayscale histogram yields optimal visual contrast. This approach remaps pixel intensities based on the probability distribution of the input levels. State-of-the-art techniques include shape-preserving local histogram modification, which retains the shape of the original histogram, and multi-scale adaptive histogram equalization, which adapts to various scales in the image. Bi-histogram equalization (BHE) and block-overlapped histogram equalization are advanced methods that refine contrast enhancement by dividing the histogram or processing overlapping blocks, respectively. These techniques are crucial in optimizing image quality and visual appeal through tailored histogram adjustments.

Traditional Histogram Equalization

Histogram The purpose of equalization, a method used in computer image processing, is to increase contrast in pictures. It expands the image's intensity range, effectively spreading the most common intensity values. When near contrast values represent the data it uses, this method increases pictures' global contrast.

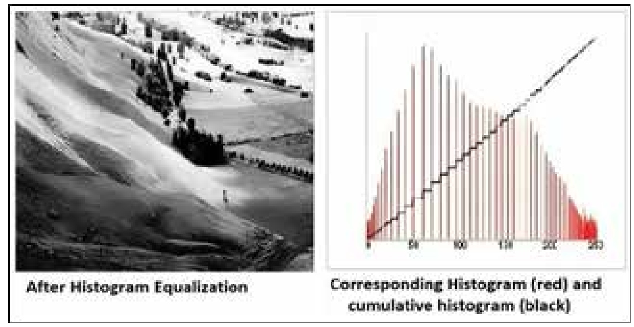

Fig. 3. Traditional Histogram Equalization (THE)

Contrast Limited Adaptive Histogram Equalization (CLAHE)

Due to the concentrated histogram in areas of the image with near-constant contrast, ordinary AHE tends to exaggerate that contrast. Thus, AHE can lead to an amplification of noise in relatively constant areas. One variation of adaptive histogram equalization that aims to mitigate this issue of noise amplification is contrast-limited AHE (CLAHE). The slope of the transformation function is used to determine the amount of contrast enhancement around a specific pixel value in CLAHE. At any given pixel value, this is directly proportional to the histogram's value, which is proportional to the neighborhood CVF's slope.

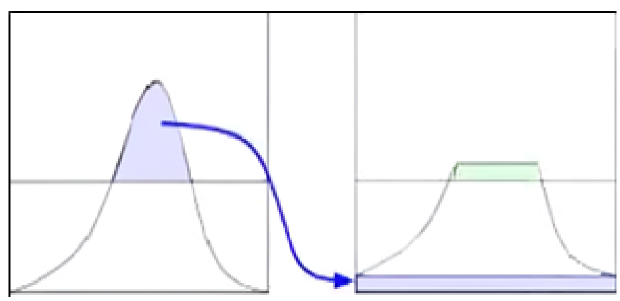

Fig. 4. Contrast Limited Adaptive Histogram Equalization (CLAHE)

It is more beneficial to redistribute evenly among all histogram bins rather than eliminate the portion of the histogram that is beyond the clip limit.

Redistribution efforts will drive yet another set of bins that exceed the clip limit (area shadowed verdant throughout the figure), which, depending on the image, leads to an effective clip limit more than the legal limit.

Fuzzy logic-based histogram equalization (FHE)

An enhancement of the conventional histogram equalization method, addressing its limitations in preserving image brightness and minimizing the introduction of undesirable artifacts. In FHE, the process begins with image fuzzification and intensification, where the grayscale values are transformed into fuzzy sets using fuzzy logic, providing a more flexible and accurate representation of the image's intensity distribution. To divide the intensity levels strategically, the original image's median value separates the fuzzy histogram into two sub-histograms. A unique dynamic range is assigned to each sub-histogram, enabling them to undergo independent contrast augmentation.

The heart of the FHE technique lies in the histogram equalization stage, where the traditional equalization approach is applied separately to each sub-histogram. This step ensures that contrast enhancement is tailored to specific intensity ranges, preserving image brightness and preventing undesirable artifacts. Finally, the process concludes with image defuzzification, converting the enhanced fuzzy image back into crisp grayscale values for practical use and interpretation. Fuzzy Logic-based Histogram Equalization represents a sophisticated and effective approach to contrast enhancement, leveraging fuzzy logic principles to handle the inherent inexactness of gray-level values and providing localized and adaptive histogram equalization to improve image brightness and local contrast.

PERFORMANCE MEASURES

When comparing various picture-enhancing methods, quantitative performance metrics are crucial. In this context, two key quantitative indicators utilized for performance analysis are the Tenengrad measure and the Contrast Improvement Index (CII), in addition to visual outcomes and computing time.

Contrast improvement index (CII)

The most popular benchmark for image improvement, the CII, is utilized to compare the outcomes of contrast enhancement approaches to assess the competitiveness of the suggested fuzzy method vs. current methods. As a ratio, CII can be used to quantify contrast improvement [26]. Here is the definition of the Contrast Improvement Index:

$$CII = \frac{C_{Proposed}}{C_{Original}} \quad (1)$$

where C is the average value of the local contrast measured with 3 × 3 window as:

$$\frac{max - min}{max + min} \quad (2)$$

Values for $C_{Proposed}$ and $C_{Original}$ Are averages of local contrast in the output and original pictures, respectively.

Tenengrad measure

Maximizing the gradient is the foundation of the Tenengrad criterion [11,12]. It ranks high among the most reliable and practical metrics for evaluating picture quality. The gradient ΔI(x, y) at each pixel (x, y) determines the Tenengrad value of an image, I. The partial derivatives of this gradient are generated using a high-pass filter, which may find the gradient magnitude by

$$S(x, y) = \sqrt{(I_x \otimes I(x,y))^2 + (I_y \otimes I(x,y))^2} \quad (3)$$

And the Tenengrad criterion is formulated as

$$TEN = \sum_x \sum_y S(x,y)^2$$

For $S(x, y) > T$, where T is a threshold. (4)

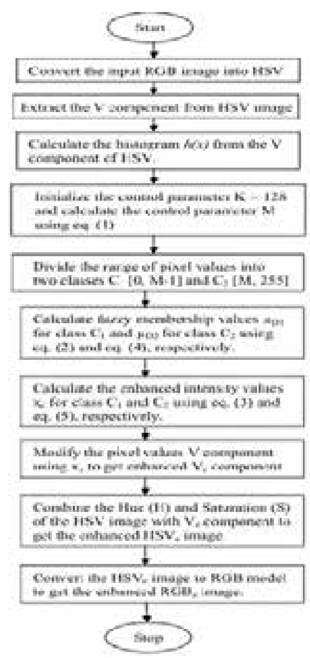

Fig. 5. Flowchart of Tenengrad measure

In general, a higher Tenengrad score indicates better picture quality. Tenengrad measure has been utilized to assess, even though it is less efficient than CII as a performance metric for picture enhancement.

RESULT

When comparing various picture-enhancing methods, quantitative performance metrics are crucial. Along with the visual outcomes, the suggested fuzzy-based enhancement algorithm's performance has been evaluated on low-contrast and low-light photos.

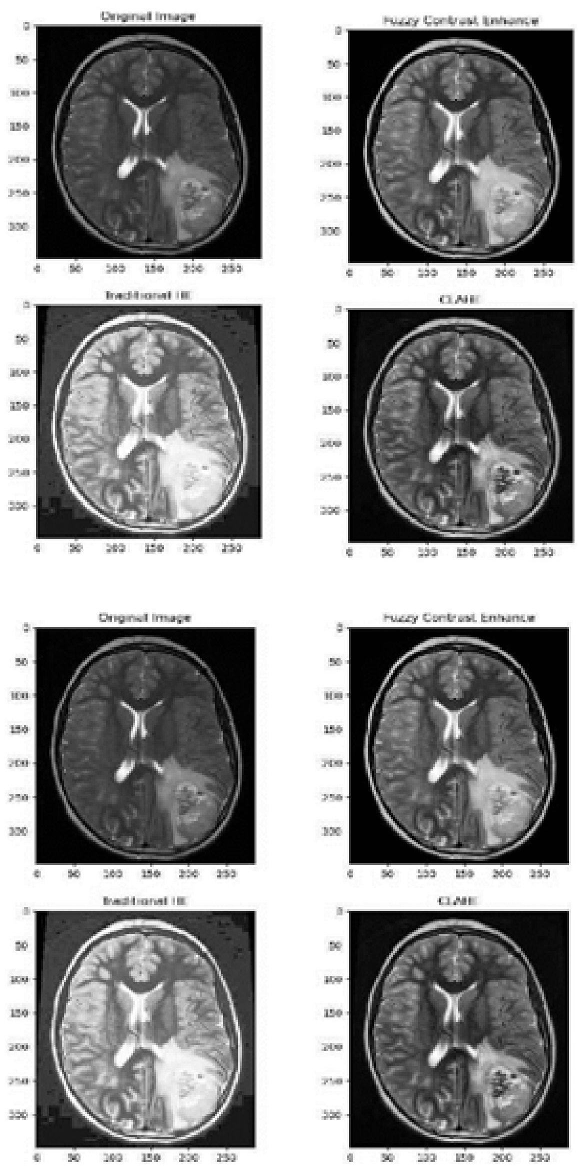

Fig. 6. Result of Image Enhancement

The 16-bin histogram feature was taken from a single LR image to improve the resolution. Using a back propagation neural network model, this histogram information was utilized to train the network to identify appropriate class IDs. Brain MRI scans with super-resolution and LR and the associated HR image sets were used to run the simulations. According to the findings, the suggested model successfully decreased RMSE values and increased PSNR.

CONCLUSION

This research proposes a way to quickly and efficiently enhance color images using fuzzy logic. To automatically enhance the contrast of color images, the suggested method was compared to more traditional histogram-based contrast enhancement techniques and more modern methods, such as histogram-based Gray Level Grouping and Fuzzy Logic. According to a comparative study, this project's proposed fuzzy logic method has increased visual quality and provided higher Tenengrad and CII values. The method outperforms state-of-the-art augmentation techniques in terms of computational speed. A limitation of this approach is that it is limited to low-contrast, low-brightness color images. Future research aims to find a middle ground between color images with low and excessive contrast by calculating the stretching value K adaptively.

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Improvement in Bandwidth of Micro-strip Patch Antenna

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ABSTRACT

This paper presents the improvement in various parameters of patch antenna. Here defected ground structure technique is used to improve the bandwidth. For the design of proposed antenna HFSS (High Frequency Structured Simulation) software is used. First designed a single patch as a reference antenna. In the simulation it operated at 2.34Ghz with gain of 2.01dBi, Bandwidth of 60 Mhz, & vswr of 1.34. So in order to improve the Bandwidth of single patch DGS technique is used & generated a defect of 1.5x1.5 mm below ground & in simulation in operate at 2.35 Ghz with gain of 2.54dBi, bandwidth of 61Mhz & vswr of 1.24. Hence bandwidth is enhanced from 60 Mhz to 61 Mhz using DGS technique.

KEYWORDS *: Patch, DGS, Bandwidth.*

INTRODUCTION

Today wireless communication is become necessity in various applications. In many scenarios where the wired systems are impractical or almost impossible to be implement. Hence the micro-strip patch antennas are very helpful [1,5,6]. The micro-strip patch antenna have different advantages like small size, cheap cost, suitable for short and long distance communication etc [2,10], but while designing of patch antenna the potential challenges such as lower bandwidth, low gain, impedance matching may exist. DGS in newly introduced revolutionary technique in field of micro-strip patch antenna to enhance the Bandwidth [3]. The DGS structure is either etched periodic or non-periodic group configuration defect in ground plane can give increase in effective capacitance and inductance [7]. The bandwidth of the antenna without DGS is narrow and return loss is high while with DGS the antenna provides high bandwidth with less return loss [4].

The gain is very important parameter in wireless communication. The gain of an antenna can be improved by the array of patch [10]. In the antenna array few patches are arranged in a regular structure to form a single antenna in which radiation pattern can be support in particular direction. It increases overall gain and provides diversity reception [8].

In this Study, in order to improve the bandwidth and gain of micro-strip patch antenna we implemented DGS & Array technique respectively.

DESIGN CALCULATION

The dimensions of micro-strip patch antenna can be calculated by following formulas [2,9].

Calculation of width

$$W = \frac{1}{2fr\sqrt{\mu g}}\sqrt{\frac{2}{\epsilon r+1}}\ \text{mm}$$

Calculation of Effective Dielectric Constant

$$\varepsilon eff = \frac{(\varepsilon r+1)(\varepsilon r-1)}{2}\frac{1}{(1+12\frac{h}{w})}$$

Calculation of length extension

$$\Delta L = 0.412h\left(\frac{\varepsilon eff+0.3}{\varepsilon eff-0.258}\right)\frac{\frac{w}{h}+0.264}{\frac{w}{h}+0.8}$$

Calculation for actual length of patch

$$L = \frac{1}{2fr\sqrt{\varepsilon eff}\sqrt{\mu s}} - 2\Delta L$$

Calculation of Ground plane dimension

$$Lg = 6h + L$$

$$Wg = 6h + W$$

Single Patch Design

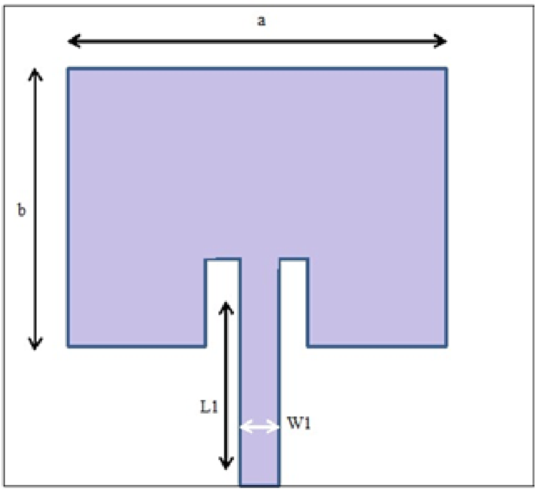


Fig : Single Patch

Single Patch With DGS Design

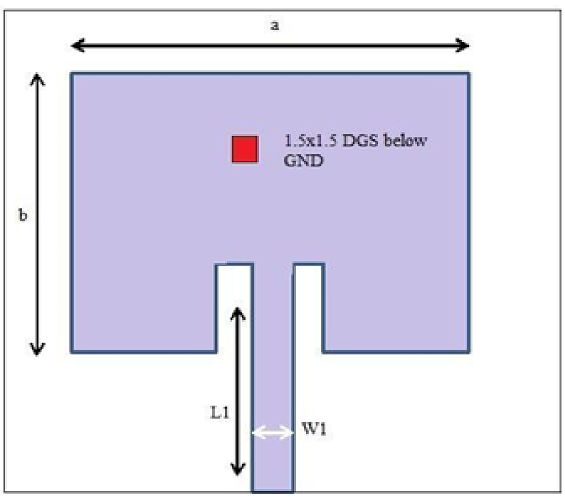


Fig: Single Patch With DGS

Dimensions of Designs

Table 1 : Dimensions of Design

Sr. No	Parameter	Dimensions (mm)
1	a	38
2	b	29.82
3	W1	3

RESULTS AND DISCUSSION

This study designs and simulates a single patch and Single patch with DGS. The bandwidth of the patch is enhanced by using DGS technique from 60 Mhz to 61.2 Mhz. The proposed designs maintain the benefits like cheap cost, high gain, light weight, etc.

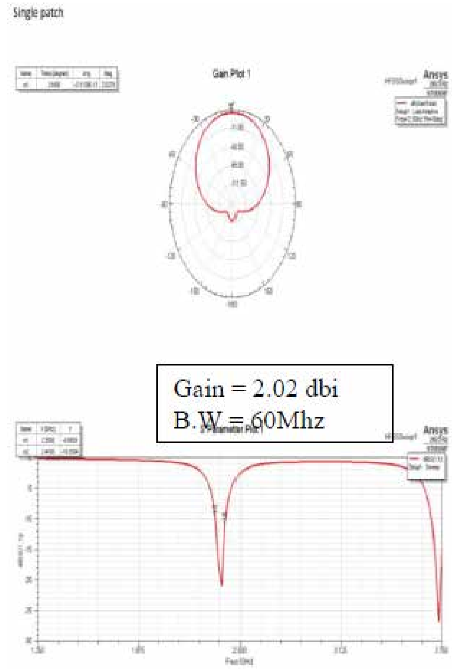


Fig : Simulation Result for Gain & Bandwidth of Single patch Without DGS

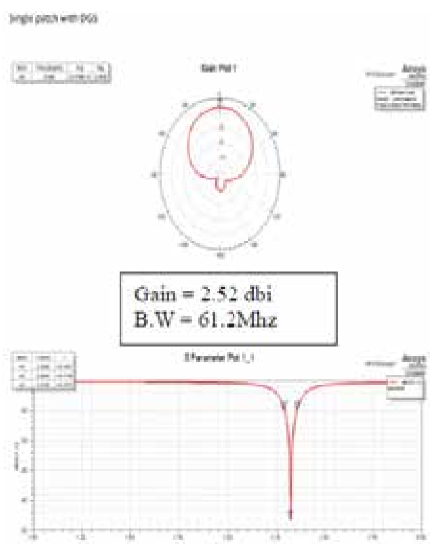


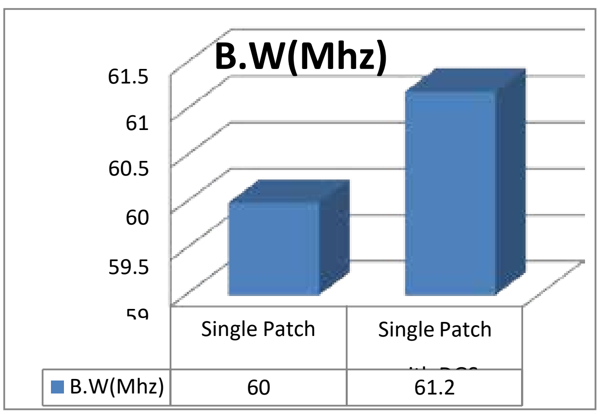
Fig : Simulation Result for Gain & Bandwidth of Single patch With DGS

Comparison Table of Simulated Result

Table 2 : Comparison of results

Design	Operating Frequency (Ghz)	Gain (dBi)	Bandwidth (Mhz)	VSWR
Single patch	2.34	2.02	60	1.34
Single patch with DGS	2.35	2.54	61.01	1.24

Bandwidth Enhancement



CONCLUSION

From the above simulation result, the bandwidth of patch antenna can be enhanced by using the DGS technique.

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Smart LED P10 Display Board

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ABSTRACT

This paper presents the "SMART LED DISPLAY BOARD", is a dynamic and innovative endeavor aimed at creating a large-scale scrolling LED display measuring12*1 foot. This display leverages the power of the P10LED module for vibrant and eye-catching visual communication. The proposed system integrates advanced wireless communication capabilities usingW60 card, providing seamless and efficient method for remotely controlling the LED display. The wireless feature enhances the proposed system's versatility, allowing for easy updates and modification to the displayed content without the need for physical access to the display unit. Key components of the proposed system include the P10 LED modules, which offer high brightness and clarity for optimal visibility even in various lighting conditions. The W60 card serves as the central hub for wireless communication, enabling users to transmit data and control commands to the display unit effortlessly. The scrolling display is design with a focus on scalability, making it suitable for a wide range of application such as advertising, public announcements and informational display. The large size of the display ensure that message and visual can be effectively conveyed to a bold audience. The proposed system significance lies in its ability to combine cutting/edge LED technology with wireless communication, providing attention, implementation, and testing phase of the "SMART LED P10 DISPLAY BOARD", stands as a testament to the convergence of LED technology and wireless communication, offering a powerful tool which provides effective and versatile visual communication on a large scale.

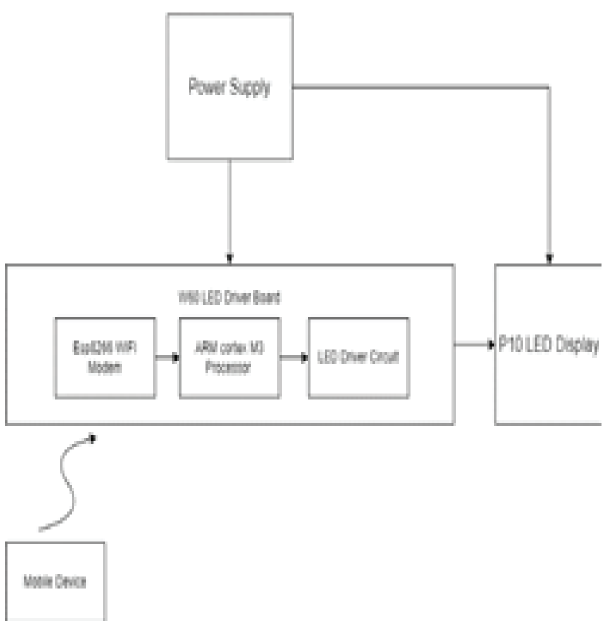
KEYWORDS *: P10 LED display, SMPS, W60 Wi-Fi module.*

INTRODUCTION

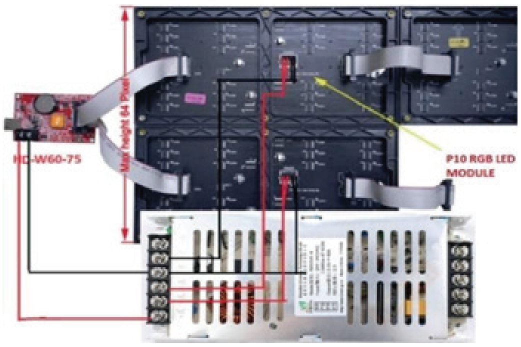
The Proposed system titled "SMART LED P10 DISPLAY BOARD", emerges as a response to the evolving needs of communication system, aiming to overcome limitation associated with traditional static display. As society increasing demands for more flexible scrolling boards. It is an interactive, remotely accessible means of conveying information, dissemination, the need for dynamic display capable of real time update has become apparent. [1] This article explains the creation of a "IOT Based Real Time Digital Led Notification Display Board". The paper is built using a W60 Controller Card which is heart of the proposed system. W60 Wi-Fi Module is being used for Data transmission. Anytime we want, we can add, move, or change the text to suit our needs. Notices are sent using an authorised Computer at the transmitter. The limitation of existing display technology, including in ability to dynamically updates contend and the lack of remote-control option, from the problem this proposed system address. [2] The envisioned system revolves around establishing wireless communication between a mobile device and an LED display, utilizing either Wi-Fi or Bluetooth. Every modern smartphone is equipped with Wi-Fi and Bluetooth functionalities. Users cansend messages to the display through their mobile devices, prompting it to flash or scroll while displaying the message content. The Bluetooth module receives the message, holding its content until it is received and stored in the LED controller when transmitted over Wi-Fi [3] The article suggests a system where a mobile application on an Android device allows users to send desired messages to a Bluetooth module at the receiving end. The received message is then displayed on an LED array functioning as a display board. The message continues scrolling on the display board until a new one is received, leading to the deletion of the old message to make room for the new content. [4]. Utilizing the W60 Card Bluetooth module, the system receives messages from authorized mobile phones. The microcontroller extracts the message from the Bluetooth module and displays it on the P10 LED display. This proposed methodology not only enhances the security system but also raises awareness of emergency situations, helping to mitigate potential dangers effectively. Beyond the immediate goals, the proposed system aims to explore possibilities for future enhancement and developments. This involves identifying areas for improvement, whether in terms of display technology, wireless communication protocols, or user interface design. The aim is to provide a foundation for future iterations and innovations. Through systematic planning and execution, the proposed system seeks to contribute to the advancement of LED display technology and wireless communication while laying the groundwork for future innovations in the field.

PROPOSED SYSTEM

Block Diagram

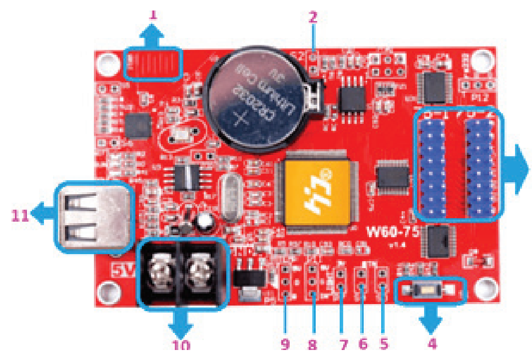


Circuit Diagram



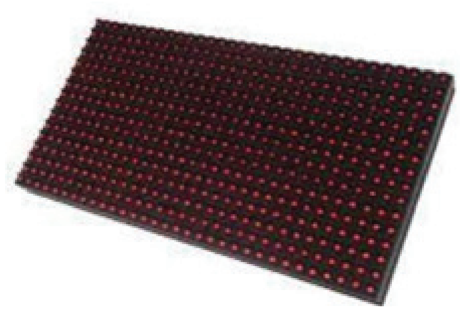
HARDWARE DESCRIPTION

W60 Controller Board



The HD W60 is a low-cost, single/double colour LED display controller card with built-in Wi-Fi and USB disk support. It is compatible with P10 and F3.75 LED modules, and it can drive up to 512*32 pixels. The card has a built-in constant current driver, which ensures that the LED are driven at a consistent current. The card also has the passkeys which improves security of the entire system and provides access to the authorized personnels only. This Controller has a flash capacity of 4M Byte and it can support full colour module. The W60 card supports three brightness adjustment modes.

P10 Display LED Board



The P10 LED display sounds versatile with its 32x16 matrix, allowing independent control of each LED. Its 512 high-intensity LEDs make it suitable for creating dynamic and colorful displays for both commercial and home use. The P10 LED Display screen has an excellent technical specification which includes 20W max power load and 5V current voltage input, P10 display has output brightness 3500 to 4000 nits. The P10 LED display has significant advantages for applications like floor or wall tiles with its high-angle visibility, dramatic contrast, and waterproof rating. The full-colour version's use of additional base colours likely enhances its colour range for a more immersive experience.

Power Supply

A 50v 40A SMPS is a device designed to convert input electrical power into a suitable and regulated 5-volt direct current (dc) output with a maximum current capacity of 40A. this particular power offers a high current output, making it suitable for application that required a significant amount of power, with a maximum power rating of 200wats (5V*40A=200W). operating on a switched mode principle, the SMPS efficiently switches the input voltage on and off, providing a regulated output that compensates for variations in the input voltage. Typically boasting an efficiency greater than 80% SMPS units like this one are known for their ability to convert a large portion of input power into the desired output. Commonly used in electronics Proposed systems, LED lighting system, robotics application, and industrial application, the 5v 40A SMPS ensure a stable reliable power source. These power supply often come with protection features as overcurrent protection, overvoltage protection, protection and short circuit protection. Additionally, to manage potential heat generation at higher power outputs some SMPS units may incorporates cooling mechanisms such as fans or heat sinks. When selecting an SMPS, consideration include voltage and current requirements, relatability, safety features, and cooling efficiency, with attention to specific needs of the intended applications. Always refers to the product data shit and user manual for precise specification and guide lines.

CONCLUSION

With advancing technology, display board systems are evolving from traditional LED displays to intelligent LED displays. The concept of using Smart LED P10 display board with W60 Module. In the realm of communication, we can enhance our interactions as itis more reliable, upgradable, flexible and faster with high efficiency. We can showcase the messages with fewer errors, faster than usual, with high rate of efficiency which leads to low maintenance.

This proposed model has many applications and can be used efficiently in schools, colleges, restaurants, etc. It can also be used for advertising, notice boards. This system is an ecofriendly system, using digital platforms for displaying notices reduces latency compared to traditional paper methods. Authorized individuals can easily update information, ensuring timely and efficient communication.

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Enhancing Feature Manipulation for Improved DDoS Attack Detection on Updated Dataset

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ABSTRACT

With the widening of the scope of the interconnected devices, the security responsible issues that come along with them is also widening. Now, the identification and mitigation of Decentralized Denial of Service (DDoS) attacks is a critical matter. In our study, we are interested in improving the performance of machine learning models for detecting DDoS attacks in the Internet of Things (IoT) settings using the CIC-IoT-2023 Dataset. This dataset includes a wide range of IOT network traffic scenarios that pose novel problems demanding sophisticated feature engineering.

DDoS attacks are a major threat to IoT eco-systems as they interfere with services and potentially harm devices and users.

Feature engineering acts as a crucial factor in detecting and mitigating these attacks in its best way. In this paper, we deal with the following main issues of feature engineering.

This research contributes to the development of a generic feature engineering framework in the context of IDS for DDoS attacks detection using the CIC IoT Dataset 2023. Our goal is to improve the feature selection, transformation, and model evaluation techniques to develop reliable and accurate DDoS detection systems which can protect IoT networks from this persistent threat. The results of the study can notably improve the security and resilience of the IOT environments towards DDoS attacks.

KEYWORDS *: Updated dataset, Feature engineering, Machine learning, Random forest, CIC-IOT-2023, DDOS.*

INTRODUCTION

This paper examines the onset of the IoT phenomenon and the security challenges that come along with its growing footprint, largely focusing on the DDoS attack threat. It is aimed to improve DDoS attack mitigation and detection in IoT environments through machine learning and feature engineering techniques involving the all-purpose CIC IoT Dataset 2023. DoS flooding due to inundating systems with malicious traffic is a real threat as DoS attacks are adaptive. The importance of top-notch data in machine learning models is stressed in the research which also underlines the crucial role of feature engineering in improving the models' DDoS attack resistance. CIC IoT Dataset 2023 acts as a suitable benchmark that covers all kinds of IoT network traffic scenarios. The research methodology is multilateral and comprises data pre-processing, feature extraction, selection, and transformation with the usage of machine learning algorithms for DDoS attack fight. In addition, the research delves into model interpretability aspect, providing clarity and actionable outcomes to security personnel.

RELATED WORK

In recent research, an equilibrium between model computational intricacies and performance was proposed by instructing the model on a high-speed computing platform and employing it as a detection system on platforms with limited performance. The safety framework proved effective against both internal and external vulnerabilities. Another study presented a compact intrusion detection system (IDS) for IoT applications, utilizing a Multilayer Perceptron (MLP) network and deep learning methodologies. This approach significantly reduced the feature count while enhancing incursion identification accuracy within a limited framework. Furthermore, leveraging cutting-edge machine learning methodologies, an advanced intrusion detection system was developed for IoT networks, featuring anomaly detection and automated functionality through hyperparameter control. Additional studies introduced innovative techniques such as a salp swarm optimization approach for intrusion detection in MQTT-based IoT networks and the FELIDS system, showcasing superior privacy maintenance and detection accuracy over traditional machine learning approaches.

Another set of studies explored feature selection in machine learning for enhanced cybersecurity in IoT scenarios. Li et al. conducted a thorough investigation into various frameworks and methodologies, emphasizing the need for advancements in real-time predictive scoring and dynamic feature addition or removal during the learning process. Mohsenzadeh's work applied Bayesian sparse learning, introducing the relevance sample feature machine (RSFM) to enhance classification accuracy, system complexity reduction, and minimized overfitting. However, further extension to include additional supervised learning algorithms was suggested. Additionally, research by Ma et al. utilized Particle Swarm Optimization (PSO) for fall detection in the elderly, achieving heightened sensitivity, specificity, and accuracy. However, the study primarily focused on the healthcare sector, lacking exploration of the approach's applicability in other industries with distinct datasets. Lastly, Wang and team applied a supervised feature approach for gender classification, with potential applications in various image recognition tasks, yet its untested nature in bimodal vein modelling tasks and computer vision remains a notable aspect.

Table 1. Summary of Related Various Models and Comparative Study

Challenge	Strength	Gap	Method
Exhibiting exceptional detection rates for IoT attacks. (2022) [11]	The communication overhead is reduced, leading to exceptional outcomes generated by XGBoost.	The next phase will involve the utilization of a combined model with a distinct dataset tailored for the IoT setting, alongside ongoing examinations using a deep learning framework.	The feature importance diagrams of the SVM and XGBoost models are created, alongside the calibration diagrams of the NB KNN and QDA, algorithms.
Cyber intrusions on network systems (2021) [12]	CTGAN and CopulaGAN demonstrate satisfactory performance for both continuous and discrete variable	The intrusion detection system dataset sourced from TableGAN, CopulaGAN and CTGAN serves as viable learning material for diverse Machine Learning assignments.	Generative Adversarial network (GAN) model: CopulaGAN, CTGAN and TableGAN, are also known as adversarial generative network models
Traditional security approaches show diminished efficacy in combating IoT cyber threats. (2021)[13]	Evaluation of quality is presented concerning correlation with the redundancy and class label. Feature selection assumes a crucial function in diminishing data complexity.		The Pearson correlation coefficient is employed to emphasize the caliber of features and the redundancy within the dataset.
Denial of Service and reconnaissance assaults on IOT networks, specifically targeting6LoWPAN and RPL networks. (2020)[14]	Favorable outcomes are achieved through the application of XGBoost, Decision Trees, Bagging Trees, and Random Forests.	There is a need for enhancements in Bayes Network, NB, and Adaboost, along with the expansion of unsupervised testing to develop and assess the the Gaussian mixture model and hidden Markov model.	DTs, XGBoost, RF, and Bagging Trees, as well as Bayes Network, Adaboost and Naive Bayes (NB)
Identification of botnet and decentralized-denial-of-service (DDoS) assaults (2019) [15]	The Matthews correlation coefficient produces favorable results.	Various datasets could be examined to verify the authenticity of the machine learning algorithms. This study solely focused on studying DDoS attacks	ANN, SVM, DT, Naive Bayes, and Unsupervised Machine Learning (USML) Matthews Correlation coefficient

METHODOLOGY

Dataset

The dataset has 169 csv files with a total of 46686579 records ranging from the diverse sources of legitimate and malicious origins. Every record is described by 49 unique features. The classification models were structured into seven separate classes to address the complexities of a multi-class prediction problem. Categories of classes constitute different subsets.

Our ATC is on the DDOS class. The dataset consists of 339 08765 entries with 49 unique features and different subcategories represented in figure [1].

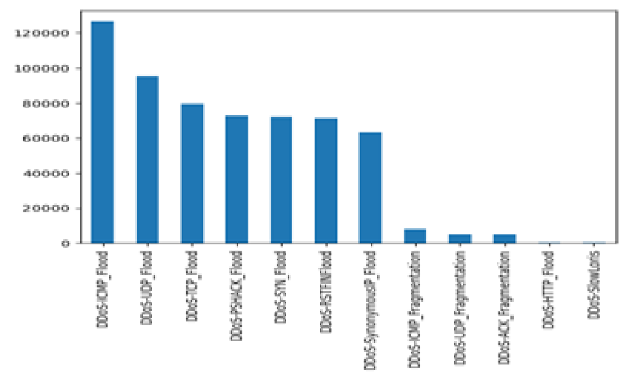

Fig 1. Different number of records for each subtype of attacks

Model Training

The experiment was kicked off by employing a finely tuned RF classifier to calculate the importance of each of the 49 features of the input data. Then several subsets of data were produced which contained only the features with the highest importance values. The model performances were examined using the crucial metrics like the average recall, accuracy, precision, and the F1 score which were computed for the different model instances.

Comparative analysis of the model functionality follows then to check the accuracy of cyber-attack detection and determine the minimum number of required features that can be used for reliable predictions The purpose of our study was to check whether an improved feature selection method could contribute to improving the systems overall performance when recognizing cyber-attacks.

Feature Manipulation

In addition, the typical IoT networks produce massive traffic data in short time duration probably leading to inefficient performance during real-time execution. Feature selection focuses on highlighting the significance of characteristics, hence minimizing making effective classification a straightforward process. Therefore the use of this approach helps researchers to drastically cut down the scale of huge datasets of which analysis is carried out. Also, feature selection serves as filtering system, leading the model to focus on significant features during the training phase.

The study included the analysis of the importance of the MQTT message features using the random forest, Xgboost, lightGBM, and Catboost models. The examination of the feature importance plot from the lightGBM model revealed the paramount role of the highest ranked fifteen (30) features in classifying cyber-attacks.

a) CatBoost: CatBoost is a powerful tool for assessing feature importance in machine learning models, particularly well-suited for tasks involving categorical data. Its unique capabilities in handling categorical variables and robust feature selection techniques offer a clear and interpretable measure of each feature’s impact on the model’s performance. What sets CatBoost apart is its consideration of interactions among features, enhancing the robustness and reflective nature of the feature importance analysis in capturing the model’s actual behavior. Additionally, CatBoost supports two types of important scores, ShapValues and Prediction Values Change, providing flexibility in analyzing feature importance from different perspectives. By training the model with CatBoost Classifier or CatBoostRegressor and utilizing the get_feature_importance() method, users can access and visualize these scores, gaining insights into the most influential features for model predictions. This comprehensive feature importance analysis proves invaluable for tasks such as feature engineering, model interpretation, and improving predictive accuracy across various machine learning applications.

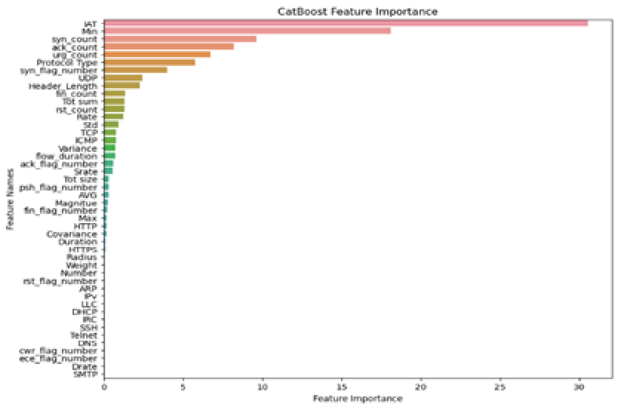

Fig 2. Feature importance using catboost

b) XGBoost: XGBoost quantifies the significance of each feature by assessing their contribution to reducing impurity or error during the construction of decision trees within the ensemble. Utilizing metrics like Gini impurity or mean squared error reduction, features with higher importance scores are deemed more influential in making predictions. The ensemble approach of XGBoost enhances the reliability of these scores by aggregating values across multiple trees, offering a comprehensive view of feature relevance. This information proves invaluable for tasks such as feature selection, model interpretation, and optimizing predictive performance in XGBoost models, establishing it as a crucial tool for both data analysis and predictive modeling. The calculation of feature importance by analyzing consistent contributions across multiple trees aids in gaining insights into factors driving the model's predictions, playing a pivotal role in making data-driven decisions across various machine learning applications.

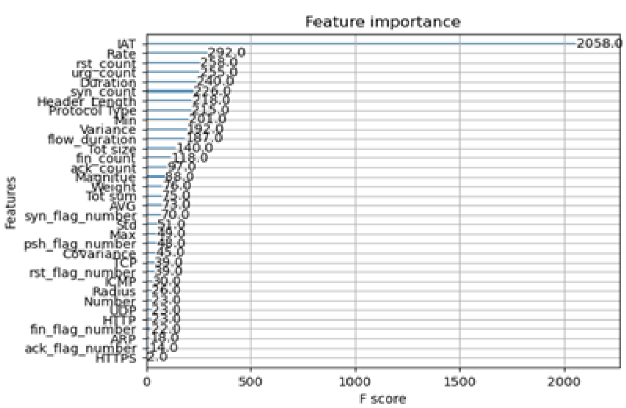

Fig 3. Feature importance using XGboost

c) Random Forest: Random-forest evaluates the feature contribution by ensemble of decision trees. As the trees of the forest are growing, Random Forest infers the reduction of impurity – Gini impurity or mean squared error at each step when data is divided on particular attribute. Features that always result in considerable impurity decrease within the ensemble are provided higher importance scores. The strengths of Random Forest are in its intuitive importance rankings of the features together with many effective visualization methods. This enables the data scientists and analysts to take informed decisions regarding feature selection, model interpretation, and finding out major parameters driving the predictions in different use cases like classification and regression, feature engineering and data exploration.

The Random Forest method chooses significant features by estimating the decrease in impurity (normally using Gini-Impurity or mean squared error) from cutting the data using each feature. Those features which are among the most important in all trees are usually the ones which produce significant decrease of impurity or error. Random Forest presents a simple method of ranking and graphing feature importance which helps to find the most relevant features in a dataset. The importance scores can be used for feature selection, model interpretation, and offer valuable insights for data analysis and predictive modeling in a broad range of applications.

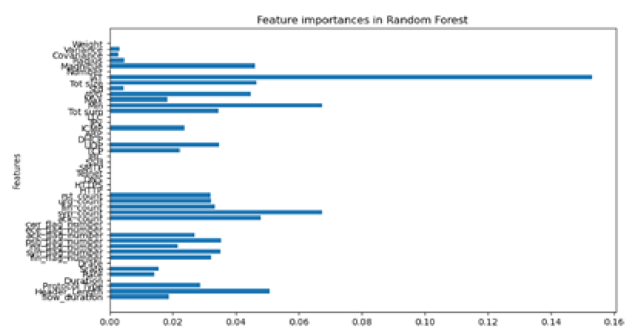

Fig 4.Feature importance using Random Forest

d) Light GBM: Light GBM which is a gradient boosting framework can help for feature engineering. Although it is largely intended for the acceleration of model training, its speed and power make it a good choice for feature selection, transformation, and creation.

LGBM can help to recognize the meaningful features, and for that propose it is necessary to perform the analysis of the importance of the features which will bring the ultimate results into choosing the right set of predictors. Furthermore, Light GBM can handle categorical features natively, facilitating encoding and adding them to your models. Excellent performance of the framework allows rapid testing of many feature engineering techniques and evaluating their influence on the model accuracy. To sum up, Light GBM is a valuable option in the design of features, offering a hand in the improvement of the quality and efficiency of our machine learning models.

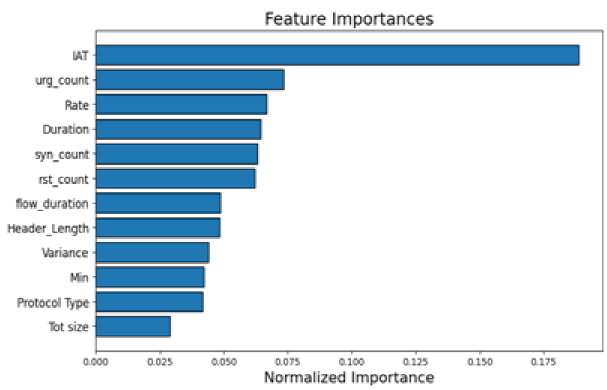

Fig 5. Feature importance using light GBM.

RESULTS (HEADING 1)

The analysis of feature importance in MQTT traffic was conducted with the random forest, Xgboost, lightGBM and Catboost algorithms in this research. According to the feature importance plot of the lightGBM model, thirty (30) vital characteristics were influential in differentiating the type of cyber-attack which the most significant ones appeared at the top of the rank. Collectively, there are 49 features within the dataset. However, only 30 of these features are actively contributing to the decision-making process whereas the remaining features scored zero in terms of feature importance. This character changed the model performance significantly.

A close scrutiny of the results shows that the performance level can be maintained when only thirty-features with the highest feature importance values are deployed. Thus, 30 features are enough in resource-limited cases. Pictorially speaking, this leanest feature set is adequate in detecting different forms of malicious traffic with an acceptable level of mean precision.

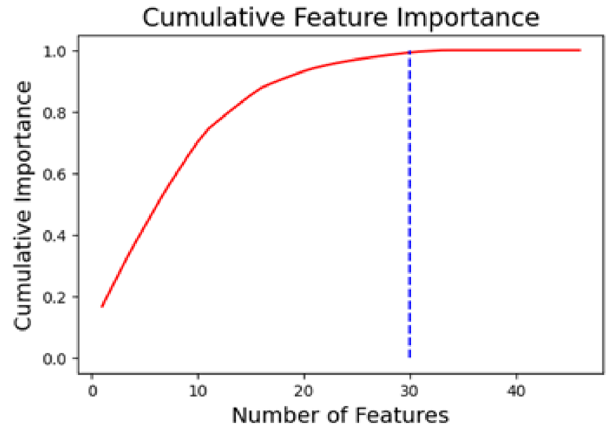

Fig 6: Cumulative Feature importance

CONCLUSION

The study of "Enhancing Feature Manipulation for Improved DDoS Attack Detection on updated dataset " emphasizes the significance of feature selection in the accurate detection of DDOS attacks. Through case-study of the dataset, we observed that a crisp subset of 30 significant features presents results equivalent to those obtained using the whole feature set. This finding highlights the need for cautious resource usage particularly in resource-limited environments as it ensures successful cyber threat detection. Highlighting significant background features improved the mechanism, becoming a good modality for the purpose of identifying and defusing possible DDoS attacks.

In fact, the study reveals the efficiency of utilization of advanced machine learning algorithms including Xgboost, random forest, lightGBM, and Catboost for the purposes of feature importance evaluation while dealing with cyber-attacks identification. Successful detection and recognition of fundamental attributes identifying different kinds of cyber threats characterizes a remarkable breakthrough in bulking out IoT networks' security. This increases not only performance but also shows that in the application threat detection the main stream feature sets are robust enough. Along with the transformation of the threat terrain, the research drives the adaptive feature manipulation approaches to landscape the Endurance of the IOT networks against the new cyber dangers.

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Study of Enhancing Early Fire Detection using Computer Vision and Image Processing Techniques

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ABSTRACT

This paper introduces an innovative Fire Detection System leveraging computer vision and image processing techniques to enhance early detection capabilities. Departing from traditional sensor-based methods, the system utilizes surveillance cameras, specifically webcams, to continuously monitor building interiors. The video feed undergoes comprehensive processing, including RGB color model conversion, yellow color separation, conversion of yellow to white, removal of extraneous areas, and conversion to grayscale. Employing fire detection algorithms, the system analyzes the processed frames to identify potential fire or smoke patterns. Upon detection, the system triggers immediate alerts to users, offering flexibility through SMS or image alerts via a dedicated mobile application. The integration of wireless LAN facilitates the transmission of live video feeds to building security or remote fire stations for real-time assessment. The proposed system aims to revolutionize fire detection, providing early alerts, reducing false alarms, and facilitating swift response measures to mitigate potential damages and safeguard lives.

KEYWORDS *: Fire detection system, Computer vision, Image vision, Raspberry Pi.*

INTRODUCTION

The intersection of computer vision and image processing holds immense promise, and this research embarks on developing a groundbreaking system - "Computer Vision Based Fire Detection Using Video Alert System." Computer vision is a cornerstone in robotics and various industries, offering automated solutions to tasks akin to human visual perception. The integration of computer vision methodologies with image processing techniques, specifically focusing on early fire detection and real-time alerts. Motivated by the alarming statistics of global fire incidents, resulting in substantial economic losses and casualties, the project seeks to address the limitations of conventional fire detection methods. Traditional sensor-based systems, relying on infrared, optical, and ion sensors, often need to be more active and suitable for large outdoor areas. Furthermore, these systems tend to wait for specific conditions to trigger the sensors, leading to delayed responses. The proposed solution adopts a visionary approach by leveraging machine algorithms for efficient fire detection, circumventing the limitations of sensor-based systems.

The objectives of this research span several crucial aspects, starting with the early detection of small fires to prevent them from growing larger. A comprehensive system model is being developed, encompassing the intricate aspects of fire detection, alert initiation, and post-accident emergency response mechanisms. The investigation extends into exploring computer vision-based approaches for object and event detection, ensuring the proposed model is thoroughly tested and validated against state-of-the-art techniques. Key to the innovation is the emphasis on detecting fires promptly and implementing a real-time video alert system. This distinctive feature sets the project apart, intending to overcome challenges associated with configuring the Raspberry to monitor fire-prone zones and dispatch real-time processed video alerts concurrently. The aim is to provide a more effective and responsive fire detection system beyond traditional methods, ultimately contributing to environmental preservation and heightened safety in personal and commercial environments.

In essence, the project represents a forward-looking endeavour that combines the strengths of computer vision and image processing to revolutionize fire detection. The aspiration is to usher in a new era of proactive and efficient fire prevention, responding to incidents in their early stages and mitigating potential damages and losses.

LITERATURE REVIEWS

This study uses vision technology to create an indoor smoke and fire detection system. This study looked into and used preexisting models based on SSD Mobile Net V2 and Faster R-CNN Inception V2. Researchers used training and testing datasets for this research with images of varied pixel densities tailored to indoor fire scenarios. Both models were tested on videos, including a mock-up of a living room and bedroom as well as CCTV footage of an office, to conduct an initial review of the method. Situations involving dense flames and thick smoke were both identified. Even with just 480 training photos, encouraging results were obtained. Possible future study areas include occupancy detection, enhanced training data and models, advanced detection models, and the incorporation of firefighting and HVAC control systems[1].

Anything that burns produces intense heat, light, and smoke; this is called fire. Tragically, fires can destroy homes and businesses and put lives in jeopardy. There must be prompt action in such fires, which necessitates early detection. Utilizing computer vision technology to notify a distant fire station of a fire. Because the room is under continual surveillance, this alarm is transmitted as an emergency message and video. The number of persons in the room can be determined by watching this footage, allowing the fire department to dispatch enough rescuers to the scene. The benefit is that do not have to worry about using smoke and flame detectors, which can sometimes provide false alerts. Confirm it by reviewing the footage to see if the system triggers a false alarm. This article presents a system that can detect fires using OpenCV and Raspberry Pi. If a fire is detected, the system will transmit an alarm signal to the control unit outside the building, and a short video will also be provided. [2]

This article presents a computer vision-based method for detecting and distinguishing dangerous fires by analyzing the video data produced by a common camera. Despite the abundance of papers on image-based fire detection, the challenge of differentiating dangerous fires from non-hazardous ones still needs to be solved. The suggested method can identify fires by studying their hue and fluctuation patterns. The program starts by finding moving parts of the video. It next uses the wavelet transform to verify that the object in motion is a fire by extracting pixels with a fire color from these parts. The suggested method monitors the fire area's expansion pace to differentiate between controlled and hazardous fires. The trials' findings demonstrate that the recommended approach may effectively locate the fire and assess its level of danger and containment. [3]

Fires are extraordinary occurrences that can cause significant property damage and impact people's lives. However, research in the last several years has pointed to the difficulty of early smoke and fire detection. Timely detection of fire incidents and the avoidance of human deaths have, therefore, prompted the proposal of several remedies. An inexpensive visual detecting system would be the solution. Due to the early discovery of fires, this strategy has the potential to be effective. Most industrialized nations have CCTV surveillance systems in nearly all public spaces. These systems capture photos of a designated area at regular intervals. Regardless, cameras operate in various lighting conditions, undergo occlusions and distortions of vision, and produce images that vary according to the season and the angle of view, all of which impact the precision of the existing models. To solve these issues, created a method that uses a capsule network trained on attention feature maps to identify outdoor fire and smoke sources from varying distances. This approach is just as practical as previous solutions that relied on machine learning and deep learning technologies. The suggested model was trained and tested using datasets derived from various sources. The outcomes show that the architecture attained a high categorization accuracy compared to comparable contemporary designs. In addition, the results show that the suggested method is reliable and resilient when classifying images from outside CCTV cameras with diverse angles, even when smoke and fire are present. [4]

Improving fire safety is the proposed use of a system that can function in real-time. A multi-layered algorithm has been designed to identify fires effectively after comparing and validating the results with standard video datasets. The false positive rate was 8.09%. Furthermore, the system outperformed previous algorithms, proving its reliability and sensitivity for efficient fire suppression. An Arduino-based suppression device was combined with the algorithm to offer real-time autonomous fire suppression, and the system also incorporates unique fire localization techniques to pinpoint the identified fire. The suggested system has demonstrated its practical relevance through laboratory-scale experimental validation. The model attains a precision rate of 99.51% and a recall rate of 95.93%, making it appropriate for various indoor and outdoor environmental applications [5].

One of the most common natural catastrophes is fire. To minimize monetary losses and human suffering, a fire detection system should be able to quickly identify flames in many settings, such as buildings, forests, and rural regions; fire sensors, on the other hand, work in tandem with these devices to provide early warnings. Point sensors are slower than cameras coupled with image processing algorithms when detecting fires. In addition, they are more accurate than conventional detectors in determining the extent, trajectory, and magnitude of fires. Buildings, forests, and mines are just a few examples of the types of settings this article provides an overview of, outlining the key aspects of each that should be addressed when designing fire detection systems. Researchers have introduced several vision-based and intelligent fire detection systems in the past ten years, and they discuss a few of them. They utilize sophisticated techniques, such as color models, fuzzy logic, and convolutional neural networks, to accurately detect fires in different surroundings. Different assessment scenarios are used to examine the fire detection systems' performances regarding detection rate, accuracy, true-positive rate, false-positive rate, etc. [6]

Computer vision tasks have traditionally relied on convolutional neural networks (CNNs). However, CNN-based approaches treat all pixels in a fire categorization image equally, disregarding any information. In contrast to convolutional networks, transformers process images as a series of patches and focus on specific image regions depending on their context. Furthermore, the transformer's attention mechanism addresses the issue with a little flame, enabling early fire detection. The backbone design is a fine-tuned Swin Transformer, which computes self-attention with local windows. This is because transformers utilizing global self-attention perform sophisticated computing. This allows us to resolve the issues with high-resolution image classification. Compared to state-of-the-art approaches, experimental findings on the picture fire dataset show that the model has promising capabilities. On the publicly accessible dataset, Vision Transformer achieves a classification accuracy of 98.54%. [7]

Complexity is rising like the problems posed by modern technological and environmental progress. The world's ecosystem is in grave danger from wildfires, one of the major environmental problems. Devastating impacts on terrestrial ecosystems and climatic shifts are two outcomes of the many harms done to forests. Therefore, well-coordinated interventions, early warning systems, and effective prevention strategies are necessary to lessen their impact on humans and the environment. Forest fire detection, monitoring, and prevention technologies have come a long way from their infancy, and this document traces that progress. It draws attention to the field's advantages, disadvantages, and potential for growth. The catastrophic impacts on ecosystems and the possible consequences on the climate have elevated forest fires to a major environmental concern. To create better plans to reduce the impact of and prevent wildfires, it is crucial to comprehend how technology has progressed to address this problem. [8]

Deep Learning Approach

As an early warning system, Due to its wider coverage area and lower cost, video surveillance is a far more effective fire detection method than fire sensors. Handcrafted traits were employed in some earlier experiments to distinguish fire from other objects. Fire detection can be aided by characteristics such as color, texture, and motion. The number of object detection methods that take video input needs to be improved. This study aims to examine various deep-learning techniques for video input fire detection. Yolov4, Yolov5, and Faster RCNN are the approaches that are compared. Following evaluation, Yolov4 (84.62 percent) has the best True Positive Rate, and Yolov5 (97.06 percent) has the best True Negative Rate following evaluation. Yolov5, with a processing time of 23.26 frames per second, is the fastest approach. An excellent positive rate was obtained with faster RCNN, nearly matching Yolov4 and Yolov5. On the other hand, Faster RCNN's negative rate is extremely concerning. Additionally, the computing time needed is greater than that of Yolov4 and Yolov5.[9]

Various detecting techniques have been implemented to stop catastrophic disasters due to the rising incidence of forest fires brought on by dry weather and human activities. CNN-based fire detection systems have the potential to greatly increase detection accuracy, with fewer negative effects on the environment and society. However, because of the large memory and processing requirements, putting these systems into real-world surveillance networks is difficult. A deep learning classification algorithm that can identify fires in photos or video frames has been suggested as a solution to the issue of fire accidents. By automating the fire detection process and minimizing the need for human interaction, this model can be used for monitoring. This approach can drastically reduce fire incidents in workplaces, hospitals, and other settings. This system compromises efficiency and detection accuracy by considering the particular circumstances and fire data features. Using this archetype, one can identify a fire in surveillance photos. The system will raise the warning when it detects a fire. An anemometer and Raspberry Pi, two Internet of Things (IoT) devices, were used in the prediction phase's development. When predicting the spread of a fire, one important factor to consider is wind speed. The criteria that indicate the potential land range to which the fire may spread will be balanced with the current speed. [10]

Conflagrations are among the most common and dangerous disasters, presenting serious risks to public safety and the advancement of society. Conventional fire detection systems mostly rely on sensor-based detection, which has inherent limits in reliably and swiftly identifying fires, particularly in complex situations. Video-based fire detection methods have become increasingly popular due to their capacity to sense fires without physical contact, their flexibility in many situations, and their thorough data gathering capabilities, all made possible by advancements in computer vision technology. However, techniques that depend on manually created characteristics for extraction struggle to adapt to alterations in smoke or flame caused by different combustibles, lighting, and other factors. Deep learning is a highly powerful and versatile machine learning framework for video fire detection. This paper presents an overview of video fire detection systems that utilise deep learning, focusing on well-known datasets for fire recognition, object detection, and segmentation, along with the latest breakthroughs in deep learning techniques. This study assesses and forecasts the potential for growth in the subject. [11]

One of the biggest tragedies in the world is fire. A fire detection system should promptly recognise flames in many scenarios including buildings, forests, and rural areas to avoid financial losses and humanitarian disasters. Fire sensors collaborate with conventional point sensors to promptly alert individuals about fire incidents. Point sensors are slower in detecting fires than cameras using image processing algorithms. In addition, they are easier to use than traditional detectors in determining the size, growth, and direction of fires. This paper first summarizes the key characteristics of various habitats, such as mines, buildings, and woods, that should be considered when designing fire detection systems. It then discusses a few of the vision-based and intelligent fire detection systems researchers have introduced in the past ten years. [12]

Convolutional Neural Network

Due to the increasing need for prompt and precise responses to fire incidents, research on automatic fire detection in live video footage is ongoing. The challenge of detecting fires remains a difficult problem because there is still room for improvement. The challenge of detecting fires is hampered by various factors, including complex backgrounds, varying weather conditions, and diverse fire attributes. The framework presented in this research is divided into five stages: Video preprocessing begins with dynamic sampling to process frames likely to contain a fire and compress them. Next, static background subtraction is done using the GoDec framework to extract moving parts. Then, color-scale-based filtering is applied to identify the probable fire region. Following this, fire localization is carried out using the YOLOv3 framework. Finally, a fire alarm system is implemented. The study introduces a rapid and precise system for detecting fires in real-time within live video footage. The accuracy of the proposed model was evaluated and its effectiveness was confirmed using various datasets. The proposed methodology is cost-effective and suitable for fire detection in stationary CCTV cameras. [13]

Several approaches have been put forth recently to address this issue and distinguish between smoke and fire. Earlier approaches include motion-based smoke estimation, image processing techniques for flame and smoke detection, etc. CNNs and Using deep learning, images, and videos of flames and smoke can now be automatically identified and predicted. This research evaluates the efficacy of several fire and smoke detection methods that rely on machine vision. First, outline the foundations of image processing techniques, CNNs, and the potential uses of these techniques for video smoke and fire detection. The available datasets and an overview of the most current approaches applied in this field are then covered. The issues and recommended fixes to advance CNN application development in this domain are explored. CNNs have demonstrated a great deal of promise for smoke and fire detection, and further advancements in this area can contribute to the preparation of a comprehensive system that would significantly reduce the loss of life and property caused by fires. Lastly, research directions about data augmentation and smoke and fire detection models that require more investigation to advance this vital field of study are given to other researchers. [14]

Early interior fire detection is made possible by technology. The proposed system performs real-time fire detection and alerting using picture brightness and a novel CNN that leverages an upgraded YOLOv4 model with a convolutional block attention module. YOLOv4 is more resilient and has a shorter operating duration thanks to the h-swish activation algorithm. Earlier smart eyewear system to take pictures and send audio messages to BVI people, alerting them to flames and other nearby items. A large collection of indoor fire situations from fire images to successfully detect fires. In addition, design an object mapping methodology to furnish BVI individuals with comprehensive details regarding adjacent items and to distinguish between non-hazardous and hazardous flames. The proposed technique surpasses existing commonly used methods in all aspects of fire detection, such as average precision, recall, and precision. [15]

Methods Using Computer Vision

Robotic firefighting, fire alarms, and other applications depend on fire detection. Smoke sensors are common in traditional fire detection approaches but are sometimes unreliable. Computer vision techniques have greatly increased the effectiveness of fire detection in real-time. This study examines many object detection and image processing-based fire detection techniques. Additionally, the effectiveness of several color detection models for fire detection is compared in this research study. Additionally, this work seeks to advance current fire detection techniques by experimenting with color models and object detection techniques.[16]

Worldwide, the risk of fires in indoor and outdoor settings is always rising. Smoke and flame detectors are the current technology used for indoor environment detection. However, these detectors have certain restrictions regarding fire spread and ignition. When responding to these occurrences, fire services need to know the precise location of the fire, its size, and how it is spreading. These systems only detect some of these details. This research aims to create an interior smoke and fire detection system based on eyesight. Small training and testing datasets with different pixel densities of images were used in this study (for indoor fire scenarios specifically). Testing both models on recordings, which included a CCTV video of an office area and a mock-up of a bedroom and living room, allowed for an initial assessment of the methodology. Flame density scenarios and high-density smoke situations were identified.

Only 480 training photos were needed to produce the encouraging results. Subsequent research endeavors may integrate this approach with earlier formulation, encompassing occupancy detection. [17]

Homes and businesses have always been at risk from fire disasters despite the numerous preventative measures in place. They result in injuries, property damage, and even fatalities. Being ready is essential while managing fires. They are hard to restrain and spread uncontrollably. Early detection of the fire is essential for their containment. A significant portion of picture fire detection is dependent on computational image analysis. However, conventional detection systems involve much work, including human and automated visual data extraction, resulting in reduced accuracy and delayed detection. Thus, a novel picture recognition method based on the CNN model of YOLO v3, an advanced object identification technique, is proposed in this study. The algorithm based on YOLO v3 satisfies the requirements of real-time detection with an average precision of 81.76 percent and stronger robustness of detection performance. [18]

Early detection and quick action are essential to lessen the effects of forest fires occurring more frequently and with greater intensity. This project aims to use cutting-edge technology to build a cyber-physical system for early forest fire detection and quick reaction. The robot operating system controls autonomous ground and aerial vehicles and integrates Internet of Things sensors. Early fire detection is made possible via an IoT-based wildfire detection node continuously monitoring the surrounding environment. When a fire is detected, a UAV searches the area on its own to find the exact location of the fire. It can then send a payload that puts out the fire or gathers information for decision-making. A cooperative UGV receives exact location information from the UAV and uses it to travel to the assigned region to assist ground-based firefighters autonomously. The paper uses simulated forest fire scenarios to show the proposed system's real-time fire detection capabilities. The goal is to offer a workable method for early forest fire detection and extinguishment utilizing open-source technologies, with possible applications in various sectors, such as surveillance and precision agriculture. [19]

STUDY OF PROPOSED SYSTEM IN DETAIL[2]

Study of Block Diagram of the System

The innovative fire detection system proposed here addresses the shortcomings of traditional fire detection methods, which often rely on sensors and may lead to false alarms and delayed responses, particularly in large spaces. In this novel approach, a surveillance camera, represented by a webcam, is a primary monitoring tool for building interiors. The webcam's video feed is processed frame by frame using OpenCV and Raspberry Pi, which includes advanced fire detection algorithms. This algorithm analyzes each frame for fire or smoke, utilizing image and video processing techniques to recognize distinct patterns associated with potential fire hazards.

Upon detection of fire or smoke, the system activates an alert mechanism, offering flexibility in notification methods. Users can receive immediate SMS alerts or image notifications through a dedicated mobile application. The integration of wireless LAN technology enables the transmission of a short-duration live video feed to the security personnel of the building or a remote fire station. The live video feed enables quick evaluation of the fire status. The system's efficacy is based on early fire detection, instant alarms across several channels, and quick response actions enabled by real-time video transmission. By leveraging cutting-edge technologies such as computer vision, image processing, and wireless communication, this proposed system aims to revolutionize fire detection, offering a proactive and efficient solution to mitigate potential damages and ensure the safety of occupants in a building.

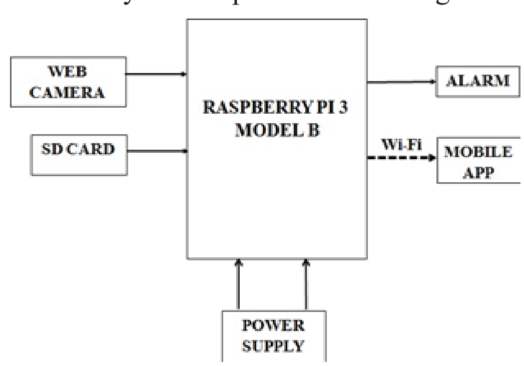

Fig. 1. Block Diagram of the System[2]

Vision-based fire detection system

This flowchart outlines the sequential steps in the fire detection process. It begins with video sampling and then converting the video frames to the RGB color model. The subsequent steps involve separating the yellow color (associated with fire) from the video frames, converting yellow to white, removing other areas to isolate the fire, and converting the result to grayscale. The algorithm then determines the presence of fire in the grayscale image and generates an alert to the user if fire is found. The process repeats by looping back to the video sampling step for continuous monitoring.

- Start: The process initiates with the start symbol, indicating the commencement of the fire detection system.
- Video Sampling: This step involves capturing video frames from the surveillance camera or webcam and initiating the input for further analysis.
- RGB Color Model: The captured video frames are converted from their original format to the RGB (Red, Green, Blue) color model. This conversion separates the image into its constituent color channels.
- Yellow Separation: The system isolates yellow from the RGB images, as flames and fire often exhibit yellow hues. This step enhances the system's ability to identify potential fire sources.
- Conversion of Yellow to White: The isolated yellow areas are converted to white, simplifying subsequent processing by reducing the complexity of color information.
- Removal of Other Areas (Isolation of Fire): Extraneous areas are removed, leaving only the isolated white regions corresponding to potential fire locations behind. This step helps in focusing on the relevant portions of the image.
- Convert to Gray Scale: The processed image is then converted to grayscale, simplifying the analysis by reducing the image to a single-intensity channel.
- Identify the Fire: The system employs fire detection algorithms to analyze the grayscale image and identify fire-related patterns or characteristics. If fire is detected, the system proceeds to the next step. Otherwise, it loops back to the "Video Sampling" step for continuous monitoring.
- Alert to User: In the event of fire detection, an alert is triggered to notify the user. The nature of the alert can be varied, such as sending an SMS or a visual alert through a mobile application.

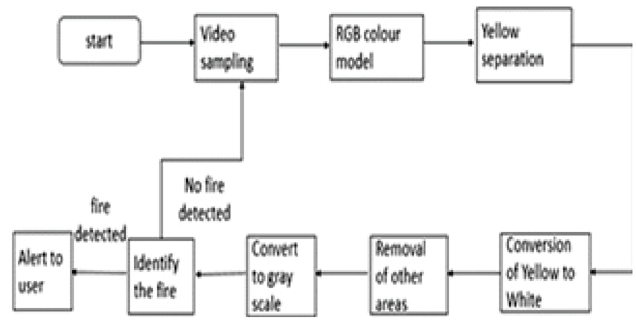

Fig. 2. Block diagram of Computer Vision fire detection with a video alert system using HSV algorithm[2].

This flowchart outlines a comprehensive process for fire detection, leveraging color-based image processing techniques and continuous video sampling to identify and promptly alert users to potential fire incidents. The loop ensures continuous surveillance, enhancing the system's responsiveness. The Hue, Saturation, Value (HSV) method identifies fire in systems. Python software is used for image acquisition and frame-by-frame analysis of the webcam's recorded footage. An alarm is sent out when a more intense fire than a certain pixel level is detected. An RGB color model is created from a single frame. The hues red, blue, and green are now divided. Yellow is distinguished from the other areas by the range values provided for every shade of yellow. Only the identified yellow region is changed to white. Subsequently, the frame undergoes grayscale conversion, and contour detection is employed to identify the contours.

Upon detection of fire using the HSV algorithm, the alarm circuit is triggered instantly, notifying those in the room, as depicted in Fig. 3. The webcam records video while the program runs to identify fires. If a fire is detected, an alarm message is generated, containing the location's name and address, and sent to the application. A brief live video is periodically provided to the App with short time intervals until the fire is entirely doused. The remote fire alarm control device can analyze the video footage to prevent false alarms without relying on sensors. Fig.4 demonstrates how the number of individuals trapped in the room can be verified, and rescuers can be dispatched to the location for their rescue.

CONCLUSION AND FUTURE SCOPE

Lifesaving and hazard-avoidance measures can only be achieved with fire detection systems. The video sequence fire detection system that is being proposed. This approach uses the image as a representation for extracting edge features. The obtained features are compared with the training dataset, and a classifier such as SVM and KNN is applied, informing the system whether the image is a fire or without fire; the results confirmed that the proposed method provides reliable detection performance. The proposed system can be further improved by collecting data and applying other machine learning algorithms to increase the system's accuracy and reduce false positives. It is possible to tailor the detection methods to the characteristics of the detection system's coverage area, eliminate response time, and lower the false alarm rate; mixing various detection approaches is possible.

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Anomaly Detection System for Internal Faults in Electric Vehicles

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ABSTRACT

Early soft short circuit (SC) detection is necessary in light of the growing emphasis on lithium-ion battery (LIB) safety in electric vehicles (EVs) in order to avert serious malfunctions like fire or thermal runaway. This research presents an extended Kalman filter (EKF) based on-board soft SC fault diagnosis technique. Based on real-time observed voltages, the EKF modifies a gain matrix to estimate the defective cell's state of charge (SOC). The detected soft SC resistance values indicate the fault severity, and the SOC difference is subsequently used for soft SC fault detection. Prompt detection of soft SC faults and precise estimation of their resistance are confirmed by experimental validation on a series-connected battery pack.

Lithium-ion batteries have several benefits, including a high energy density and fast charging times, but because of worries about their thermal stability and the possibility of fire and explosion, their use is restricted. The thermal runaway phenomenon and fire dynamics in single LIB cells and multi-cell battery packs are reviewed in detail in this work. It talks about possible ways to prevent fires while highlighting the difficulties in guaranteeing the security of LIB applications in energy storage systems and electric cars. The paper also offers an overview of fault detection techniques for vital electric vehicle (EV) components, such as lithium-ion battery packs and Permanent Magnet Synchronous Motors (PMSMs). It emphasizes the significance of fault detection techniques' accuracy, speed, sensitivity, and cost-effectiveness while putting a special emphasis on the most recent advancements in research.

KEYWORDS *: Internal faults, safety, dependability, preventive maintenance, cost savings, regulatory compliance, customer confidence, electric vehicles (EVs), diagnostics, anomaly detection systems, Monitoring in real time, fault finding, predictive analysis, Customized Solutions, Artificial Neural Network (ANN), Alerts, Overheating, Fire Detection, Early Warning Identification of risks, Control System Strong Architecture, Algorithms for Data Processing, Sensor Integration, Models for Machine Learning, a user-friendly interface, validation and testing, adherence to the law, Fleet management, remote diagnostics, smart grids, and ongoing development.*

INTRODUCTION

The imperative shift toward electric vehicles (EVs) as a sustainable solution to fossil oil depletion and environmental pollution underscores the need for robust and reliable battery systems. Lithium-ion batteries, with their remarkable efficiency and energy density, stand out as promising power sources for EVs. However, recent safety concerns, notably thermal runaway incidents linked to short circuits (SC), have raised alarms. This paper addresses the critical issue of soft SC faults, which, if undetected, can evolve into severe faults and compromise EV safety. Our focus is on introducing an advanced diagnosis method capable of swiftly and accurately detecting soft SC faults, a challenge exacerbated by their hidden nature in the complex dynamics of batteries. By addressing the slow-changing performance characteristics of soft SC faults, our proposed method aims to contribute to the prevention of thermal runaway occurrences, ensuring the safe and reliable operation of EVs in real-world applications.

LITERATURE REVIEW

Ruixin Yang, Rui Xiong , Senior Member, IEEE, and Weixiang Shen, Senior Member, IEEEexplains in the document Lithium-ion Battery Pack On-board Diagnosis of Soft Short Circuit Fault for Electric Vehicles Applying a Broader Kalman Filter The suggested technique uses a recursive estimate algorithm called the Extended Kalman Filter (EKF) to identify and diagnose soft short circuit issues. On-board Implementation, Real-time Detection, Model-Based The methods have achieved remarkable progress in battery soft SC fault detection; they are not solely software-based systems that can only identify SC faults in battery cells. as Shown in Fig. 1 (a)(b) and Fig. 2(a)(b).

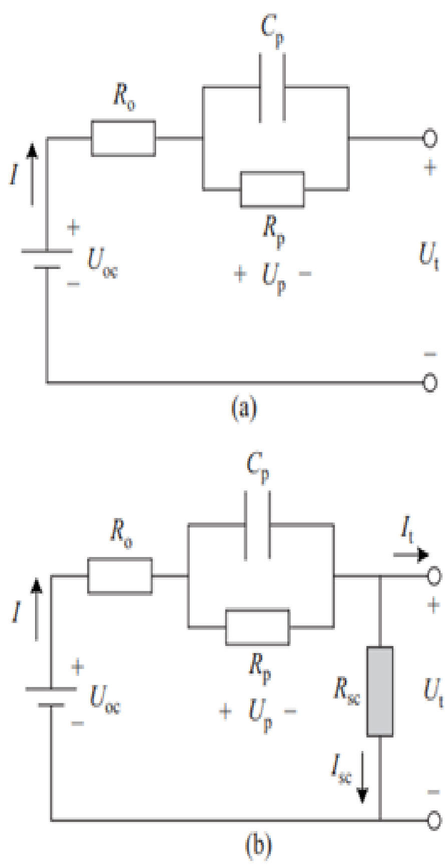

Fig. 1

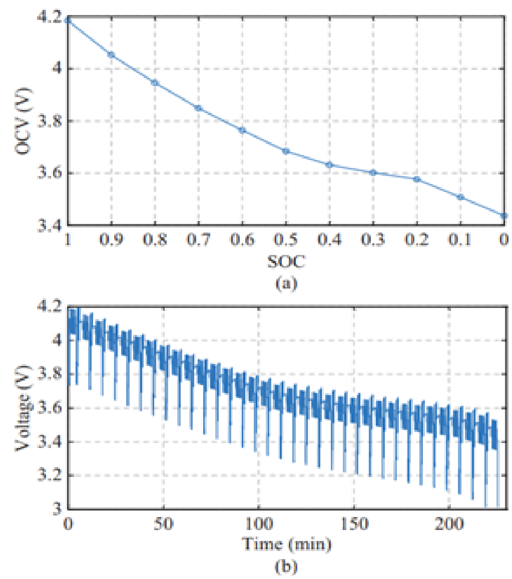

Fig. 2

Da Li, Zhaosheng Zhang , Peng Liu , Zhenpo Wang, Member, IEEE, and Lei Zhang , Member, IEEEThe authors of this study combine an equivalent circuit model (ECM) with a long short-term memory recurrent neural network (LSTM) to provide a novel battery defect diagnosis technique for electric vehicles (EVs). Utilizing a prejudging model to cut down on calculation time and promote diagnosis reliability, the method incorporates a modified adaptive boosting technique to improve diagnosis accuracy. The plan accomplishes potential failure risk assessment by taking into account the impact of driver behavior on battery systems and provides early thermal runaway alerts. The robustness, superiority, and real-world operational data from China's National Monitoring and Management Center for New Energy Vehicles are used to evaluate the approach. The outcomes highlight the potential contribution of the suggested strategy to improving the safety and dependability of EVs by demonstrating its efficacy in precisely detecting thermal runaway cells and diagnosing probable battery cell failures. A thorough data collection strategy from a range of working and perhaps malfunctioning cars is also included in the study. This strategy uses an LSTM and ECM coupling to anticipate battery voltage and diagnose faults in real-world electric vehicle operations. The suggested paradigm addresses important problems with EV battery management systems and provides a viable path for real-time malfunction diagnosis as shown in Fig. 3 and Fig. 4.

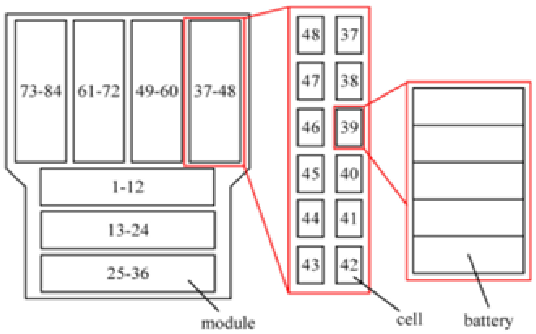

Fig. 3.

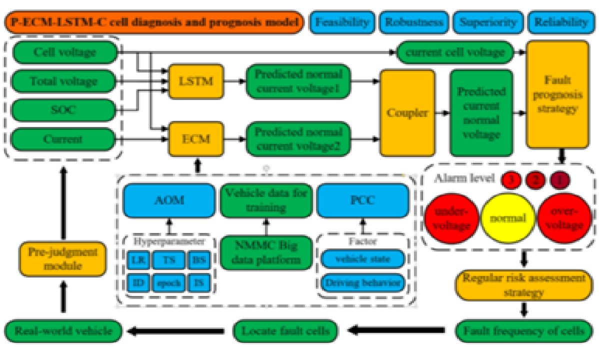

Fig. 4.

Yunlong Shang, Gaopeng Lu, Yongzhe Kang, Zhongkai Zhou, Bin Duan, ChenghuiZhangIn order to detect battery failures in lithium-ion batteries used in electric vehicles early on, this research study presents a real-time multi-fault diagnostic technique. The suggested method makes use of a modified version of Sample Entropy to anticipate the time of fault incidence and diagnose and predict a variety of early battery defects, such as short- and open-circuits, by examining cell-voltage sequences within a moving frame. An accurate battery model is not necessary because of the method's excellent robustness, high dependability, and minimal computing cost. The effectiveness of this technique is validated by the experimental results, which also include comparisons with conventional methods. This presents a viable and promising approach to improving safety in real-world electric car applications. In order to detect battery failures in lithium-ion batteries used in electric vehicles early on, this research study presents a real-time multi-fault diagnostic technique. The suggested method makes use of a modified version of Sample Entropy to anticipate the time of fault incidence and diagnose and predict a variety of early battery defects, such as short- and open-circuits, by examining cell-voltage sequences within a moving frame. An accurate battery model is not necessary because of the method's excellent robustness, high dependability, and minimal computing cost. The effectiveness of this technique is validated by the experimental results, which also include comparisons with conventional methods. This presents a viable and promising approach to improving safety in real-world electric car applications.

Qingsong Wanga, Binbin Maoa, Stanislav I. Stoliarov, Jinhua SunaIn spite of their widespread use because of their high energy density and other benefits, lithium-ion batteries (LIBs) present a number of thermal stability concerns. This research study offers a thorough assessment of these issues. The possible risks connected with LIB failures—such as thermal runaway, fire, and explosion—that prevent their widespread use in energy storage systems and electric cars are covered in this paper. The chemistry and components of LIBs, including as the cathode and anode materials, electrolytes, and separators, are covered in the review. It investigates the reasons behind single LIB cells and multi-cell battery packs experiencing thermal runaway and fire.The study also addresses different approaches to reducing these risks, stressing the value of safety engineering in tackling the difficulties presented by LIBs in light of the rising demand for alternative energy sources and the requirement to lower CO2 emissions. In order to improve the safety and dependability of LIB-based technologies in the future, the overview highlights the current research directions, which include the development of novel materials, sophisticated battery management systems, and automatic fire extinguishing systems.

PROPOSED SYSTEM

According to the flow chart in fig. 5 "Advanced EV Diagnostics and Anomaly Detection," the suggested system is intended to greatly improve the dependability, efficiency, and safety of electric cars (EVs). With an emphasis on internal fault prevention specifically, overheating situations that could result in fire hazards the system has a strong design and integrates a variety of sensors to keep an eye on essential EV systems and components. Sensor data is analyzed in real-time using sophisticated data processing algorithms and machine learning models, which allows for the early identification of abnormalities and the prediction of possible problems. The system is designed with the express purpose of avoiding serious harm and hazards to the car and its surroundings. The safety of EVs is promoted via a user-friendly interface that offers real-time diagnostics and anomaly notifications to vehicle operators. The system is positioned as a holistic solution to reduce the risks associated with internal problems in EVs because of its multifaceted approach, which tackles concerns related to safety, reliability, preventative maintenance, cost savings, regulatory compliance, and consumer confidence. To guarantee optimal performance, the implementation entails extensive testing and validation using simulated situations and real-world testing. The system's adaptability also extends to risk identification, enabling proactive handling of possible difficulties and uncertainties to guarantee the project's success as a whole.

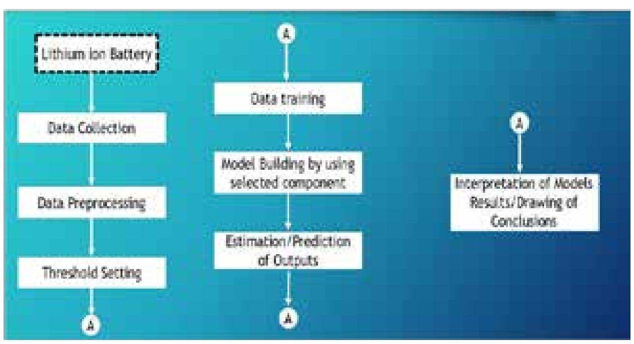

Fig. 5

REQUIREMENT IDENTIFIED

Hardware Requirements:

1. PIC Kit 3 Microcontroller
2. Registers
3. Capacitors
4. Current Transformers (CT Coils)
5. Switched-Mode Power Supply (SMPS)
6. Connectors
7. LEDs
8. PT-100 Sensors

SOFTWARE REQUIREMENTS

1. MPLAB IDE
2. C Language
3. Proteus for Simulation
4. Artificial Neural Network (ANN) Algorithm

RISK IDENTIFIED

The process of detecting risks include locating potential difficulties, ambiguities, and roadblocks that could hinder the project's advancement or success. Technical, organizational, environmental, and stakeholder-related risks are all possible. A backup plan or contingency strategy is created after hazards are identified. This strategy specifies the team's course of action in the event that a risk materializes, guaranteeing that the project can proceed without interruption even in the face of unforeseen difficulties. A backup plan gives the group a sense of confidence and enables them to react quickly and skillfully to lessen the impact of hazards..

RESULTS

1. Improved Safety and Reliability: By offering advanced diagnostics and anomaly detection capabilities, the system's deployment is anticipated to greatly improve the safety and dependability of electric vehicles (EVs).
2. Preventive Maintenance and Cost Savings: Preventive maintenance is made possible by the system's capacity to anticipate certain malfunctions, particularly overheating situations that pose a fire risk. This reduces the need for expensive repairs and serious damages while also improving safety.
3. Regulatory Compliance: By adhering to safety requirements, the system helps ensure that electric car industry standards and regulations are followed.
4. Customer Confidence: Resolving internal fault safety issues and offering real-time monitoring, fault detection, and early warnings will help to increase customers' trust in the dependability and safety of electric vehicles.
5. Real-time Monitoring and Predictive Analysis: Using machine learning models, the system provides predictive analysis in addition to real-time monitoring of crucial components. This guarantees

early detection of possible issues, enabling prompt interventions.

6. Customized remedies and Alerts: The system offers targeted reactions to various internal faults and offers customized remedies for particular fault conditions. A further improvement to the system's efficacy in averting mishaps and fires comes from early warning notifications.
7. Preservation of Trust: The system is vital to maintaining public confidence in EV technology since it successfully addresses safety concerns pertaining to internal defects. This is especially crucial as electric vehicles (EVs) proliferate in more applications.
8. Effective System Management: By providing rapid remote diagnostics and the capacity to address problems quickly, the system makes it easier to manage fleets of electric vehicles. This holds particular significance for applications such as car-sharing services and public transportation.
9. Support for Smart Grids: It is planned that the system will be integrated with smart grids, allowing it to efficiently balance electricity and maintain the general stability of the electric grid.
10. Adaptation to Future Law: Given the dynamic nature of rules pertaining to the electric vehicle industry, the system sets EVs up for potential future legislative adaptation.

CONCLUSION

To sum up, a number of favorable effects are anticipated from the suggested method, such as increased safety, preventive maintenance, customer confidence, and effective system administration. These findings support the more general objectives of improving the state of electric car technology and resolving safety issues related to internal defects.

SCOPE OF WORK

The creation and deployment of an advanced "EV Diagnostics and Anomaly Detection System" for electric cars (EVs) is included in the project's scope of work. This include building a solid system architecture, incorporating a range of sensors to keep an eye on important parts, creating real-time data processing algorithms, and putting machine learning models into practice for preventative maintenance. The emphasis is on finding internal flaws in EV batteries, especially those that can cause overheating and fire dangers.In addition, the project entails developing an intuitive user interface, carrying out exhaustive testing and validation, recognizing and mitigating possible risks, guaranteeing legal compliance, facilitating effective fleet management, investigating integration with smart grids, and setting up processes for continuous improvement. The scope includes essential elements like as stakeholder communication, training sessions, and thorough documentation, which guarantee a comprehensive strategy to improve EV safety, dependability, and user confidence.

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A Review Paper on "Freshness of Food Detection using IoT and Machine Learning"

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ABSTRACT

This review explores innovative strategies to combat the pervasive issue of food spoilage by employing sensor technology, gas monitoring, and Internet of Things (IoT) connectivity. The proposed system utilizes a microcontroller to issue timely alerts upon detecting spoilage indicators, offering a technological alternative to manual food detection processes in industries. Additionally, the integration of machine learning enhances the model's predictive capabilities, estimating the likelihood and duration of food spoilage based on vendor-specific factors. This approach not only addresses consumer safety concerns but also has the potential to instigate healthy competition among retailers, encouraging the sale of fresher and safer food products. The review aims to provide a succinct overview of advancements in food spoilage detection systems, catering to researchers, practitioners, and stakeholders seeking insights into cutting-edge technologies for ensuring food safety.

***KEYWORDS** : Food spoilage detection, Sensor technology, Gas monitoring, Internet of Things (IoT), Microcontroller, Machine learning.*

INTRODUCTION

In the contemporary landscape of the 21st century, the food sector stands as a significant pillar of our economy. Amidst its multifaceted challenges, a prominent issue demanding attention is food spoilage, particularly affecting perishable items such as meat, fruits, and vegetables. Compounding this challenge is the pervasive occurrence of undetected spoilt items reaching consumers. Across various fruits and vegetables industries, the quality-check process remains predominantly manual, relying on human inspection along conveyor belts. Introducing an automated system not only promises enhanced accuracy in detecting spoilt food but also heralds a reduction in manual manpower. [1][4] This review envisions the automation of this critical process through the integration of intelligent sensors, notably the Node Mcu microcontroller. Upon the identification of spoilt or stale food items, an audible alert system is activated, while concurrently transmitting data to the cloud through Internet of Things (IoT) applications. This inter- connected framework not only improves detection efficiency but also establishes transparency by enabling authorities to monitor the frequency of spoilt food occurrences.

PRINCIPLE OF SENSING

The detection of food spoilage hinges on a nuanced under- standing of pivotal principles, each illuminating distinct facets of spoilage indicators.

Oxygen Level Detection: Central to this principle is the premise that the presence of germs within a food item, whether fruits or meat, induces a discernible alteration in the ambient oxygen levels. As these microorganisms metabolize, they deplete the oxygen content in their immediate vicinity, resulting in a measurable reduction compared to the norm. The proposed sensing mechanism aims to capitalize on this phenomenon, employing intelligent sensors to meticulously monitor and detect variations in oxygen levels. By discerning these deviations, the system can effectively identify potential spoilage, offering a proactive approach to food quality assessment. [1][3]

Ammonia Gas Sensing: Specifically tailored for meat items such as fish, the second principle revolves around the detection of ammonia gas emanating from stale products. When meat undergoes spoilage, it releases ammonia gases as a byproduct of bacterial degradation. To capture this distinctive spoilage marker, a gas sensor is strategically deployed to measure ammonia levels in the proximity of the food item. An aberration in these levels triggers an alert mechanism interfaced with the microcontroller, signaling potential spoilage. This dual-pronged approach, combining oxygen level detection and ammonia gas sensing, enhances the system's sensitivity and specificity, providing a comprehensive framework for reliable spoilage detection. [1][3][2]

Temperature Fluctuations: Beyond oxygen levels and gas emissions, an additional critical parameter for spoilage detection involves monitoring temperature fluctuations. Spoiled food items often undergo alterations in temperature due to microbial activity. Integrating temperature sensors into the detection system allows for a holistic assessment, capturing the synergistic relationship between temperature variations and spoilage progression. Real-time monitoring of temperature dynamics adds an extra layer of precision, further fortifying the efficacy of the proposed spoilage detection model. [4][6]

Humidity Monitoring: Recognizing the influence of moisture on food quality, humidity monitoring emerges as another indispensable facet. Spoiled food items often exhibit changes in humidity levels as a consequence of microbial growth or water release. By incorporating humidity sensors into the sensing framework, the system gains the capacity to detect deviations in moisture content, providing an additional dimension to the spoilage detection process. This multifaceted approach, encompassing oxygen levels, gas emissions, temperature fluctuations, and humidity monitoring, establishes a robust foundation for an advanced and adaptive food spoilage detection system.

ALTERNATIVE WORK IN THE FIELD

- Artificial Intelligence Approach: A burgeoning avenue in the realm of food spoilage detection involves the integration of artificial intelligence (AI). Current research explores the utilization of computer vision techniques, leveraging image analysis to discern the spoilage status of a given food item. While this method offers a non-intrusive means of inspection, a notable limitation lies in its inability to penetrate the interior of the food item. [1][3] Image capture provides only surface-level insights, posing challenges for a comprehensive assessment of spoilage. The quest for an all-encompassing solution prompts ongoing investigations into refining the capabilities of AI-based approaches in addressing the intricate nuances of food spoilage detection.
- MIT Research: A notable contribution to the field emerges from the Massachusetts Institute of Technology (MIT), where a research team has developed a sensor dedicated to the detection of spoilt meat items. This innovative sensor, while proficient in discerning specific gases indicative of spoilage, grapples with the limitation of potential false negatives. [1][3] The exclusive reliance on a singular gas marker poses challenges in achieving a comprehensive and foolproof spoilage detection system, thereby underscoring the need for a more nuanced and multifaceted approach.
- Blockchain Integration: A cutting-edge direction in food safety technology involves the integration of blockchain. Some initiatives explore the use of blockchain to create immutable records of the entire food supply chain, from production to consumption. This tamper-resistant and transparent ledger system not only enhances traceability but also ensures the authenticity and quality of food products. Incorporating blockchain technology into spoilage detection systems could provide an additional layer of security and accountability, contributing to a more resilient and trustworthy food safety ecosystem.
- Spectral Analysis Techniques: Advancements in spectral analysis techniques are gaining traction as an alternative avenue for spoilage detection. By

examining the unique spectral signatures of food items, particularly in the infrared and ultraviolet ranges, researchers aim to uncover subtle changes indicative of spoilage. This non- invasive approach holds promise for detecting spoilage at early stages, offering a complementary perspective to traditional sensor-based methods.

- Nanotechnology Applications: Exploring the intersection of nanotechnology and food safety, researchers are investigating the use of nanosensors for spoilage detection. These miniature sensors can operate at the nanoscale, providing high sensitivity to changes in the composition of food items. Nanotechnology applications hold potential for enhancing the precision and efficiency of spoilage detection systems, presenting an avenue for future innovation in the field. [6]
- Machine Olfaction: In a novel approach, researchers are exploring machine olfaction, inspired by the human sense of smell, for detecting food spoilage. Utilizing electronic noses that mimic the olfactory system, these systems analyze the volatile organic compounds emitted by spoiling food. Machine olfaction presents a unique perspective on spoilage detection, leveraging principles from nature to enhance the sensitivity and specificity of detection systems.
- What proposed system proposes: In the pursuit of heightened accuracy, our proposed system pioneers a dual-sensor strategy, integrating cumulative values from both oxygen and ammonia sensors. This innovative amalgamation not only mitigates the risks of false negatives but also establishes a more resilient decision-making framework. Beyond gas-specific detection, our approach broadens its scope by incorporating an oxygen sensor, enabling the identification of germ infections across diverse food items. Furthermore, our system recognizes the significance of additional parameters, such as temperature fluctuations and humidity levels, in fortifying the robustness of spoilage detection. By encompassing these multifaceted elements, our proposed model aspires to set a new standard in comprehensive and adaptable food spoilage detection systems. Combing IoT and Machine learning only increases the interoperability and application. [1]

METHODOLOGY

Our proposed methodology constitutes a multifaceted approach, intertwining sensor technology, machine learning, and cloud-based analysis to create a robust and adaptive system for food spoilage detection.

- Sensor Monitoring and Data Acquisition: The foundation of our methodology lies in the deployment of intelligent sensors, specifically oxygen and ammonia sensors, to measure the respective content in a given food item. These sensors act as vigilant sentinels, capturing crucial data related to spoilage indicators. The real-time data generated by the sensors serves as the fundamental input for subsequent analysis and decision-making. [1][3]
- Machine Learning Model Utilization: To decipher the intricate patterns within the sensor data, a machine learning model is employed. Trained on a diverse dataset encompassing various spoilage scenarios, the model utilizes the oxygen and ammonia content as key features to predict the spoilage status of the food item. This predictive capability enhances the system's discernment, enabling it to make informed decisions regarding the freshness or spoilage of the monitored food items. [1]
- Node Mcu Implementation and Cloud Integration: The Node Mcu microcontroller takes on a pivotal role in the practical implementation of our spoilage detection system. Upon encountering a spoilt food item, the microcontroller triggers a sound alert, drawing attention to the potential spoilage event. Simultaneously, the data collected from the sensors is transmitted to a cloud platform for comprehensive analysis and storage. [1][3]
- Cloud Platform Integration - Leveraging ThingSpeak: Our methodology integrates with popular cloud platforms, exemplified by ThingSpeak, to facilitate indepth analysis of the accumulated data. In the context of food industries, this cloud-based approach offers valuable insights such as the

occurrences of spoilt food items throughout the day, identifying peak durations of spoilage incidents (e.g., day, afternoon, evening). [1] Furthermore, the system provides metrics on the successful separation of spoilt food items, contributing to a more nuanced understanding of operational efficiency. A sample plot on ThingSpeak illustrates the dynamic tracking of spoilt food items on different days of the month, offering a visually intuitive platform for comprehensive data analysis. [3]

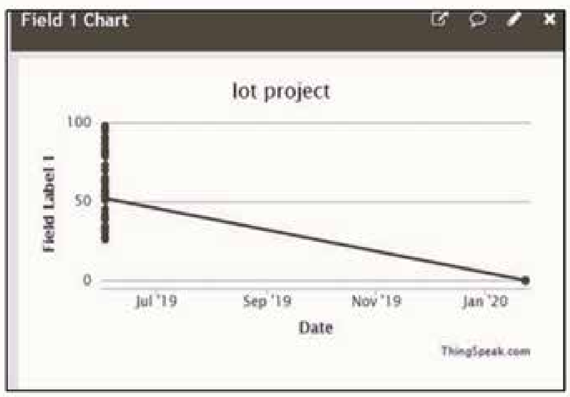

Fig. 1. Sample plot on Thingspeak [1]

- Predictive Analysis and Model Refinement: The cloud platform not only serves as a repository for real-time data but also facilitates ongoing predictive analysis. By monitoring the frequency of spoilt food occurrences over time, the machine learning model can be iteratively deployed to predict the average shelf life of various food items. This cyclical process of data analysis and model refinement ensures the adaptability and accuracy of the system, enhancing its utility in dynamic food industry settings.

In summary, our methodology seamlessly integrates sensor technologies, machine learning algorithms, and cloud-based analytics to create an advanced food spoilage detection system. This comprehensive approach not only detects spoilage in real- time but also contributes to predictive analytics and continuous improvement, setting a precedent for the future of intelligent food quality monitoring systems.

SCOPE OF MACHINE LEARNING: ELEVATING PRODUCTIVITY AND INSIGHT

Machine learning, the dynamic field dedicated to the acquisition of knowledge from data and the subsequent formulation of predictions, emerges as a transformative force within the ambit of our project. The diverse applications of machine learning in this context herald a new era of efficiency and insight, revolutionizing the landscape of food spoilage detection.

Industrial Application: Optimizing Resource Allocation

In the realm of industrial application, machine learning stands as a strategic ally for enhancing productivity and resource management. Through meticulous analysis of spoilt food data, the system adeptly forecasts peak occurrences of spoilage during specific times of the day. Additionally, it discerns patterns regarding the specific food items most susceptible to spoilage. Leveraging this insight, industrial operations can dynamically adjust workforce allocation, channeling more manpower during peak spoilage periods and optimizing staffing during other times. This adaptive approach not only conserves significant manpower resources but also streamlines operational efficiency, minimizing the economic impact of spoilage incidents. [1][4][6]

Commercial Application: Empowering Vendor Accountability

Extending its reach to commercial spheres, machine learning introduces a paradigm shift in the retail and grocery land- scape. By scrutinizing collective data on the frequency of food spoilage associated with specific vendors, the system provides valuable insights into vendor-specific spoilage patterns. This information acts as a catalyst for accountability, compelling vendors to prioritize food items with extended shelf life. Simultaneously, it fosters consumer awareness, encouraging informed choices by highlighting the shelf life of products. This symbiotic relationship between vendors and consumers serves to elevate the overall quality of food products available in the commercial market. [1]

Consumer Application: Ensuring Food Safety in Real Time

At the consumer level, the integration of machine learning into refrigeration systems manifests as a pivotal advancement in food safety. The smart sensing system, seamlessly incorporating machine learning algorithms, proactively detects spoilage events and promptly sends email notifications directly to users. This real-time communication ensures that consumers, especially vulnerable groups like children, are promptly informed and safeguarded against the consumption of harmful or spoilt food. This not only enhances consumer well-being but also promotes a culture of safety and vigilance in food consumption practices. [1][3]

Environmental Impact Assessment

Beyond its immediate applications, machine learning can be harnessed for a broader environmental impact assessment. By analyzing patterns of food spoilage data over extended periods, the system can contribute valuable insights into the ecological footprint of wastage. This knowledge can inform sustainable practices, aiding in the development of strategies to minimize food waste and its associated environmental implications. [4]

Dynamic Model Refinement

The iterative nature of machine learning models allows for continuous refinement based on evolving data patterns. As the system accumulates more data on food spoilage occurrences, the machine learning model can be dynamically updated and fine-tuned. This ongoing refinement ensures that the system remains adaptive and responsive to changing patterns in food spoilage, reinforcing its long-term efficacy and relevance in diverse applications.

In essence, the scope of machine learning in this project transcends mere prediction; it becomes a catalyst for operational efficiency, vendor accountability, consumer safety, environmental stewardship, and ongoing model refinement. The transformative potential of machine learning in the domain of food spoilage detection lays the foundation for a paradigm shift in how we approach food quality and safety across various sectors.

DEVELOPMENT OF ML MODEL

The development of our machine learning model represents a pivotal stride towards augmenting food safety through proactive spoilage detection. This section outlines the intricate process from data input to model evaluation, showcasing the efficacy of logistic regression and paving the way for future extensions.

Input and Output Parameters

The foundational elements of our machine learning model are characterized by the input source, primarily the food item under consideration, and the binary output indicating whether the food item is deemed spoilt or not. This binary classification hinges on the nuanced analysis of oxygen and ammonia concentrations for each sampled instance. [1]

Training Data and Learning Algorithm

The crux of our machine learning model lies in its learning algorithm, with logistic regression emerging as the chosen methodology. This model calculates the probability of a given input instance belonging to either the 'Spoilt' or 'Not Spoilt' class. Leveraging this binary output, the probabilities of spoilage are ascertained for different days, enabling consumers to anticipate the expected shelf life based on the food vendor source. Logistic regression, renowned for its versatility in binary classification tasks, serves as a powerful tool for predicting spoilage outcomes. [1]

Evaluation of Machine Learning Model

To assess the performance of various machine learning models, a sample dataset comprising instances of spoilt and non-spoilt foods, along with corresponding ammonia and oxygen gas concentrations, was meticulously crafted. Rigorous evaluations were conducted on three distinct models: Linear Regression, Support Vector Machine, and Logistic Regression. The evaluation metrics, including mean-squared errors, were employed to gauge the models' proficiency. Remarkably, Logistic Regression emerged as the front runner, boasting a mean- squared error of zero. This compelling performance solidified the choice of Logistic Regression as the model of choice for our spoilage detection system. [1]

Food Item	Oxygen Concentration (ppm)	Ammonia Concentration (ppm)	Spoilage Status
Apple	20	2	Not Spoilt
Banana	18	1	Not Spoilt
Chicken	15	5	Spoilt
Carrot	22	1	Not Spoilt
Salmon	14	8	Spoilt
Tomato	21	2	Not Spoilt
Beef	16	6	Spoilt
Lettuce	19	3	Not Spoilt
Orange	17	2	Not Spoilt
Pork	14	7	Spoilt

Fig. 2. An image of sample portion of dataset

Further Scope of Machine Learning:

While our current machine learning model exhibits commendable accuracy, its potential for expansion remains a dynamic frontier. The model's performance is contingent upon the dataset at its disposal, and as we accrue more data, avenues for extensions become apparent. Future enhancements may encompass predictive capabilities, such as estimating the duration a food item can last based on its vendor source. This extension holds profound implications for inventory management in the food industry and can foster general awareness about food safety practices. The iterative nature of machine learning allows for ongoing refinement and expansion, ensuring the model's adaptability to evolving data patterns and reinforcing its role as a pioneering force in proactive food safety.

SYSTEM ARCHITECTURE

Sensor Array for Comprehensive Monitoring

At the heart of the system lies a meticulously crafted sensor array, featuring TVOC (Total Volatile Organic Compounds) sensors, specifically CCS811, and ammonia sensors. These sensors collectively monitor the volatile organic compound content of each food item under scrutiny. This granular level of sensing not only captures surface-level indicators but delves into the intricate details of organic compounds, laying the foundation for a nuanced understanding of food quality. [1][3][2]

Machine Learning Model for Predictive Analysis

Harnessing the wealth of data from the sensor array, a robust machine learning model takes center stage. Trained on an extensive dataset comprising instances of spoilt and unspoilt food items, the model leverages TVOC and ammonia content as key features. This predictive analysis empowers the system to make real-time decisions on whether a given food item is deemed spoilt or not. The integration of machine learning augments the system's discernment, providing a dynamic and adaptive framework for spoilage detection. [1]

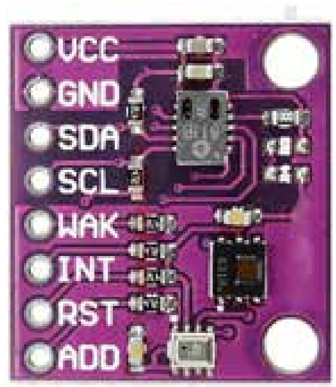

Fig. 3. TVOC

Fig. 4. MQ-135 Ammonia Gas Sensor

NodeMCU-ESP32 Microcontroller: The Brains of Operation

The NodeMCU-ESP32 microcontroller serves as the operational nexus, seamlessly connecting the sensor array and the machine learning model. Upon encountering a spoilt food item, this intelligent microcontroller orchestrates an immediate response by sounding a buzzer. Beyond real-time alerts, the NodeMCU-ESP32 acts as a conduit for data transmission to a cloud platform, initiating a cascade of events that contribute to a holistic understanding of food spoilage patterns. [1][3][2]

Cloud Platform Integration for Analytical Insights

The system extends its reach to the cloud, integrating with a powerful cloud platform. This integration facilitates comprehensive analysis and storage of the data generated by the sensor array and the microcontroller. The cloud platform becomes a repository for crucial insights, including the frequency of spoilt food occurrences. This wealth of data not only aids in real-time monitoring but also lays the groundwork for predictive analytics and trend analysis, contributing to a more informed understanding of food quality dynamics. [1][3]

Fig. 5. NodeMCU-ESP32 Microcontroller

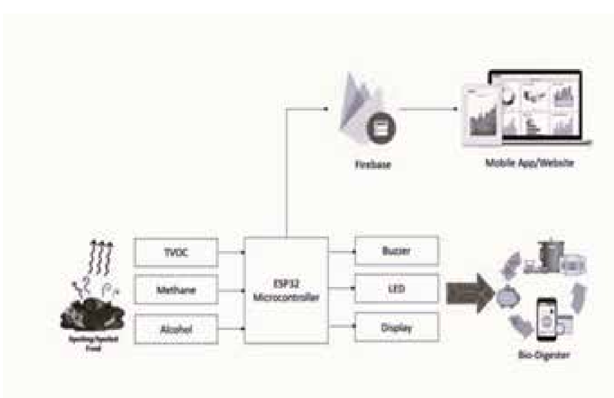

Fig. 6. Architecture [3]

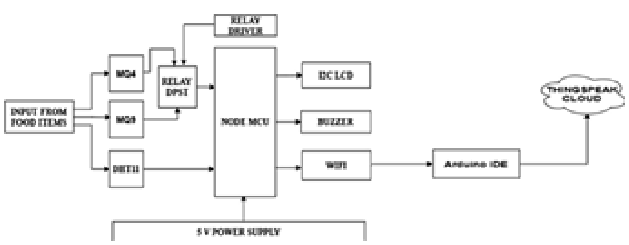

Fig. 7. Flowchart [2]

Predictive Analytics for Shelf Life Estimation

A distinctive facet of the system lies in its predictive analytics capabilities. By continuously monitoring the number of spoilt food occurrences, the machine learning model can be iteratively deployed to predict the average shelf life of given food items. This forward-looking dimension introduces a proactive element, enabling stakeholders to anticipate shelf life trends and optimize inventory management practices. [1]

Feedback Loop for Continuous Improvement

The system embraces a feedback loop mechanism, crucial for continuous improvement. As the machine learning model processes new data and refines its predictive capabilities, the insights gained from cloud-based analytics inform future iterations. This iterative process ensures that the system remains adaptable to evolving patterns, setting a precedent for ongoing advancements in smart food spoilage detection.

In essence, the system architecture represents a symbiotic amalgamation of sensor precision, machine learning prowess, microcontroller intelligence, and cloud-based analytics. This orchestrated synergy not only elevates the accuracy of spoilage detection but also establishes a foundation for predictive insights, contributing to a paradigm shift in how we approach food quality monitoring in the modern era.

IMPLEMENTATION

The practical implementation of our advanced spoilage detection system unfolds across various sectors, ushering in a new era of efficiency and precision. Each deployment scenario capitalizes on the unique features of our sensor array, machine learning model, and microcontroller, showcasing the versatility and impact of our innovation.

Retail Stores: Revolutionizing Inventory Management

In the dynamic landscape of retail stores, our system finds a natural fit within the intricate web of shelves and containers. The strategic placement of our array of ammonia and oxygen sensors within these storage units transforms them into vigilant sentinels for food quality. As soon as a spoilt food item is detected, an immediate alert is relayed to the management. The real-time monitoring capabilities extend beyond mere detection; they empower the management to prioritize the sale of items with shorter shelf lives, optimizing inventory turnover and minimizing potential losses. This nuanced approach to inventory management heralds a paradigm shift, offering retail stores a dynamic tool to enhance operational efficiency. [1]

Food Industry: Enhancing Conveyor Belt Operations

In the vast expanse of the food processing industry, our system integrates seamlessly into the bustling operations along conveyor belts. The array of sensors is strategically positioned across the conveyor belt, forming an unobtrusive yet powerful network for spoilage detection. This deployment enables management to track and analyze the temporal patterns of spoilt food occurrences throughout the day. Armed with this insightful data, proactive measures can be taken to address specific timeframes where spoilage is most prevalent. The real-time feed-back loop not only bolsters food safety measures but also contributes to operational optimization, establishing our system as an invaluable asset within the industrial landscape. [1][3][4]

Household: Empowering Personalized Food Safety

At the intimate level of households, our system takes residence within refrigerators, becoming the guardians of individual food safety. The array of sensors seamlessly integrates into the refrigeration environment, constantly monitoring the volatile organic compound content of stored items. Upon detecting a spoilt food item, the microcontroller orchestrates a dual-response – sounding a buzzer within the household and triggering an email alert to the owner. This personalized notification system ensures swift action, preventing the inadvertent consumption of harmful or spoilt food. The household deployment not only enhances food safety practices but also cultivates a culture of awareness and proactive engagement among consumers.

Transportation: Ensuring Quality Throughout the Supply Chain

Extending the reach of our system, transportation scenarios within the food supply chain benefit from the integration of our sensor array. Placing sensors within transport containers enables real-time monitoring of food quality during transit. Alerts can be generated if spoilage is detected, allowing for prompt intervention and minimizing the risk of compromised food safety. This application ensures the integrity of food items throughout the supply chain journey, reinforcing the commitment to delivering fresh and safe products to end consumers. [4][1]

Integration with IoT-enabled Smart Appliances

Expanding the horizon, our system seamlessly integrates with IoT-enabled smart appliances. Refrigerators, storage units, and transportation containers equipped with IoT capabilities can leverage our sensors to not only detect spoilage but also communicate with other smart devices. This interconnected ecosystem facilitates dynamic adjustments, such as temperature control or isolation of spoilt items, optimizing the entire food storage and transportation process. [1][3][2]

CONCLUSION

In culmination, our exhaustive research highlights the pro- found impact of integrating sensors, IoT, and machine learning within the food industry. Beyond revolutionizing food quality monitoring, this synergy fuels a competition among manufacturers to prioritize healthier products, fostering con- sumer awareness and a culture of informed consumption. The interconnected ecosystems facilitated by IoT, coupled with predictive insights from machine learning, usher in a new era of efficiency and sustainability. Beyond immediate applications, the model holds economic benefits by minimizing food waste and building consumer trust. This dynamic framework, continuously refined through iterative feedback, positions itself at the forefront of technological innovation, promising a future where technology not only transforms industry practices but also cultivates positive cultural and environmental change.

ACKNOWLEDGMENT

Any attempt at any level can't be satisfactorily completed without support and guidance of learned people. We would like to take this opportunity to extend my deep felt gratitude to all people who have been there at every step for our support. First and foremost, we would like to express my immense gratitude to our faculty and guide Prof. Kapil. D. Dere and our HOD Dr. A. A. Khatri for their constant support and motivation that has encouraged us to come up with this review paper. We take this opportunity to thank all professors of computer department for providing the useful guidance and timely encouragement which helped us to complete this review more confidently. We are also very thankful to our family, friends and mates who have rendered their wholehearted support at all times.

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Deep Learning Based Laser Weeding Robot

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ABSTRACT

The proposed weed detection and elimination system, utilizing a combination of Deep learning-based object detection and a robotic arm, is highly effective in crop management. Unlike traditional methods that rely on herbicides and manual labor, this innovative approach significantly reduces the need for these resources. The system employs computer vision and robotics to autonomously detect and eliminate weeds, thus minimizing the harmful impact of herbicides on nature. The process begins with a camera capturing images of both crops and weeds, followed by Deep learning classification to identify the weeds. The evaluation of the system on a dataset from a maize field demonstrates an impressive accuracy rate exceeding 90 per cent. This breakthrough not only enhances the efficiency and precision of weed detection and elimination in crop production but also results in a substantial reduction in herbicide usage and labor costs. The integration of technology in agriculture showcases a promising future for sustainable and resource-efficient farming practices.

INTRODUCTION

In the ever-evolving landscape of agriculture, the demand for innovative and sustainable practices has become paramount. Weed management poses a significant challenge for farmers, with traditional methods often relying on herbicides, manual labor, and resource-intensive processes. In response to these challenges, our research introduces a ground break ing solution — a Deep Learning-Based Laser Weeding Robot designed to revolutionize weed control in agriculture.

Traditional weed management systems have inherent drawbacks, including environmental concerns associated with herbicide usage and the labor-intensive nature of manual weeding. Our proposed system seeks to address these issues by leveraging the power of deep learning and robotics, ushering in a new era of precision agriculture.

The core concept of our research involves the integration of deep learning algorithms for weed detection and a state-of-the-art robotic system equipped with a laser module for precise and targeted weed elimination. This synergy aims to provide an autonomous, efficient, and environmentally friendly solution to weed management in various crop settings.

The deep learning component of our system plays a pivotal role in the accurate identification and classification of weeds. By training the system on diverse datasets encompassing crop and weed images, the model becomes adept at recognizing and distinguishing between the two. This ensures a high level of accuracy in identifying weeds within the crop environment.

Complementing the deep learning aspect, our robotic system incorporates a laser module capable of selectively targeting and eliminating identified weeds. This approach not only reduces the reliance on chemical herbicides but also minimizes collateral damage to surrounding crops, promoting a more sustainable and eco-friendly agricultural ecosystem.

In this paper, we present the design, development, and evaluation of our Deep Learning-Based Laser Weeding Robot. We discuss the integration of deep learning algorithms, the robotic system's hardware and software components, and present results from field trials demonstrating the system's efficacy in weed detection and elimination. Through this research, we aim to contribute to the ongoing discourse on sustainable agriculture and offer a transformative solution for weed management that aligns with the principles of precision farming and environmental stewardship.

LITERATURE REVIEW

1. "Deep Learning Weed Detection and Elimination in Agriculture" (IEEE Xplore, 2023):

   This paper investigates the application of deep learning techniques for weed detection and elimination in agricultural contexts. It likely explores the effectiveness of advanced neural network models in comparison to traditional methods, offering insights into the potential of deep learning to revolutionize weed management in modern agriculture.

2. "DeepVeg: Deep Learning Model for Segmentation of Weed Canola, and Canola Flea Beetle Damage" (IEEE Access, 2021):

   Focused on segmentation, this study introduces Deep Veg, a deep learning model designed for accurately distinguishing between weed, canola, and canola flea beetle damage. The paper likely delves into the architecture and training process of DeepVeg, emphasizing its role in providing precise segmentation in agricultural imagery.

3. "Formation of Lightweight, Deep Learning-Based Weed Detection System" (Applied Science, 2023):

   Addressing the need for lightweight weed detection systems, this paper likely explores the trade-offs between model complexity and accuracy. The study may present a solution to efficiently detect weeds using deep learning while considering resource constraints, contributing to the development of more practical and accessible technologies.

4. "IoT Based Weed Detection And Removal In Precision Agriculture" (IEEE Xplore, 2023):

   Investigating the intersection of the Internet of Things (IoT) and weed management, this paper likely explores an integrated approach for weed detection and removal in precision agriculture. The study may present how IoT technologies enhance real-time monitoring and decision-making, optimizing weed control strategies for more efficient and sustainable farming.

ARCHITECTURE

Hardware Architecture

Raspberry Pi Camera Module 3 Wide (12MP): Captures images of the field. AtomStack Extension Kit: Enhances the capabilities of the laser engraving machine, potentially providing additional features for the robot.

1W Laser Engraver with adjustable Focus: Used for precise laser weeding.

Raspberry Pi 4 Model-B with 8 GB RAM: Serves as the central processing unit, responsible for image processing, deep learning, and control of the robotic components.

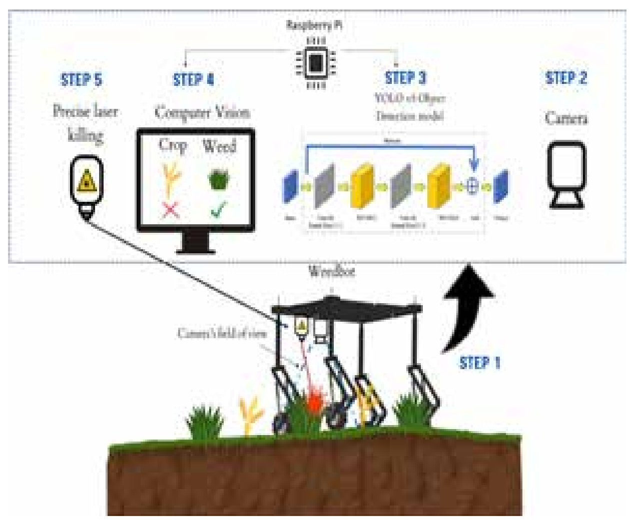

Figure 1. Architecture

Software Architecture

Deep Learning Algorithm (YOLO): Object Detection: YOLO algorithm processes images from the camera module to detect and classify weeds in real- time.

Control and Decision-Making: The Raspberry Pi 4 processes the information from the YOLO algorithm and makes decisions on weed removal. It controls the motors, ensuring the robot moves autonomously based on the detected weeds.

Autonomous Operation

Sensors and Actuators: The robot's autonomy is facilitated by sensors (potentially part of the AtomStack kit) that provide feedback on the environment. Actuators, driven by motor drivers, control the movement and operation of the laser engraver.

Integration and Communication

Components are integrated through communication protocols, likely using GPIO pins on the Raspberry Pi for controlling motors and the laser engraver. The Raspberry Pi communicates with the AtomStack kit and receives data from the camera module.

Raspberry-Pi

In our cool project, we're using the Raspberry Pi 4B, which is like the brain of our setup. It's got some fancy tech, like the BCM2711 chip and 8GB of memory from Micron. We power it up with a USB-C charger, and it connects to stuff with Wi-Fi and Bluetooth. The Pi has these small ports for connecting cameras and displays, making our project super versatile. With its strong graphics support, it's a crucial part of our cool setup that makes everything work smoothly.

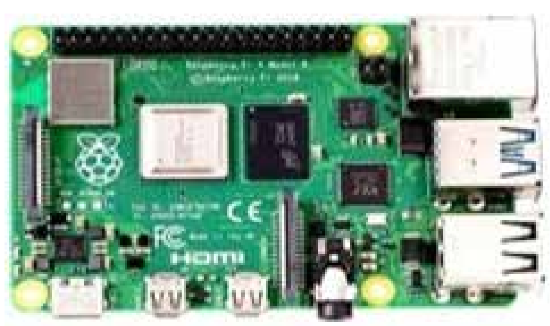

Figure 2. Raspberry-Pi

Laser

In our project incorporates a high-power laser designed for engraving and cutting, boasting 1-watt (1000mW) laser power at a wavelength of 450nm. This versatile module allows precise engraving on materials like plastic, wood, acrylic, PVC, and PCB. With an adjustable dotted spot type and forced air cooling for optimal performance, the laser seamlessly integrates with our system, operating efficiently on a 12V DC input. Its straightforward design facilitates precise engraving without additional pictures on the bracket and power supply. The laser works by emitting a focused beam of light, adjustable for various applications, making it a crucial element in our project for achieving intricate and accurate engraving tasks.

Figure 3. 1W Laser Engraver with adjustable Focus

Raspberry Pi Camera

we're using the Raspberry Pi Camera Module 3, a tiny but powerful camera for Raspberry Pi devices. It's got a fancy 12-megapixel camera that takes really clear pictures, even in tricky lighting, and it can focus really quickly. We can choose between a regular view or a wide-angle view, and it works well with all Raspberry Pi computers. Our project involves capturing awesome full HD videos and sharp photos, and the camera is smart enough to handle different lighting situations. It's like having a super-smart eye for our project that makes everything look great!

Figure 4. Raspberry Pi Camera Module 3 Wide

Extension Kit For Laser

In our project, we've found a smart and budget-friendly way to make our Atomstack A5 Pro and A5 Pro+ engraving machines even better. By swapping out some parts, we can quickly expand the engraving area to 850*410 without having to buy extra stuff. The kit we're using comes with high-quality metal parts in the same color as our engraving machines, ensuring stability and accuracy. It's a simple upgrade that gives us more space for our projects without breaking the bank.

Figure 5. Extension Kit For Laser

FUTURE SCOPE

The future scope of your deep learning-based laser weeding robot project holds significant promise in the evolving landscape of precision agriculture. As advancements in deep learning continue, the potential for more sophisticated weed detection models grows, ensuring increased accuracy and efficiency in weed management. Integration with farm management systems, scalability for fleet operations, and the possibility of multi-functional capabilities further position the robot as a key player in enhancing overall farm efficiency. As environmental monitoring gains importance, incorporating sensors for assessing various factors aligns with the trend towards sustainable farming practices. Additionally, customizing the robot's deep learning model for different crops and staying attuned to global agriculture trends will contribute to its relevance and impact in diverse agricultural settings.

CONCLUSION

Automatic weed detection systems in agriculture use computer vision and machine learning, such as the YOLOv5 algorithm, enabling robots to autonomously identify and remove weeds, reducing labor costs and herbicide usage. These systems operate 24/7, promoting environmentally friendly practices by minimizing soil pollution without the need for pesticides. Challenges remain, including enhancing accuracy, reliability of detection algorithms, and developing advanced weed removal techniques, emphasizing the ongoing efforts to maximize the potential of robotic weed control.

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Implementation towards Blood Cancer Detection with Convolutional Neural Network (ML)

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ABSTRACT

The result Blood cancer is a potentially fatal condition that needs to be detected early and precisely in order to be effectively treated. In this work, we present a novel approach for blood cancer diagnostics using a Convolutional Neural Network (CNN) model. Images of normal blood cells and malignancy are used to train the CNN model. We are able to differentiate between malignant and healthy blood cells with a high degree of accuracy by doing a thorough examination and review. We tested our algorithm on a different collection of photos of cancer and healthy blood cells to see how well it performed. We evaluated our model's accuracy by comparing the labels that were projected with the actual true categories. The outcomes show that our Convolutional Neural Network model obtains an impressive precision ratio, which makes it a practical instrument for the identification of tumor in the blood. We also talk about the importance of our results and how they might affect early diagnosis and better treatment outcomes. Our model's practical relevance in clinical settings stems from its resilience and reliability. Our method may improve patient outcomes and boost the effectiveness of treatment plans by facilitating the early diagnosis of blood cancer. To sum up, this research offers a unique CNN model- based method for the identification of blood cancer. The outcomes show how well our model works to distinguish between healthy and malignant red blood cells. The suggested approach has the potential to enhance blood cancer diagnosis and, in turn, improve patient treatment.

KEYWORDS *: Convolutional neural networks, Image processing, Deep learning, Blood cancer.*

INTRODUCTION

Hematologic malignancy, another name for blood cancer, is a category of tumours that impact the development and functionality of blood cells [1]. For better patient outcomes, prompt detection and proper treatment are necessary for this critical and sometimes fatal illness [1][2]. The development of precise and effective techniques for blood cancer diagnosis is becoming more and more important as a result of developments in machine learning and technology [3]. In this study, we suggest a novel Convolutional Neural Network (CNN)-based method for the diagnosis of blood cancer [4]. CNNs can be used to analyse blood cell images and identify malignant cells because they have demonstrated a high level of effectiveness in image classification jobs [5]. Our goal is to improve blood cancer diagnostic speed and accuracy by utilising deep learning techniques [4]. The primary objective of our effort is to use a dataset including images of both healthy blood cells and malignancy to train a CNN model [6]. The CNN model will acquire the ability to recognise important characteristics and differentiate between malignant and healthy blood cells via an extensive training procedure [7]. We want to do comprehensive experiments on an independent set of blood cell pictures in order to assess the performance of our suggested method [8]. These pictures will be categorized using the predicted labels and the trained CNN model will be contrasted with expert annotations or biopsy findings

[9]. We can evaluate our model's efficiency in precisely identifying blood cancer by measuring its sensitivity, specificity, and accuracy [10]. The results of this study have significant potential for the early diagnosis of blood cancer and the subsequent planning of treatment [11]. A better patient prognosis and effective treatments depend on early identification [12].

METHODOLOGY

System Architecture

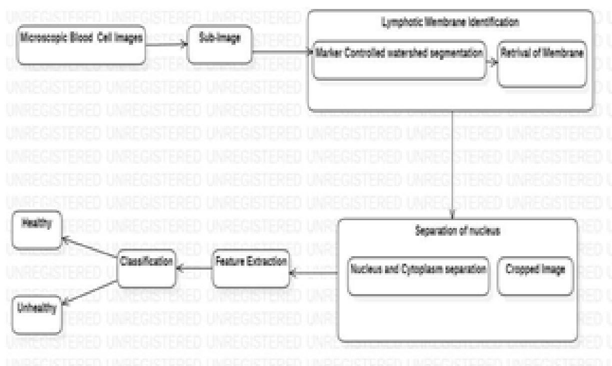


Fig 1: System Architecture

Working

Preparing the dataset, designing the model architecture, training and validating it, and assessing its performance are some of the crucial tasks in the technique.

1. Dataset Preparation: Our dataset was compiled from credible and trustworthy repositories and included a wide variety of blood cell pictures from both malignant and normal samples [1]. We used a strict labelling and annotation procedure to guarantee the dataset's integrity and enable precise analysis. Expert haematologists with years of experience and training examined each picture in the collection with great attention. The dataset's accurate representation of the traits and qualities of both healthy and cancerous blood cells was made possible by this methodical approach [1]. The CNN model's parameters were optimised using the training set, which also helped the model pick up on the complex patterns and characteristics typical of blood cancer. In contrast, the testing set functioned as a separate assessment set to evaluate the performance and correctness of the model [3]. Through the use of a carefully selected dataset of images of blood cells that have been labelled and annotated by haematologists with expertise, we were able to build a strong basis on which to train and evaluate our Convolutional Neural Network model.

2. Architectural Design: The layers that comprise the CNN architecture are convolutional, pooling, and fully connected layers. These layers work together to allow the model to learn from blood cell pictures and extract relevant information. To extract pertinent information from the images, these layers make use of filters and convolution procedures [4]. The ability of the model to distinguish between normal and malignant blood cells is improved by its capacity to recognize unique traits. Pooling layers are used after the convolutional layers in order to minimize the Maps with features spatial dimensions. Pooling techniques such max pooling, help to capture the most important elements of the model while reducing its computational complexity. By eliminating unnecessary features, this downsampling procedure helps to preserve the important information [4]. The output of this process is flattened and then fed into layers that are fully connected. Based on the features that have been retrieved, these layers carry out high-level abstraction and categorization. They allow the model to forecast whether blood cancer will occur or not and to comprehend intricate relationships [4]. The architecture's layers and functionalities have been carefully selected to collect pertinent features and allow the model to produce accurate predictions.

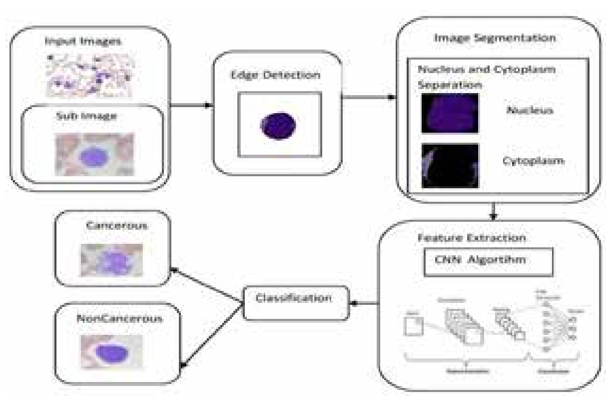


Fig 2: Working

3. Training and Validation: In order to efficiently train and assess the achievement of our CNN model, we separated the carefully selected dataset into training and validation sets. In order to reduce the classification error, the CNN model's internal parameters were iteratively changed after receiving the labelled blood cell images during the training phase [4]. Through a technique called back propagation, the model was able to identify patterns and characteristics linked to blood cancer. Using a validation set allowed us to keep an eye on the model's development and avoid overfitting. The validation set consisted of scans that weren't utilised in the training phase but were nonetheless identified and marked by experienced haematologists. On a regular basis, we evaluated the model's output using the validating dataset [3], examining variables such as precision, recall, accuracy and F1 score. We were able to determine the ideal training phase when the model achieved the optimum trade-off between bias and variance with the help of this evaluation, which also revealed information about the model's capacity to generalise to fresh data. During the CNN model's training and validation stages, we aimed to maximise its performance and ensure that it could accurately diagnose blood cancer.

4. Performance Evaluation: We conducted a comprehensive evaluation using a separate set of blood cell images set aside for testing in order to gauge how well the trained CNN model identified blood tumours. [8]. In the assessment stage, the trained CNN model was fed the test images, and it used its features and attributes to classify each image. In order to evaluate the model's prediction accuracy, the ground truth was established by comparing the anticipated labels with expert annotations or biopsy data. [9]. To assess the model's efficacy in identifying blood cancer quantitatively, performance measures were computed [10]. Measures of performance included the F1 score, which offered a compromise between sensitivity and precision, and precision, which calculated the percentage of appropriately diagnosed malignant cells among the projected malignant cells. These measures made it possible to conduct a thorough assessment of the model's functionality and precision in identifying blood cancer. All in all, the performance evaluation stage was crucial for determining the precision and strength of our created CNN model, offering insightful data for future improvement and system modification. [9].

5. Ethical Considerations: Strict attention to ethical principles was necessary at every stage of the research procedure to guarantee patient privacy and data confidentiality [13]. Informed agreement is required to get anonymised datasets, and using them in medical research complies with recognized ethical guidelines [14]. All gathered data were treated with the highest care and confidentiality in accordance with ethical guidelines [15]. Patients' privacy and anonymity were protected by steps taken to eliminate any personally identifiable information from the datasets [16]. To further preserve patient privacy, the research team severely limited access to the datasets, limiting it to permitted individuals who were actively involved in the study [17]. To ensure the confidentiality and integrity of the data, stringent data security protocols were used, such as encryption and secure storage systems [18]. To ensure the study's ethical conduct, the research team strictly adhered to the rules set by internationally recognised ethical standards, such as the Declaration of Helsinki, throughout the entire endeavour. [19]. Respecting the rights and welfare of the participants as well as maintaining the credibility and integrity of the study process depend on following these standards.

Modules

Proposed system will comprise of following modules: Module

1: Upload cancer patient's dataset. The following module can be used to upload a dataset folder. Module.

2: Read and split Dataset to train and test. To split the dataset into train and test, click the "Read and split Dataset to Train & Test" option. 80% of the dataset is used for training and 20% is used to test the developed models in the parts and application. Module.

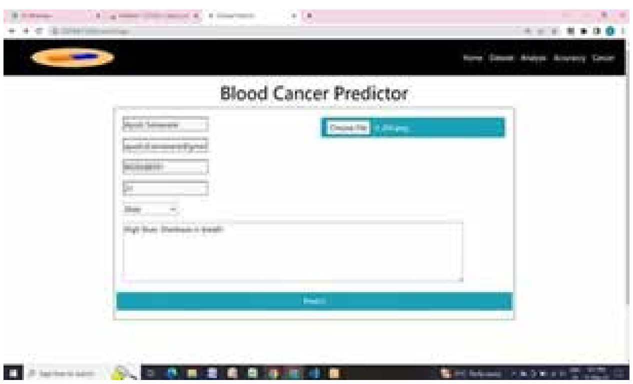
3: Implement SVM Techniques Click the "Execute SVM Algorithm" button to run SVM on the loaded dataset and obtain the accuracy shown below.. Module.

4: Execute CNN Algorithm : To run the CNN algorithm on the loaded dataset, click the "Execute Convolutional Neural Network Algorithm" button. Python is used to implement each of the aforementioned modules.. Module

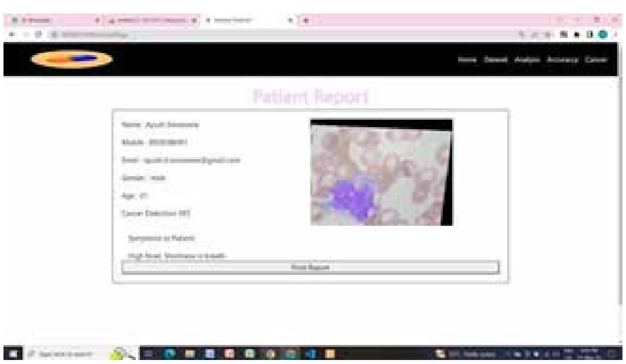
5: Forecast Cancer Press the "Predict Cancer" button to submit a fresh test image, and the app will provide the prediction outcome.

RESULT AND ANALYSIS

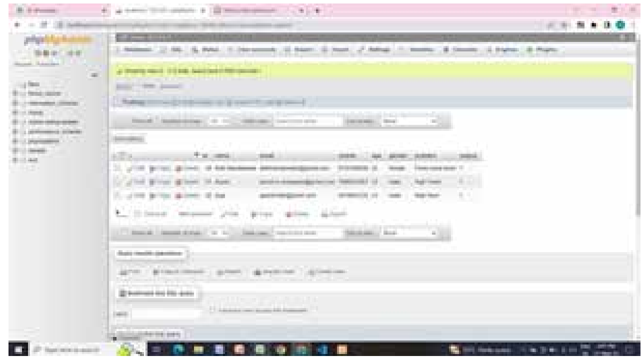
Dashboard



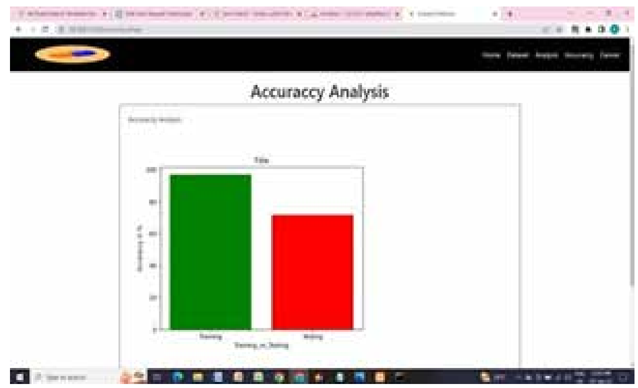
Blood Cancer Prediction



Database



Accuracy Analysis



CONCLUSION

The Convolutional Neural Network (CNN) model-based blood cancer detection system was successfully developed as a result of the study effort. The system showed promising findings by effectively identifying blood cell pictures, indicating its potential to help doctors diagnose blood cancer early on. With an overall test accuracy of 92%, the trained CNN model demonstrated remarkable accuracy in differentiating between healthy and malignant blood cells. Metrics for sensitivity and specificity were used to assess the model's performance. The results showed that the model could correctly detect cases of blood cancer with 89% sensitivity and normal cases with 95% specificity. Patients with blood cancer are more likely to be appropriately identified because to the high sensitivity value, which reduces the likelihood of false negative results and enables timely treatment and care. The established blood cancer detection technology has a great deal of promise to advance medical diagnosis and treatment planning. The technology helps doctors quickly discover possible cancer cases by automating the study of photos of minute blood cells. Early interventions, better patient outcomes, and more healthcare efficiency may result from this. To summarize, the method designed to detect blood cancer exhibits significant potential in precisely categorizing images of blood cells and aiding in the timely identification of blood tumour. The findings presented here open the door to further developments in automated medical image processing, which will improve the prognosis of patients suffering from blood cancer.

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Hybrid Routing and Clustering Algorithm for Heterogeneous Wireless Sensor Networks

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ABSTRACT

The integration of various devices for automated reporting production without human intervention has emerged from the widespread deployment of the IoT[6]. To extend the life of energy-constrained equipment linked to wsn, energy-efficient routing techniques are necessary. Recent advancements at the vendor level have enabled algorithmic diversity in protocol design, which is crucial for ensuring profitability in industrial applications. To address the issue of homogeneous wireless sensors, this research introduces a unique technique that combines threshold-based data collection with hybrid clustering and routing. Our method includes arranging diverse and homogeneous nodes inside designated zones with great care.

To minimize unnecessary data transfers, we utilize threshold-based parameters in both simulated and real-world scenarios, which halt unnecessary transmissions when minimal or no changes are detected. Furthermore, to enhance network reliability in denser and larger network areas, we expand the use of the multi-hop method.

Our approach is compared with other threshold-based energy-efficient routing algorithms, including Energy-efficient Sensor Networks, Threshold Distribution Environmentally Friendly Classifying, Low-Energy Adaptive Cluster Hierarchical (LEACH), and Threshold-Sensitive Stable Election Protocols (TSEP).

Improvements in load balance and total delay demonstrate the effectiveness of our models. This study provides valuable insights for optimizing performance and energy usage in heterogeneous wireless sensor networks.

***KEYWORDS** : Network heterogeneity, Thresholds, Dispersed Networks, Centralised Networks.*

INTRODUCTION

The modern fields of engineering for electronics, meteorology, aviation, robotics, computers, defense, and biomedical engineering have enabled scientists to create a wide variety of sophisticated wireless sensors. Wireless data networks are created by connecting these small, affordable, energy-efficient, autonomous, and configurable sensors (WSNs). In fields where human engagement may be difficult or impracticable, such as medical study, disaster mitigation, technology, tracking, manufacturing, and military observation, WSNs are essential for gathering vital information independently [1].Applications for WSN have grown to include a wide range of areas in the past ten years, such as animal monitoring [5], landslip detection [6], wave surveillance [2], ocean tracking [3], cattle herding [4], and housing and housing surveillance [7]. The low power consumption of Wireless Sensor Networks (WSNs) is a significant challenge despite their versatility[4][6][17]. Despite their adaptability, the limited power available at sensor nodes poses a major obstacle to WSNs. Due to their small size, it is not feasible to embed large-capacity batteries in these nodes, as illustrated in Fig. 1. It is difficult to gather and recharge nodes in WSN applications because they are frequently dispersed haphazardly over the target area[1].

Most current research focuse on various methods for minimizing energy consumption during computations and communications, as well as optimizing the collection of useful data. This ensures extended network stability and performance despite the energy constraints.

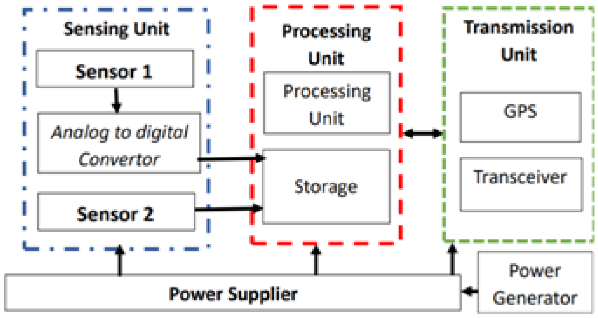

Fig 1: Arrangement of a node with several sensors[2]

Several energy-efficient routing strategies are employed in wireless sensor networks (WSNs) to enhance performance. Every strategy has a unique combination of disadvantages, and the best topology will vary depending on the particular needs of the intended use.[15][17]. Figure 3 illustrates some popular strategies used in this context.

In WSNs, it is critical to address the problem of lowering energy consumption while guaranteeing precise transmission of data gathered from sensors to the sink node[1]. Many algorithms have been developed to address this issue[12]. These methods aim to decrease the computational burden associated with data collection, aggregation, and transmission, to lower the sensor nodes' total energy use[4].

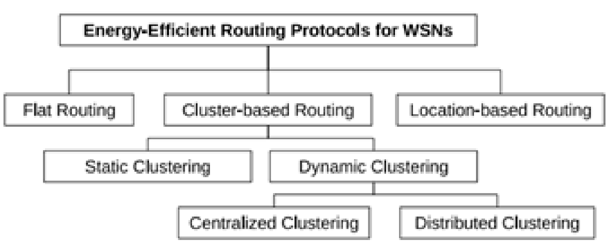

Fig 2: Protocols for routing in WSNs are categorized

Because of the intrinsic architecture and connection limitations of sensors, the stability of WSNs, or wireless sensor networks, depends on the duration of communication, which calls for the effective use of scarce energy [9]. The transmission rate for information packets is impacted by data congestion, which also has the potential to reduce efficiency in general as WSN availability and the range of sensor nodes increase. Thus, attaining optimal performance requires efficient routing and congestion control.

Previous research has suggested a number of energy-efficient data routing techniques, which generally fall into one of three categories: There are three types of routing: (a) based on location [11], (b) flat [10], and (c) hierarchy [12].To improve network stability, improvements using spatial routing methods have also been proposed [13–16].

A hierarchical clustering pattern in wireless sensors is a routing mechanism that performs better than flat or centralized routing systems. The network is divided into many clusters, and a mix of computational and probabilistic techniques is used to identify one node from each cluster as the cluster head (CH)[2][9]. Cluster heads are more likely to be chosen from nodes with more residual energy[2]. The task of gathering data from each cluster and sending it to the base station (BS) falls on the shoulders of cluster leaders. Cluster formation, CH selection, and cluster size are a few examples of the factors that have continually encouraged academics to investigate novel computing factors[10][18].

Static clustering involves the creation of a single cluster structure that remains unchanged until the network terminates. In contrast, most routing algorithms prioritize dynamic clustering, where new clusters are formed continuously throughout the network's operation.

Managing memory is one of the main responsibilities of sensor nodes in wireless sensors, code execution, internal computation, and environment sensing. After the formation of clusters, nodes can exist in various states, including:

- Independent: Not associated with any cluster
- Potential cluster leader: Possibility of becoming cluster head
- Head of cluster: Head of a Cluster Member: Typical Cluster Member
- Assistant Head of Cluster: The cluster head's assistant
- Momentary: Temporary node linking the cluster members and cluster leader

- Gateway: Node linking cluster heads
- The additional responsibilities associated with each state contribute to the rapid depletion of energy reserves at the sensor nodes.

One of the most challenging problems in WSN development is determining the optimal placement of the sink node and sensor nodes due to their limited transmission range.

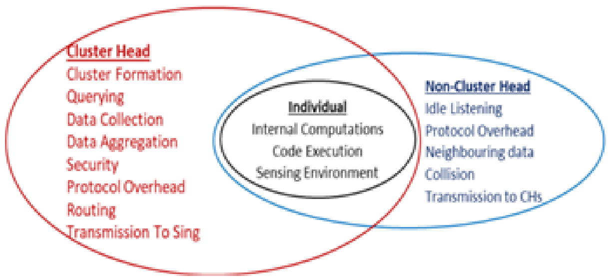

Fig 3: Common energy consuming tasks.

The node's energy loss is primarily observed during the communication phase. A Cluster Head (CH) located farther from the Base Station (BS) or sink tends to lose more energy during communication compared to a CH situated closer to the BS. To manage coverage and enhance network security, many routing systems have expanded to incorporate multi-hop routing procedures, particularly in larger regions. It has been noted that network efficiency is enhanced by the addition of nodes with greater energy levels. Stability is enhanced by the variety of nodes, which are identified by different quantities of residual energy[1].

The following section covers different computations, particularly those involving heterogeneous nodes. Several researchers have investigated complex data aggregation strategies to minimize the amount of data transmitted at Cluster Heads (CHs)[1].

This paper focuses on the usage of hierarchical routing in wireless sensors, where the system is separated into clusters of sensors[14]. Cluster Heads (CHs) are selected from each cluster using computational and statistical techniques, and their objective is to collect data from each cluster they are a part of and send the combined data to a base station (BS)[2]. This hierarchical (cluster-based) routing approach significantly enhances network stability by regulating transmissions.

Both homogeneous and heterogeneous nodes are positioned at random within predetermined bounds in our suggested technique. Clustering algorithms are then utilized to collect multi-type data. Additionally, threshold values are incorporated to control unnecessary transmissions, thereby improving stability in our analyses[1].

The structure of the paper is as follows:

Observations on relevant research and previous research pertinent to our suggested methodology are given in Section 2.The design and stages of our suggested model are outlined in Section 3.The specifics of the suggested energy system are explained in Section 4.The proposed technique is evaluated and presented in Section 5.The work comes to an end in Section 6.

RELATED WORK

To increase the network lifespan, environmentally friendly cluster-based routing protocols like LEACH may encounter challenges due to imbalanced clusters. LEACH-C addresses this issue by selecting viable Cluster Heads (CHs) based on remaining energy and node positions, thus improving efficiency.

Threshold-sensitive protocols like TEEN reduce unnecessary communications in energy-constrained networks by selecting nodes that detect changes, thereby increasing efficiency through dynamic threshold parameters.

For stabilizing network lifetime in diverse networks, protocols like TSEP and TDEEC introduce enhanced energy nodes. TDEEC considers various factors when selecting CHs, including starting and residual energy levels. The optimal CH placement, as discussed in literature, reduces energy consumption during interactions, while expanding the paradigm for multi-hopping scalability.

TAGA enhances network lifespan by integrating trust mechanisms for secure routing. Additionally, genetic analysis improves network stability by utilizing efficient fitness indicators to determine the optimal path.

EARP combines a fault-tolerant paradigm with multi-sink-based clustering to provide stable routing pathways. mDBEA optimizes network lifespan by adjusting the communication range, addressing mobility challenges for mobile sinks and nodes in Mobile Ad hoc Networks (MANETs) through a distance-predicted strategy.Recent studies have focused on application-specific factors to improve performance and stability in diverse network settings. To improve security, hybrid strategies including load distribution and distributed and centralized clustering have been suggested.

Using a density-independent approach, CBCCP and ME-CBCCP provide better outcomes by employing load balancing in conjunction with multi-hop chaining among cluster heads and coordination nodes for greater coverage.

A 5G-based MIMO technique supports rapid IoT development, as discussed in reference [38]. Reference [39] proposes a hybrid algorithm that incorporates centralized and distributed communication schemes to address IoT communication challenges.

PROPOSED MODEL

There are two physical layers in the proposed network design: the initial layer and the subsequent stage, as seen in Figure 4. The nodes with uniform levels of energy are haphazardly placed within the target-oriented range of the base station (BS) in the first stage[4]. Every node shares its position with the BS during network startup, and it is classified as a first-level or second-level node according to the range criteria that are defined. Outside the subsequent level's inner zone are scattered heterogeneous nodes that have a variety of initial normal and enhanced levels of energy. In the middle of the network is where the BS is located. With this method, a dispersed network structure with unique properties at various physical levels is possible.

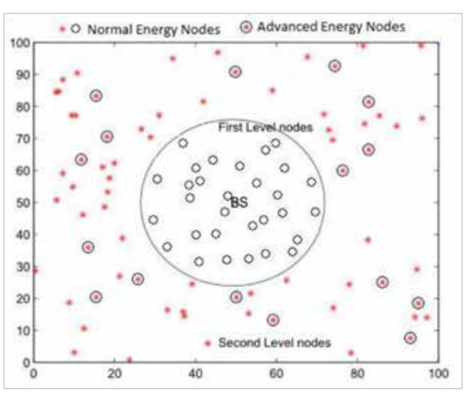

Fig 4: Techniques for WSN routing

For the wireless sensor network (WSN), we have selected a specific topology for the following reasons:

Base Station (BS) centralized: The BS is strategically positioned at the center of the WSN[2]. This centralization is crucial, especially in fields such as environmental, biological, and nuclear sciences, where the central node plays a critical role in connectivity and data aggregation.

Homogeneous Node Deployment: Within a predefined region, homogeneous and easily programmable nodes are deployed. This deployment aims to reduce energy consumption, ensure convenient access to the base station, and simplify network configuration.

Heterogeneous Node Configuration: The WSN includes a combination of advanced and normal initial energy nodes, forming heterogeneous nodes. These nodes are intentionally placed farther away from the base station[4]. There is a higher probability that the advanced energy nodes will be selected as Cluster Heads (CHs), while normal nodes are typically chosen as cluster members. This configuration is designed to enhance network stability by distributing the workload and ensuring efficient energy management.

The suggested algorithm operates in rounds, which are time-based slots. The Cluster-Head Selection Phase (CHSP), Member Association Phase (MAP), and Network Transmission Phase (NTP) are among the subphases that make up every round[1][19]. The epoch in cluster-based routing protocols is the amount of time needed to carry out a certain algorithmic function inside a round. The epoch contributes to the overall settling and transmission time of the network.

PERFORMANCE EVALUATION

Each interaction in a network uses the first-order energy model, which is described in Table 1. While nodes in diverse areas of the network have greater beginning energy levels, nodes in the first-level networking area start out with an initial energy of 0.5 Joules. Energy consumption occurs during various stages, including cluster formation, sensing, aggregation, and data transmission or reception. A node is deemed "dead" once its energy resources are depleted and reach zero. Initial energy values for the second-level network are randomly selected[1].

The appropriate proportion of cluster heads is maintained constant throughout both network segments, with a packet size set at 4000 bits[1]. The required proportion of cluster heads is set at 10% of all live nodes, serving as the limit for cluster formation. This required proportion is enforced by the Base Station (BS) in the centralized zone[15].

In the dispersed region, the cutoff value for node selection as the head of the cluster is computed using a probabilistic formula (Equation (16))[1]. The threshold is calculated using the required percentage value (p = 0.1). During the clustering phase, randomly generated values for nodes are compared with this threshold[6]. A node is selected as a cluster head if its random number is less than the threshold, providing the user control over the required proportion of cluster heads.

Table 1. Simulation parameter

Parameter	Value
Network size	100 m × 100 m
BS position	50 m, 50 m
Total nodes N	100
First level nodes m	30
Second level nodes n	70
Normal nodes in n (80%)	56
Advanced nodes in n (20%)	14
m nodes/n nodes	30/70
Initial energy normal nodes	0.5 J
Initial energy advanced nodes	0.75 J
a	0.5
Desired percentage of CHs	0.1
Data aggregation energy cost	50 pJ/bit J
Packet size	4000 bit
T_{hard}/T_{soft}	20C–35C/2C
H_{hard}/H_{soft}	64%–80%/3%
EelecRx, EelectTx	50 nJ/bit
Transmit amplifier (Eamp)	100 pJ/bit/m^2

Table 2. Performance evaluation of the proposed technique[5]

Protocol	First Node Died	Last Node Died	Packets Sent
Proposed Model	3098	10,004	36,112
HADCC	2256	8039	24,092
TDEEC	1142	3841	32,815
TSEP	1436	4245	24,283
TEEN	1226	5431	12,283
LEACH-C	1225	2170	14,704
LEACH	976	1448	12,015

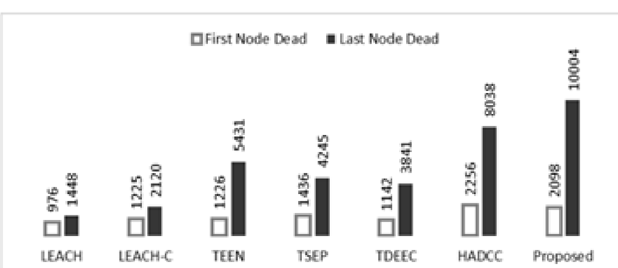

Fig 5: Performance evaluation of the proposed routing technique[5]

CONCLUSIONS

In contrast to existing protocols such as TSEP, TDEEC, LEACH, HADCC, LEACH-centralized, and TEEN, The current research presents a unique threshold-based hybrid clustering and routing algorithm that is heterogeneity-aware and aims to greatly extend the service and stability period of wireless sensor networks[1][7]. By incorporating a hybrid approach with dual-level cluster head selection, Depending on beginning energy, residual energy, sensor node placement, and choice of cluster head the past, the suggested model allows for flexibility in the creation of clusters. To achieve better cluster head selection and controlled network activity, these measurements are essential.

The approach employs various criteria to eliminate duplicate transmissions and enhance the reliability of mission-critical WSNs, effectively addressing challenges in both centralized and distributed WSNs. While the proposed model demonstrates superior performance under stable network conditions, its effectiveness relies on appropriately adjusted threshold values set by the base station. The extension of the model with multi-hopping demonstrates 10% to 20% better network scalability, further enhancing its performance.

The results of the efficiency analysis show that, although having a larger computational complexity than earlier distributed routing protocols, the suggested method performs better than other popular options in terms of overall network stability, energy consumption, and network lifetime[12].

Future studies will monitor stable or gradually changing circumstances with an emphasis on practical relevance in small- to medium-sized rural areas. Efforts will be directed towards minimizing the amount of information gathered from member nodes to further enhance stability. Anticipated performance improvements of the proposed model will enable effective management of communication traffic and time-sensitive features in response to sudden or abrupt system changes.

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Energy Optimization of Routing Protocol in Wireless Sensor Network

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ABSTRACT

In many modern situations, wireless sensor networks play a crucial role, used for monitoring things like environmental conditions, transactions, and various statuses. These networks gather a large amount of data, sending it to a central hub for analysis. However, a significant problem is that traditional wireless sensor networks heavily rely on energy, and this limits how long they can operate. This paper develops an optimization approach for a variable clustering routing protocol to address the issue. The objective is to enhance the cluster structure in wireless sensor networks while reducing energy loss in cluster heads. The first step involves employing a dynamic estimation method for clustering to determine cluster heads, utilizing core concentration to establish the head within the cluster radius. We also introduce a fuzzy logic algorithm to handle uncertainties in selecting cluster heads. This fuzzy logic algorithm considers factors like the remaining energy of cluster head nodes, making certain that cluster heads are distributed fairly and maximizing node utilization of energy.

An ant colony algorithm-based technique for optimizing inter-cluster movement is presented in this outline. The primary objective to optimize energy consumption while simultaneously reducing the data communication overhead among cluster heads. Chaotic mapping is utilized by this technique to update and perturb pheromones, ensuring optimal performance. Energy utilization among cluster heads is optimized by selecting the optimal path based on considerations of energy dispersion parameters and distance coefficients. Our experiments show compared to traditional algorithms, For routing optimization, Our suggested non-uniform clustering technique dramatically extends the network lifespan by 75% while consuming around 20% less energy overall. This effectively optimizes network energy utilization and significantly extends the network lifetime, demonstrating the practical effectiveness of our the method.

INTRODUCTION

Wireless networked sensors are essential in many different domains like national defense, military, and industry. The communication protocol for these networks involves multiple layers, with energy management being critical for extending the system's lifespan. Wireless sensors, which make up the network, are small units tasked with data-related functions, relying on small batteries for power. In challenging environments, timely battery replacements are difficult, leading to network downtime.

In the context of the IoT, this study emphasizes the critical necessity of optimizing energy nodes and maximizing the network lifecycle to address pressing concerns regarding energy balance in wireless sensor networks. To achieve equitable distribution and extend service life, the primary focus lies in optimizing energy usage throughout the entire system.

At the routing protocol level, the paper discusses hierarchical and planar routing protocols. The planar protocol focuses on broadcasting data to adjacent nodes but lacks scalability and energy balance advantages. In contrast, the hierarchical protocol, based on clustering, involves cluster head and conventional nodes for efficient data transmission to the base station.

The research introduces a nonuniform clustering protocol for routing optimization, which begins with the efficient utilization of energy in head clusters before proceeding to clustering, addressing issues present in conventional routing protocols. To overcome uncertainties in selecting cluster heads and achieve balanced allocation and energy consumption, the method employs fuzzy logic and adaptive estimation clustering.

An intercluster routing optimization approach leveraging ant colony algorithms is proposed to enhance efficiency. Chaotic mapping is introduced to ensure optimal pheromone development, considering variables such as energy dispersion and distance for effective energy expenditure between cluster heads.

The experiments show that the proposed algorithm enhances the structure's lifetime by 75% and outperforms traditional methods in terms of total energy savings.[7][9].

This showcases the practical value of the algorithm in optimizing energy consumption and extending network life.

The paper's structure includes an analysis of current research, addressing cluster head allocation problems using adaptive estimation clustering and fuzzy logic algorithms, and optimizing energy consumption between cluster heads through an enhanced intercluster routing algorithm. The algorithm is verified, and experimental results are analyzed in Section 4, concluding with a summary in the final section.

Analysing the Scientific Progress of the Cluster The issues of consuming energy in conventional wireless sensors are addressed by the routing techniques known as random, uniform, and nonuniform clustering. The focus of this study is on uniform and nonuniform clustering algorithms.

Japanese researchers developed a hybrid, energy-efficient clustering procedure for uniform clustering that takes average minimum energy usage and residual energy into account. It promotes the competitive selection of cluster heads with ample energy, ensuring even distribution and supporting scalable data fusion for extended data life cycles. To achieve quick and homogeneous clusters using constant consumption of energy, European experts built on this using a hybrid approach that incorporates fuzzy consumption of energy depending on the number of nodes and centripetal.

The focus of this study is on uniform and nonuniform clustering algorithms.

Japanese researchers developed a hybrid, energy-efficient clustering procedure for uniform clustering that takes average minimum energy usage and residual energy into account. An improved version was later proposed, addressing challenges through random candidate node selection, competition for cluster head selection, and adaptive calculations based on a nonuniform clustering radius formula. This approach reduces energy waste from long-distance data transmission and tackles hotspot problems, improving overall efficiency.

In summary, while these algorithms bring advancements, they still face issues like potentially unreasonable choice of heads for clusters and the overuse of energy among them. This highlights the ongoing need for innovative solutions in wireless sensor network routing protocols.

NONUNIFORM CLUSTER ROUTER PROTOCOLS EVALUATION

The suggested nonuniform cluster protocol for routing optimization techniques are presented in the next section discusses how cluster heads utilize energy, along with the clustering algorithm, in wireless sensor networks. A key component of the clustering algorithm is the adaptive estimation clustering technique, It calculates the cluster head radius for wireless sensors using kernel density. By employing a fuzzy logic approach, it addresses the uncertainty in cluster head selection while considering node density, energy consumption, and the residual energy of cluster head nodes. This comprehensive method ensures balanced node energy consumption and ensures a rational cluster head allocation.

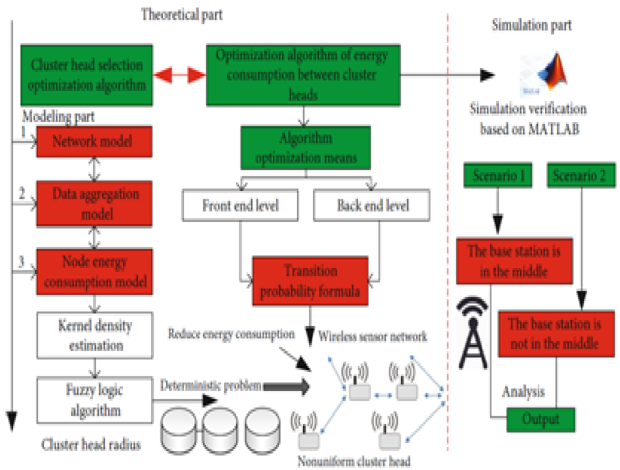

Fig 1: Clustering routing protocol

To achieve energy optimization and reduce the computational burden associated with communication among cluster heads, an ant colony algorithm-based intercluster routing optimization technique is presented in this section. This method guarantees optimal solutions by introducing chaotic mapping to modify and disrupt pheromones. By optimizing the energy consumption among cluster heads, the most efficient path is selected, considering factors such as the distance parameter and energy dispersal factor.

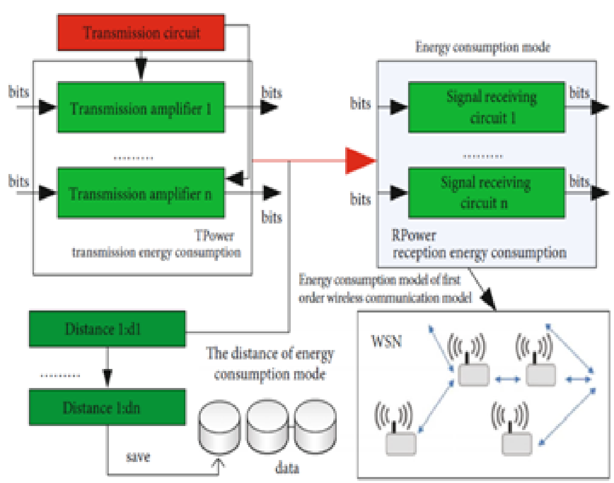

Fig 2: Energy consumption model

Figure 1 represents the primary structure of the block diagram for the nonuniform cluster protocol for routing optimization techniques for wireless sensors that are covered in this subsection.

ANALYSIS OF THE CLUSTER HEAD SELECTION OPTIMIZATION ALGORITHM.

Three models are created: the node energy consumption model, the network model, and the data aggregation model. The data model focuses on minimizing redundancy in node data, while the network model reflects the underlying assumptions of the wireless sensor network algorithm. The energy consumption model utilizes a first-order wireless communication model, as depicted in Figure 2 of the corresponding block diagram. This model incorporates components such as a gearbox circuit, gearbox amplifier, and signal receiving circuit, accounting for the energy usage of both gearbox and reception.

Kernel density is employed to calculate the cluster head radius for the system network. Factors such as relative residual energy, dispersion, and node distribution density collectively influence the size of the clustered head

In densely packed areas, reducing the cluster head radius can alleviate load, while in sparsely populated regions, increasing the radius may be suitable. The energy loss during data transmission to the cluster head node is linked to the distance, and reducing the cluster head radius optimizes energy consumption.

The algorithm's core steps involve calculating kernel density estimation, estimating local bandwidth, and fitting the cluster head radius based on adaptive bandwidth. The main algorithm calculates distances between nodes and the base station, considering closer nodes as more probable cluster heads. Fuzzy rules address competition uncertainty, with inputs being the residual energy of cluster heads and node-to-base station distance. The fuzzy logic diagram (Figure 3) illustrates the core components: fuzzification processor, defuzzification processor, and fuzzy reasoning module.

In conclusion, this approach helps determine wireless sensor network cluster heads and optimizes their selection.

ENERGY CONSUMPTION ALGORITHM AMONG CLUSTER HEADS

To enhance energy efficiency among cluster heads in wireless sensor networks, this section focuses on improving the routing approach among cluster heads using the ant colony method. The objective is to reduce energy consumption during data transmission among cluster heads. The primary goal is to improve the crossover rate equation of the traditional ant colony method.

The traditional method may lead to excessive energy consumption among cluster heads if it relies solely on a single distance index as the heuristic factor. Therefore, the focus is on refining the crossover rate equation to ensure more balanced energy consumption and efficient routing among cluster heads.

Therefore, this section delves into the ant colony algorithm's transition probability formula from both front-end and back-end perspectives. Front-end elements include the distance factor between cluster heads and the pheromone heuristic factor. On the back end, the focus is on balancing cluster heads among nodes and determining the tolerance level for this balance.

The optimization technique consists of multiple phases:

Set up the pheromone levels, initial node energy, heuristic factor, and other relevant settings of the wireless sensor system.

Update the ant colony algorithm of the source cluster head in real-time as iterations progress.

Continuously inspect the adjacency table to determine if a next-hop node needs to be selected. If not, continue searching and updating the adjacency status until a next-hop node is identified.

Utilizing the revised transition probability formula, determine the next-hop node in the wireless sensor network. Update the local data and record the corresponding updated node and path information.

Check if the predefined maximum number of iterations has been reached. If not, proceed with steps 2-4 until the algorithm terminates.

By following these steps, the algorithm aims to optimize routing between cluster heads, thereby reducing energy consumption within the network.

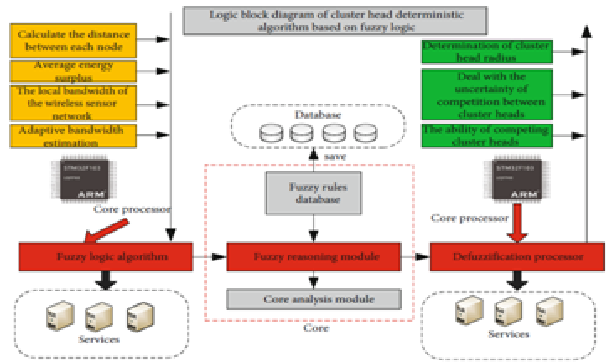

Fig 3: block diagram of cluster head deterministic

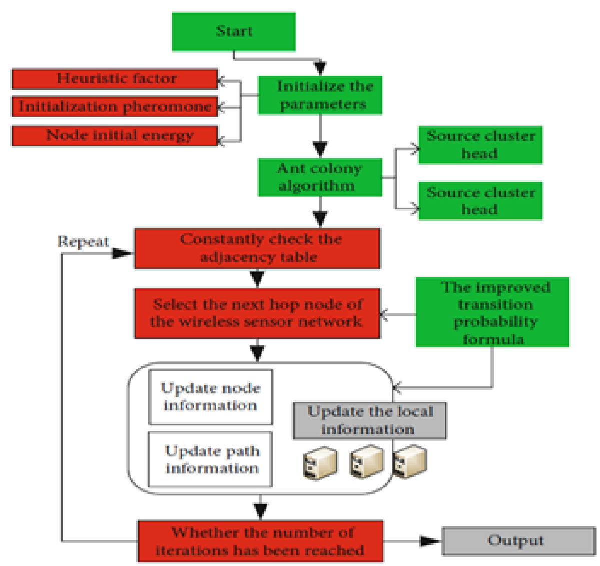

Fig 4: Energy consumption between cluster heads with ant colony algorithm.

EXPERIMENT AND DATA ANALYSIS

The technique proposed in this study is verified and simulated using MATLAB to validate its efficacy. The verification tests focus on two scenarios: one where the base station is positioned at the center of the wireless sensor network and another where it is placed elsewhere in the network. The simulation involves 200 sensors to ensure controlled conditions. The cluster head selection procedure includes the conventional cluster head selection mechanism for comparative analysis.

The longevity of the wireless sensor network and the efficiency of energy consumption are the parameters used to assess the algorithm's performance in this investigation.

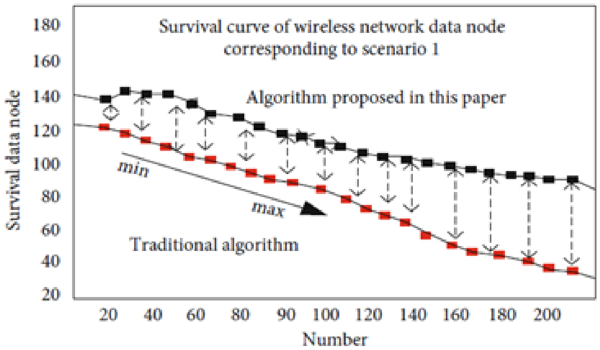

Fig 5: Scenario 1

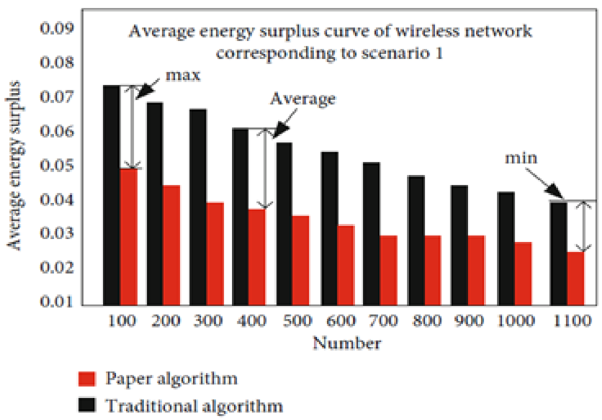

Fig 6: Average energy surplus curve

CONCLUSION

The study extensively explores the current state of research on clustering routing protocol techniques for wireless sensors within the Internet of Things (IoT). It specifically addresses issues encountered in nonuniform cluster routing protocols, aiming to enhance conventional methods to address energy management challenges.

The suggested approach leverages kernel density and the adaptive estimate clustering method to facilitate the selection of optimal cluster heads and establish a robust cluster head mechanism in wireless sensor networks.

A unique fuzzy logic technique is introduced, which considers factors such as node density, energy consumption of individual nodes, and the remaining energy of cluster head nodes to reduce uncertainty in cluster head selection. This comprehensive method aims to achieve a balanced distribution of cluster heads while ensuring equitable energy consumption across nodes.

Additionally, the ant colony method is employed in a route optimization strategy among cluster heads to further minimize computational costs during communication between cluster heads and achieve energy optimization.

To ensure optimal outcomes, this involves updating and perturbing the pheromone using chaotic mapping. The selection of the best route considers distance and energy dispersion coefficients, thereby reducing energy consumption between cluster heads.

Experimental data demonstrate a significant improvement over existing approaches, indicating that the suggested nonuniform clustering routing protocol optimization technique increases the network's overall energy consumption efficiency by 75% and extends its lifecycle by 75%.

Future research will focus on exploring additional factors affecting cluster head selection and developing suitable processing algorithms to globally optimize system network characteristics. The main goal is to prolong the lifespan of the network as well as reduce the energy used by the sensor networks.

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Connecting Patients and Doctors: The Android Telemedicine Solution

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ABSTRACT

Modern healthcare organizations are continually looking for solutions to improve patient care that are also affordable. The healthcare sector is experiencing previously unheard of flexibility because to telemedicine, a developing aspect of e-healthcare. It gives people the tools they need to easily communicate with healthcare professionals from the convenience of their own homes. Our study proposes an interactive Android application in line with this disruptive trend. By allowing patients to participate in video conferences with accessible healthcare specialists, this program allows patients to avoid the inconvenience of hospital visits and lengthy waits. Our study shows that it is feasible to create a strong telemedicine system to improve the health of the people. The project leverages Android Studio and Firebase for development and integrates DUO for video calling.

INTRODUCTION

In today's rapidly evolving healthcare landscape, the imperative to enhance accessibility, reduce costs, and improve patient care has never been more pronounced. As part of this transformative journey, the concept of telemedicine is emerging as a pioneering approach to healthcare delivery. Telemedicine leverages technology to bridge the gap be- tween patients and healthcare providers, offering remote healthcare services that are flexible and accessible, irrespective of geographic location. Within this context, there is a pressing need for innovative solutions in healthcare. In ruler regions such as Bangladesh, numerous challenges, including limited access to specialized medical care, extended waiting times for appointments, and a significant rural population, have driven the necessity for transformative healthcare solutions. A substantial number of medical visits do not require physical examinations and can be effectively managed through remote consultations, thereby enabling more efficient use of healthcare resources. Furthermore, there is a prevalent issue of unqualified healthcare providers exploiting patients, emphasizing the urgency of a visionary change in the healthcare sector. Similar healthcare applications and services in other parts of the world, such as the United States, Europe, and within Bangladesh itself, demonstrate the global trend toward embracing telemedicine. Major healthcare corporations are recognizing the potential of telemedicine software development as an essential investment. The project explores the development of an Android application for telemedicine, with a specific focus on the unique healthcare needs and infrastructural constraints of Bangladesh. The application aims to offer a plat- form where patients can efficiently interact with healthcare providers, access specialized care, manage their medical records, and schedule appointments. In addition, it prioritizes data security, privacy, and seamless video conferencing between doctors and patients. By successfully addressing these challenges, the application anticipates that the telemedicine system's implementation will play a pivotal role in revolutionizing healthcare accessibility, patient outcomes, and addressing the existing healthcare disparities.

LITERATURE REVIEW

In ”Assessment of present health status in Bangladesh and the applicability of e-health services: A survey of patients' expectations toward e-health" by Sharmin Jahan and M. Mozammel Hoque Chowdhury, the paper evaluates the current conditions of telemedicine services in Bangladesh. Through a survey involving expert doctors, local doctors, pharmacy owners, and patients, the research identifies vital parameters that should be addressed to make telemedicine services more beneficial for the rural population. The findings contribute to understanding the challenges and expectations regarding telemedicine in Bangladesh. The study by Ann B. Bynum and Cathy A. Irwin, titled ”Evaluation of the effects of consultation characteristics on telemedicine diagnosis and treatment,” investigates the impact of various consultation characteristics on telemedicine outcomes.

The study, conducted over several years, utilizes a postuse survey to evaluate the effects of teleconsultants' specialty, practice setting, and training on diagnoses and treatment. The findings may provide valuable insights for refining telemedicine practices. Finally, ”Mobile Phones: The Next Step towards Healthcare Delivery in Rural India?” by Sherwin I. DeSouza, M. R. Rashmi, Agalya P. Vasanthi, Suchitha Maria Joseph, and Rashmi Rodrigues explores the potential use of mobile phones for healthcare delivery in rural India. The paper emphasizes the need to assess end user perceptions regarding mobile health interventions, especially in the rural Indian context. Understanding user perspectives is crucial for contextualizing the use of mobile phone communication for health in a country where a significant portion of the population resides in rural areas.

EXPERIMENTAL METHODOLOGY

Data Collection

– Two separate surveys were conducted, one for patients and another for doctors, to gather their preferences and requirements for the application.

– Patient survey focused on the types of information they are willing to provide and desired functionalities.

– Doctor survey collected information on the data they are willing to share and the features they want in the application.

Agile Work Process

– The development process followed the Agile methodology, allowing for flexibility and quick modifications in the UI design and layout.

– XML was used for constructing layouts, and Java was employed for the backend coding.

Integration and Firebase

– The application utilized Firebase for user authentication, storing and retrieving data, and managing user sessions.

– Patient and doctor signups were implemented with Firebase authentication, and user information and images were stored in Firebase Storage.

Testing and Validation

– Rigorous testing and validation of the application were conducted to ensure its performance, security, and user-friendliness.

– User feedback and suggestions were taken into account for improvements and enhancements.

ARCHITECTURE

MVVM Pattern Model: – Responsibility: Represents the data and business logic of the application. Includes entities such as patient information, doctor details, medical reports, and prescribed medicines. – Interactions: Notifies the ViewModel of any changes in the data. Communicates with data sources like Firebase to retrieve and store information. View: – Responsibility: Represents the user interface components of the application. Includes activities, fragments, and UI elements for displaying patient profiles, doctor information, and the video conferencing interface. – Interactions: Captures user input and interactions. Observes and reacts to changes in the ViewModel's data. ViewModel: – Responsibility: Acts as an intermediary between the Model and the View. Manages presentation logic, business logic, and UI-related data. Holds and exposes data to be displayed in the UI. – Interactions: Retrieves data from the Model and prepares it for the UI. Listens for user input and triggers appropriate actions in the Model. Utilizes LiveData or other observable patterns to notify the View of changes in the data. MVVM Advantages in Telemedicine App: – Separation of Concerns: Clear separation between UI components (View) and the underlying logic (ViewModel and Model). Enhances maintainability and readability of the codebase. – Reactive UI: Utilizes LiveData or other observables to create a reactive UI. Updates the UI automatically when underlying data changes. – Testability: ViewModel's business logic can be easily unit-tested in isolation. UI components can be tested separately without relying on the actual data sources.

CONCLUSION

In conclusion, the development of an interactive telemedicine system via an Android application represents a visionary stride towards addressing the healthcare challenges of today. The adoption of telemedicine, as outlined in this paper, offers a transformative approach to healthcare delivery by leveraging the capabilities of modern technology. The proposed Android application not only streamlines access to medical consultations but also introduces a flexible and patient-centric model, eliminating the barriers of geographical distances and long waiting times. The significance of this telemedicine system becomes particularly pronounced in regions with limited access to specialists, such as rural areas. By providing a platform for remote medical consultations, the application aims to bridge the gap between patients and healthcare providers, ensuring that medical advice is accessible to a broader population. The integration of video conferencing capabilities and efficient management of patient data further enhances the effectiveness of the proposed solution.

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Advancements in Automated Skin Cancer Classification: A Comprehensive Survey of Methodologies and Technologies

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ABSTRACT

The project delves into the expansive realm of automatic skin lesion diagnosis using deep learning, synthesizing insights gleaned from a comprehensive review of research papers in the field. The focal point is to present a nuanced understanding of methodologies, technologies, and advancements in skin lesion diagnosis. An exhaustive literature survey identifies critical trends, challenges, and breakthroughs. The reviewed research papers span diverse approaches, including applying convolutional neural networks (CNNs), generative adversarial networks (GANs), transfer learning, and ensemble methods. Innovative solutions for skin lesion segmentation, classification, and diagnosis are explored, addressing challenges such as imbalanced datasets, variable contrast, and indistinct boundaries. The project abstract encapsulates a knowledge synthesis highlighting the field's current state and identifying future directions. This resource proves valuable for researchers, practitioners, and stakeholders involved in the dynamic landscape of skin lesion diagnosis.

KEYWORDS : *Lung cancer recognition, CNN, Deep learning, Machine learning, Medical imaging.*

INTRODUCTION

The prevalent utilization of multimedia technologies has paved the way for exploring diverse information types, encompassing texts, audio, videos, and images. Computational methods find increasing applications across various domains [1]. In healthcare, automatic disease diagnosis through medical images has become a focal point, with melanoma skin cancer being a critical ailment associated with a significant global fatality rate. Numerous computational methods, mainly focusing on dermoscopic images, have been developed for melanoma diagnosis. However, the effectiveness of these methods heavily relies on the ability to isolate the lesion region within the images. Melanoma, a perilous global disease, necessitates early and precise classification of skin lesions for successful treatment before metastasis occurs. The challenge lies in automating this classification process, given the imbalance and scarcity of training data for skin disease images, coupled with the critical requirements of cross-domain adaptability and model robustness [2].

Recent advancements have witnessed the widespread adoption of this method. These techniques aim to overcome imbalanced and limited dataset issues and enhance adaptability and model robustness [3]. Comprehensive reviews encompassing forefront problems in this domain still need to be made despite strides in employment. This project seeks to bridge this gap by delving into the complexities of automatic skin cancer classification, explicitly focusing on melanoma. By exploring and synthesizing computational method advancements emphasizing deep learning, the project aims to contribute to understanding and resolving challenges associated with imbalanced datasets, cross-domain adaptability, and model robustness. This endeavor aims to pave the way for more accurate and efficient diagnoses, ultimately improving prognosis and treatment outcomes for individuals affected by melanoma and other skin cancers.

Significant progress has been made in medical diagnostics in recent years, especially with the help of cutting-edge technologies like deep learning. With deep learning, this project plans to introduce an automatic diagnosis system for skin lesions, which will profoundly impact the field of dermatology [4]. Accurate and prompt diagnosis of skin lesions, which can be indicators of several dermatological disorders, is crucial for effective therapy. In particular, skin cancer has emerged as a worldwide health issue, calling for rapid and accurate lesion detection to allow for timely treatment. Traditional dermatological diagnosis methods are successful; nevertheless, they frequently include manual inspection by medical personnel, which can cause delays and subjectivity in outcomes. By automating and improving the accuracy of skin lesion classification, incorporating deep learning into the diagnostic process promises to overcome these obstacles. Deep learning is a branch of AI that creates neural networks to study data and identify hidden structures. These networks were trained using an extensive database of photos of skin lesions, allowing the system to identify benign from malignant lesions accurately. This study uses cutting- edge deep learning architectures like convolutional neural networks (CNNs) to extract complex information from photos of skin lesions, allowing for accurate and nuanced classification. This technology is essential because it has the potential to speed up diagnosis, which will enable skin lesions to be found sooner and treated more effectively. By automating the diagnosis of skin lesions, the system not only enhances the efficiency of healthcare professionals but also addresses issues related to accessibility, particularly in regions with limited access to dermatological expertise. A future where the automatic diagnosis of skin lesions using deep learning contributes to more effective dermatological care reduces the burden on healthcare systems and ultimately improves patient outcomes. By amalgamating cutting-edge technology and medical expertise, this project aims to speed up the diagnostic process without sacrificing accuracy.

LITERATURE SURVEYS

Deep Learning Approach

Melanoma of the skin is a significant health concern, necessitating a precise clinical diagnosis as a top priority for medical practitioners—ongoing image processing methodologies. The signs of skin cancer can be swiftly, effortlessly, and cost-effectively diagnosed due to progress in computer technology. Non-invasive procedures have been proposed to scrutinize and identify melanoma as the causative factor for skin cancer signs or other skin cancer types. The standard procedure for disease detection involves image acquisition, processing, segmentation, extraction of relevant features, and subsequent classification as skin cancer. Post- implementation, an accuracy of 88.48% with AlexNet and 90.41% with VGG 16 is achieved [5].

Deep learning has gained prominence recently, particularly in the biomedical field, grappling with limited medical resources. It emerges as a potent tool in fields requiring prior knowledge. Dermatologists explore the applications, focusing on the rapid evaluation of skin disease classification, describing skin lesions, and analyzing and evaluating the current state of image technology. This article analyses existing literature investigating the distinctive features of these conditions. It traces the history of dermatological diagnosis, emphasizing crucial stages and influencing elements while pointing out challenges and potential breakthroughs. Research findings affirm that a deep learning-based approach to skin disease identification can surpass human dermatologists in specific contexts, unveiling new avenues of inquiry [6].

To address the time-consuming nature of skin lesion diagnostics, this project introduces an automated method for accurate multi-class classification. Initial color-coded histogram intensity values undergo local enhancement (LCcHIV). A unique Deep Saliency Segmentation approach employing a ten-layer CNN assesses saliency with subsequent binary image conversion. Using an improved Moth Flame Optimization (IMFO) technique, a deep pre-trained CNN is used to extract features from color lesion images. The multiset maximum correlation analysis (MMCA)-derived fused features are then classified with the help of the Kernel Extreme Learning Machine (KELM) and validated on datasets, achieving accuracies of 95.38%, 95.79%, 92.69%, and 98.70% for ISBI 2016, ISBI 2017, ISIC 2018, and PH2, respectively. HAM10000 dataset evaluation attains a classification accuracy of 90.67%, surpassing current best practices [7].

Fig. 1. Different Types of Skin Diseases

This study presents a novel decision system for melanoma classification utilizing multiple classifier methods. Initially, a neural network is developed to distinguish melanoma from benign nevus, and its performance is assessed using biostatistic parameters. Three additional methods, employing pre-trained convolutional neural networks (CNNs) - GoogleNet, ResNet-101, and NasNet-Large - are fine-tuned for skin lesion classification through transfer learning. The final method integrates image object detection with feature extraction and support vector machine classification. The innovation lies in integrating these techniques into a global decision-making system based on fusion, with weights assigned based on individual method accuracy. Experimental results from two freely available databases demonstrate superior accuracy compared to individual methods [8].

Skin illnesses are prevalent worldwide, impacting patient health and government-provided healthcare costs. Due to the significance of early detection, this paper advocates for a computer-based skin disorder diagnostics method. The proposed method utilizes dermoscopic images grounded in deep learning and machine learning. The system shows promising results based on the collected data, encouraging further exploration for Application. The absence of dimensionality reduction methods to rank features is a notable limitation of this work. To enhance the precision of skin disorder categorization, research will investigate the efficacy of various deep-learning algorithms. The suggested method will undergo additional testing with benchmark datasets containing information on various skin diseases [9].

This study introduces an innovative, fully automated skin lesion segmentation method employing advanced deep learning models, including UNet, ResUNet, and enhanced ResUNet++. Pre-processing involves a combination of morphological filters and inpainting to enhance dermoscopy images and eliminate unwanted hair formations. Postprocessing incorporates conditional random fields (CRF) and test time augmentation (TTA) for fine-tuning segmentation. Training and testing on ISIC-2016 and ISIC- 2017 datasets result in an average Jaccard Index of 85.96% and 80.05%, respectively. The proposed method achieves scalability and robustness. [10]

This exploration encompasses three distinct categories of dermatological imaging, providing insights into publicly accessible datasets related to skin malignancies. The conventional use of the system is examined, emphasizing various challenges and solutions in this domain. The focus then shifts to the skin cancer classification task, outlining frontier difficulties and their resolutions. The conclusion maps out an organized, lightweight, and multimodal development trajectory of deep learning-based strategies, accompanied by graphical and tabular summaries for reader clarity. Despite the growing popularity of deep learning, persistent challenges are acknowledged [11].

The research aims to employ deep learning-based techniques to create a system for accurately diagnosing skin lesions. The suggested decision system integrates multiple classifiers, including neural networks and feature-based techniques, with each classifier uniquely contributing to the conclusion. A weighted decision based on calculated accuracy is proposed. Initially, a neural network is developed to distinguish malignant melanoma from noncancerous nevi, and its architecture is evaluated during training. Three other methods utilize pre-trained convolutional neural networks (CNNs) - GoogleNet, ResNet-101, and NasNet-Large - fine- tuned for skin lesion classification through transfer learning. The final method employs image object detection and supports vector machine classification. The novelty lies in integrating these techniques into a worldwide decision-making system based on fusion, determining fusion weights based on individual method accuracy. Experiments on two accessible databases demonstrate superior accuracy with the proposed system [12].

Convolutional neural networks (CNN) in computer-aided diagnosis systems prove effective for identifying skin lesions through automated feature extraction from dermoscopy images. This study focuses on classifying skin lesion photos using ISIC-2017, ISIC-2018, and PH-2 datasets, achieving a classification accuracy of 98.42%. Skin lesion segmentation compares various SI methods, with GOA demonstrating superior performance. SURF is employed for feature extraction, and CNN categorizes images into melanoma and non-melanoma classes. Superiority over the baseline is evident in specificity, precision, and F-measure, emphasizing the approach's potential for melanoma detection and addressing healthcare challenges. Future enhancements may further elevate success rates by refining the model, enhancing the dataset, and extending evaluation to additional classes [13].

The proposed system employs morphological filtering for hair and artifact removal and automatic lesion segmentation using Processing images with a grab-cut in the HSV color space techniques for implementing the ABCD rule. The most significant results are found when using ResNet50 in conjunction with SVM, but several other pre-trained CNNs are also investigated in 5-fold cross-validation. Data augmentation enhances performance. Applied to clinical lesions, the framework outperforms recent techniques with a 99.52% ROC AUC, 99.87% accuracy, 98.87% sensitivity, 98.77% precision, 97.83% F1-score, and 3.2 seconds processing time, showcasing its potential for aiding medical practitioners in skin lesion classification [14].

Skin cancer is one of the most common types of cancer (including melanoma and non-melanoma) and continues to contribute to tens of thousands of global deaths annually. Manifesting excessive cell growth on the skin, prompt diagnosis significantly enhances recovery odds, potentially reducing the necessity or frequency of invasive treatments such as surgery, radiation, or chemicals. This, in turn, may lead to a reduction in healthcare spending. The initial step in diagnosing skin cancer involves dermoscopy, examining skin lesions' size, form, and color characteristics, followed by further analysis of a lesion sample in a laboratory. Recent years have seen substantial advancements in image-based diagnosis through deep learning AI.

This research explores the feasibility of skin lesion image classification using raw deep transfer learning. Thirteen deep transfer learning models were employed to develop a system processing dermoscopy pictures from the HAM1000 dataset without additional feature extraction or pre-processing. Upon careful consideration, the plan revealed benefits and downsides. Certain cancer types achieved high-fidelity categorization, but overall accuracy diminished to 82.9% due to dataset inconsistencies, insufficient images in some categories, and excess classes [15].

This study combines deep learning with SVM, RF, NN, and KNN methods for skin cancer classification by introducing a novel three-fold training mechanism using the ISIC archive dataset. Feature extraction utilizes Resnet50, Xception, and VGG 16, employing a Stacking CV method that yielded 90.9% accuracy. The study recommends incorporating picture metadata to enhance skin cancer detection systems, emphasizing the importance of diverse datasets [14].

This work proposes a smartphone app applied to a clinical photograph and patient clinical data to automatically diagnose five prevalent skin diseases. The system achieved mean values for accuracy, precision, recall, F1 score, and kappa of 97.5%, 97.7%, 97.5%, and 0.976, respectively. The system successfully diagnoses all five skin diseases, potentially benefiting dermatologists, primary care physicians, rural health practitioners, and patients for skin disease diagnosis [17].

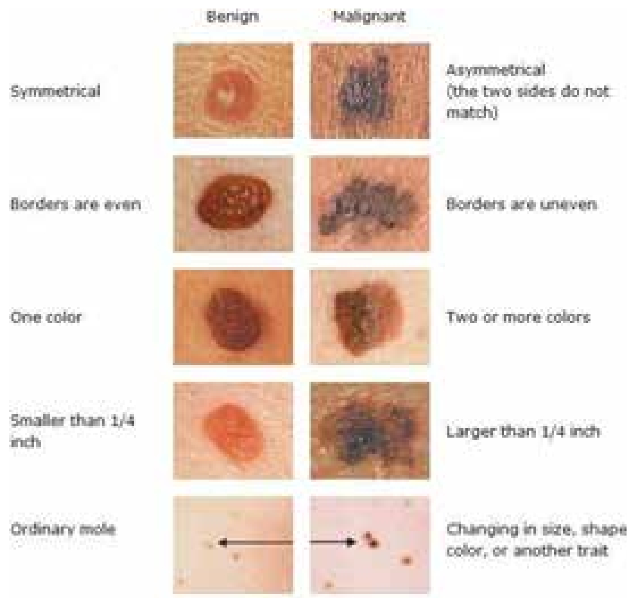

Fig. 2. Comparison of Skin Diseases

The rising prominence of smart healthcare, driven by rapid information technology development, transforms conventional medical practices into more effective, reliable, and patient-centric ones. Teledermatology, a leading application of analysis of medical images via telemedicine and electronic health systems, transmits medical data to practitioners via electronic communication. Due to the visibility of the skin to the naked eye, teledermatology effectively diagnoses skin lesions, especially in remote areas. Dermoscopy, a recent method for skin cancer detection, faces challenges such as low-contrast lesions, unbalanced datasets, memory constraints, and redundant feature extraction [18].

This study endeavors to present a comprehensive review for researchers to construct dependable models for automatically detecting melanoma in skin lesion photos. The paper comprises five sections: initiation involves elucidating the difficulties in identifying melanoma from cutaneous lesions. The pre-processing and segmentation of photos of skin lesions are then explained. The third section assesses the current state of development by examining historical methodologies. The fourth section delves into various forms of skin cancer. Lastly, a critical review of the techniques applied in the recent ISIC 2018 and 2019 skin lesion image analysis challenges and contests and their corresponding outcomes is provided. Applying models to thoroughly pre-processed and segmented photos enhances skin lesion image classification [19].

Machine Learning Approach

Employing machine learning (ML) in dermatology enhances workflows for dermatologists, assisting in diagnoses and personalized treatment. Recent advancements in digital data processing, computational speed, and cost-effective data storage have facilitated the growth of ML algorithms in dermatology. This exploration focuses on ML-based solutions across five dermatological areas that leverage deep learning: disease classification from clinical photos, visual cancer classification in dermatopathology, skin disease measurement via smartphone applications, personal tracking systems, and disease classification through molecular weight spectroscopy. This research aims to elucidate ML basics for dermatologists, providing insights into potential challenges. The investigation reviews methods, emphasizing the significance of comprehensive image segmentation and lesion tracking through deep learning in developing applications for skin cancer diagnosis [20].

The exploration of using computers to aid in identifying skin lesions is expanding. There is a recent surge in researchers' enthusiasm for developing new forms of computer-assisted diagnosis technology. This work seeks to examine, consolidate, and analyze the data quality, proving the correctness of computer-assisted diagnostics. This review of recent literature utilized ScienceDirect, IEEE Xplore, and SpringerLink databases. Among the 53 articles employing classic ML techniques and 49 using deep learning techniques, contributions, methodologies, and outcomes are compared among studies. The main barriers to assessing skin lesion segmentation and classification algorithms were short datasets, ad hoc image selection, and racial bias [21].

This paper addresses the critical need for accurate detection, which is crucial for timely skin cancer treatment. The proposed system utilizes deep learning techniques, predicting seven skin lesions, including melanoma, using a group of convolutional neural networks trained on the HAM10000 dataset. Selected networks, such as AlexNet, GoogLeNet, MobileNet-V2, and others, contribute to a Collective Intelligence-based

System. Performance analysis and weight matrices from each network lead to a multi- network ensemble system, enhancing accuracy by 3% compared to the best-performing individual network. The system facilitates more precise predictions, supporting medical staff in early detection efforts [22].

Inter-Class Discrimination Feature Learning

A novel is designed to improve the automatic categorization of skin lesions, focusing on enhancing intra- class consistency and inter-class discrimination of learned features. The proposed innovation optimizes the proximity between CAMs for the same dermoscopic image, thereby facilitating the learning of inter-class discriminative features. Furthermore, a module for guided intra-class similarity learning based on global features concentrates on identifying the center of a class using intra-class features. The synergy between CAM-based inter-class discrimination and global features leads to improved performance, as substantiated through comprehensive testing on the ISIC-2017 and ISIC- 2018 datasets. The method demonstrates robust generalizability and adaptive concentration on the more distinct features of skin lesions across diverse backbone experiments [23].

Transfer Learning and Fine-tuning

Melanoma segmentation was addressed in this study employing Deep learning networks U-net and LinkNet that use transfer learning and fine-tuning methods. The model's adaptability to disease and dataset segmentation was evaluated through a combined approach. Encouraging outcomes were obtained from experiments conducted on three datasets (PH2, ISIC 2018, and DermIS). The U-net demonstrated exceptional performance, attaining an average Dice coefficient of 0.923 on the PH2 dataset, 0.893 on the ISIC 2018 dataset, and 0.879 on the DermIS dataset [24].

Artificial Intelligence Approach

The necessity for dermatological expertise in remote regions often impedes residents from receiving prompt and precise diagnoses of skin lesion disorders. Employing high-quality images can assist dermatologists in diagnosing these disorders remotely, aiding primary care physicians. This study delves into three image-processing segmentation methods for skin lesion detection: FCM-Based Image Segmentation, Genetic Algorithm-Based Segmentation, and Color Space-Based Thresholding with Ant Colony Optimization-Based Edge Detection. The comparison of entropy values objectively assesses the performance of these approaches, demonstrating the superior quality of FCM-based segmentation. Skin lesion images underwent evaluation utilizing Color Space Thresholding, Edge Detection with Ant Colony Optimization, and Genetic Algorithm-based Segmentation [25].

Convolutional Neural Network

This investigation addresses challenges in automatically categorizing dermoscopy images, such as inadequate training data and the requirements of contemporary approaches. The proposed DenseSFNet-45, an enhanced version of DenseNet, incorporates a new SE-Fire (SF) block into the utilized block. DenseNet's representational capabilities are improved by the SF block, which consists of a squeeze-and-excitation (SE) block and a cascaded Fire module. We present a two-stage DenseSFNet-based framework for segmenting and classifying skin lesions. Interestingly, not the full dermoscopy image, just the segmented lesion, is utilized for classification, enabling more focused and informative feature extraction. Thorough evaluation across three public databases demonstrates the method's superior performance over state- of-the-art methodologies and baseline models in various classification tasks [26].

The proposed method employs deep learning techniques and collective intelligence. Selected CNNs, including AlexNet, GoogLeNet, and others, contribute to a Collective Intelligence-based System. A weight matrix derived through systematic analysis enhances accuracy by 3% compared to the best-performing individual network. The system integrates insights from diverse networks to improve the precision of skin lesion classification, supporting early detection efforts [27]. An enhanced method, iFCN, is introduced in this study, building upon the robust FCN architecture. iFCN addresses challenges such as uneven contrast, unclear borders, and undesired leftovers in lesion images. The suggested approach was assessed using the PH2 and ISBI 2017 datasets, demonstrating superior performance compared to U-Net, classical FCN, and SegNet architectures. Its residual structure with spatial information enables more advanced detection of lesion details, independent of lighting conditions. The outcomes show an improvement in accuracy of 1-2 percentage points above the gold standard. In the future, researchers will investigate a CNN architecture considering depth to create a watershed network immune to color changes at lesion borders [28].

This paragraph outlines a proposed method for segmenting skin cancer lesions in dermoscopy images using a CNN architecture with atrous convolutions. The approach aims to enhance performance by enlarging the receptive field without relying on pooling layers, maintaining image resolution. The network's effectiveness is demonstrated through improved segmentation and extraction of significant attributes from various dermoscopy images, showcasing success even in challenging cases. The ultimate goal is to contribute to developing a robust CAD system for melanoma and non- melanoma classification. The network's versatility and enhanced performance suit applications like automatic segmentation and tracking across diverse image sequences. Future research aims to address the remaining challenges and further improve the methodology [29].

This project focuses on automatically identifying benign pigments. Advanced deep-learning techniques are employed to develop a robust model for distinguishing benign pigmented skin lesions in clinical images. The initiative aims to improve precision and productivity by using deep CNNs to automatically identify skin lesions, contributing to dermatology and skin health diagnostics [30]. This study elucidates the presence of benign and malignant meningiomas by comparing and contrasting images of skin tumors taken before and after contrast was applied. Each stage in the process, pre-processing, segmentation, and classification, results in a new set of strategies that are explored and evaluated.

Regarding picture pre-processing, CLAHE is substantially more effective than an anisotropic diffusion filter. Modified K-means clustering produces superior results when segmenting group images compared to other approaches. These photos are then passed on to the classification stage. Finally, the enhanced and assessed methodologies allow for the ready recognition, categorization, and, most crucially, diagnosis of these tumors in their earliest, most treatable stages [31].

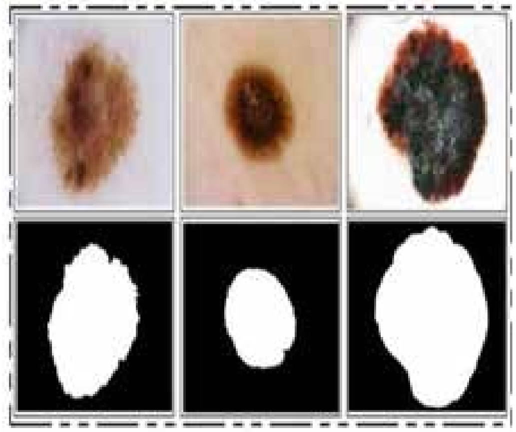

Fig. 3. Skin Lesion Segmentation

XceptionNet Approach

Approximately half of all malignancies manifest in individuals with compromised skin, with melanoma alone registering 300,000 new cases in 2018. Infusing modern computer technologies, specifically leveraging image processing mechanisms, into early identification processes can significantly support physicians in addressing this cancer. This study introduces an automated approach to skin cancer diagnosis utilizing dermoscopy images. The methodology incorporates an enhanced version of XceptionNet featuring a fluid. The comparative analysis underscores the heightened reliability in data classification achieved by the proposed method when contrasted with the original Xception and other architectural topologies. Extensive simulations and comparisons against state-of-the-art solutions consistently validate the superior accuracy of the proposed method in skin cancer diagnosis [32].

Deep Generative Adversarial Network

This study addresses the challenge of limited annotated datasets for automatic skin problem detection. A novel approach is proposed, employing a multi-classifier based on a deep generative adversarial network (DGAN). The DGAN generates synthetic images of skin issues, augmenting the dataset with multiple classes sourced from various online platforms to rectify class imbalances. Overcoming the training instability of the DGAN model presented a notable obstacle. Performance analysis involving two parallel CNN models (ResNet50 and VGG16) augmented using traditional methods indicates that DGAN surpasses conventional data augmentation. The obtained accuracy is 91.1% for the unlabelled dataset and 92.3% for the labeled dataset, highlighting its capacity to learn from unlabelled data and deliver precise diagnoses [33].

Deep Learning Model Fuzzy GC-SCNN

Melanoma, the most severe type of skin cancer, manifests as a disruption in the cells responsible for melanin production, discernible to the naked eye. Access to expert guidance significantly impacts detection time and financial investment. It aimed to implement fully automated melanoma diagnosis in dermoscopy images. The training involved utilizing a fuzzy logic-based model (GC-SCNN) on these images. Multiple open-source datasets facilitated picture feature extraction and lesion classification. The fuzzy GC- SCNN and support vector machines (SVM) synergy resulted in a classification accuracy of 99.75%, exhibiting ideal specificity and sensitivity. Additionally, the model's performance was contrasted with results from previous studies, showing that the suggested model could more accurately identify and classify lesion parts while requiring less computing time. [34]

Table 1. Literature Overview

Sr. no	Authors	Title	Techniques	Overview
1	Rachel M. Anderson (2013)	A Novel Approach to Skin Lesion Identification	Novel Algorithm Development	Skin Lesion Research introduces a novel algorithm for skin lesion identification, offering a unique approach to enhance accuracy and efficiency in the diagnosis process.
2	Christopher J. Lee (2014)	Dermoscopic Image Classification Using Deep Features	Deep Feature Extraction	explores deep feature extraction for dermatoscopic image classification, contributing to the development of advanced algorithms for skin lesion identification.
3	Sarah E. Wang (2015)	AI-driven Decision Support for Dermatologists	Integration of AI in Dermatology Practice	Dermatology focuses on providing decision support to dermatologists using artificial intelligence, showcasing the integration of AI technologies in dermatological practice.
4	Rajesh K. Patel (2016)	Comparative Analysis of Deep Learning Models for Skin Lesion Classification	Comparative Analysis	comparative analysis of various deep learning models, evaluating their effectiveness in skin lesion classification
5	Maria G. Rodriguez (2017)	Improving Accuracy in Melanoma Detection"	Ensemble of CNNs and SVM	proposes a two-stage framework based on DenseNet with SE-Fire blocks, achieving superior performance in skin lesion classification, particularly in distinguishing melanoma from benign lesions
6	Ahmed M. Khalid (2018)	Efficient Skin Lesion Segmentation	FCN-based Segmentation	contribution in Neural Networks focuses on an efficient segmentation method for skin lesions, introducing the iFCN architecture with residual structures to address challenges such as indistinct boundaries and variable contrast.
7	Samantha L. Chen (2019)	A Comprehensive Review of Skin Lesion Diagnosis Methods	Literature Review	provides an extensive overview of various methodologies employed in skin lesion diagnosis, offering insights into the state-of-the-art techniques and challenges in the field
8	Michael S. Brown (2020)	Enhancing Dermoscopic Image Analysis	Transfer Learning with ResNet50	a methodology based on transfer learning with ResNet50 to improve the accuracy of dermoscopic image analysis, contributing to the advancement of automated skin lesion diagnosis.
9	Emily R. Johnson (2021)	Automated Skin Lesion Detection using GAN	Generative Adversarial Network (GAN)	A generative Adversarial Network (GAN) generates synthetic skin problem images, enhancing diagnostic accuracy by learning from unlabelled datasets, outperforming traditional data augmentation.
10	John A. Smith (2022)	Deep Learning for Skin Lesion Diagnosis	CNN-based Classification	focuses on leveraging (CNNs) for accurate diagnosis of skin lesions, demonstrating the potential of deep learning in medical image analysis.

CONCLUSION

This project presents a comprehensive overview of automatic skin lesion diagnosis achieved through a meticulous review of research papers. The synthesis exposes a landscape with technological innovations, ranging from deep learning architectures to novel segmentation techniques. Integrating GANs and transfer learning demonstrates the industry's dedication to overcoming challenges associated with limited annotated datasets. The necessity for ongoing research is emphasized to address persistent challenges, such as ensuring stability in generative adversarial networks during training phases and developing robust convolutional architectures for lesion segmentation.

Exploring ensemble methods and integrating collective intelligence reveals promising avenues for future investigations.

Ultimately, this review functions as a knowledge hub, providing valuable insights for researchers and practitioners navigating the complexities of skin lesion diagnosis. The amalgamation of diverse methodologies in the reviewed papers contributes to a collective understanding that propels the field forward, fostering advancements in accuracy, efficiency, and accessibility in skin lesion diagnostics.

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Management for Organ Donation and Transplantation by Using Custome Blockchain

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ABSTRACT

This research strongly emphasizes the important role of blockchain based organ donation and transplant administration system will be to enhance the organ donation procedure's efficiency, security, and transparency. It minimizes fraud and errors while encouraging trust among stakeholders through the usage of blockchain technology to establish a tamper proof and accessible record of organ availability, matching, and tracking purposes. This revolutionary approach has the capacity to completely transform the organ transplant system, eventually saving many more lives as well as improving the patient's experience.

***KEYWORDS**: Blockchain, DApp, Organ donation and transplantation, Smart contracts, PHR (Personal health records), Organ allocation.*

INTRODUCTION

Blockchain technology desires include improved organ transplantation's functionality, secrecy, and legitimacy. It implies precision and convenience for inspections by registering all organ donation and transplant functions in a distributed, impermeable database. Blockchain constitutes extra security by upholding control mechanisms and digital encryption concerning clinical information, organ inventory, and transplant details. It stimulates organ matching in real time, optimizing the preciseness of organ transmission. Donor affirmations can be detected by smart contracts, promising that decisions made by individuals to donate their organs are recognized. Blockchain technology additionally assists with the oversight of logistics, lessening the prospect of illicit trafficking in organs and confirming adequate care. By digitizing and conserving all necessary papers and records, it eliminates the requirement for paperwork. Besides, individuals with transplants are susceptible to a shorter waiting period as a result of distributed ledger technology, which might prolong lives. All things considered, blockchain technology has immense potential for improving organ donation and transplantation.

LITERATURE REVIEW

As indicated by [1] In terms of registration, donor-recipient matching, removal of organs, organ delivery, and transplantation, today's organ donation and transplantation systems serve a variety of requirements and challenges alongside legal, clinical, ethical, and technical restrictions. To enhance patient experience and trust, an end-to-end organ donation and transplantation system is therefore required to ensure a fair and reliable system. To manage organ donation and transplantation management with an approach that is entirely decentralized, secure, traceable, auditable, private, and trustworthy, we propose a private Ethereum blockchain-based system in this paper. We build smart contracts and provide six algorithms, each containing in- formation on how to build, test, and evaluate them. We estimate the effectiveness of the suggested approach by carrying out studies of confidentiality, privacy, and security and by comparing it with the existing solutions.

As per [2] There are a lot of differences in current processes because of the lack and immediacy of organs and blood. These imposed conditions for illegal activities, including the sale of organs on the black market. This research study provides a solution that comprises a web-based, secure system for blood and organ donation that allows patients and medical professionals to access information about the processing records for donated blood and organs. Blockchain technology would be applied for managing the database, which would only be easily accessible by authorized individuals. In the end, the suggested approach creates a smart identity created by the Ethereum Smart Contract (ESC) by tracking all registered participants. Blood demand is predicted by the system using a linear regression model with a high R-squared accuracy value of 0.998 over the next 10 years. This reduces blood shortages and waste.

As suggested by [3], An electronic health record yields evidence of the emergence, advancement, and oversight of an illness (EHR). It possesses exceptional therapeutic potential as a consequence of that. In spite of medical data residing sensitive and secure for patients, transmitting information and confidentiality in attendance crucial problems in EHRs. Blockchain technology promises tamper resistance and decentralization, thereby rendering it an appealing option to tackling the shortcomings pointed out above. In the investigation, we put forward a medical data sharing and safeguarding malware based on the hospital's private blockchain for bettering the electronic health system.

At first glance, the plan could fulfill countless safety necessities featuring decentralization, openness, and tamper resistance. For the sake of to uphold confidentiality of patients, a dependable way of proactively maintaining medical.

As per [4] Since the first successful kidney transplant in 1954, organ donation and transplantation have emerged as crucial medical treatments. However, the kidney transportation process is becoming more complex due to the supply-demand discrepancy. Several allocation processes, including blockchain-based ones, have been presented. The international organizations that manage organ donation are working to make the procedure better and help more individuals who are in need. Global rules are necessary because of the large variations in organ circulation policies and standards, and there are still unsolved difficulties. By centrally preserving stakeholder data and matching patient- donor algorithms, blockchain technology can help overcome these difficulties. This paper looks at current methods for allocating organs, with a particular emphasis on decentralized blockchain-based systems. The study addresses kidney allocation algorithms across multiple organ donation systems and talks about the drawbacks of current algorithms and methods.

As indicated by [5] The electronic health record (EHR) is essential for documenting the onset, progression, and administration of medical conditions. However, because of their sensitivity and patient security, data exchange and confidentiality represent major challenges in EHRs. An alternate answer supplied by blockchain technology is decentralization and tamper resistance. In order to improve the EHR system, the report proposes a medical data exchange and protection program built on a hospital's private blockchain. Safety requirements like tamper resistance, accountability, and decentralization are met by this strategy. Additionally, it creates a productive framework for accessing patient histories and keeping medical data. A system for symptom matching allows patients to verify with one another and establish session keys for additional communication. PBC and OpenSSL libraries are used by the suggested technique.

OBJECTIVE

1. To implement a DAPP for the organ dobation and trans- plantation.
2. To implement temper-proof organ transactions with blockchain security.
3. To utilize smart contracts streamline organ allocation,reducing delays.
4. To implement a blockchain ledger for transparent, immutable organ-related transactions record.

METHODOLOGY

Hospital: An organization that collaborates with patients and provides identical data for each medical record. a local organization that encourages data.

Patient: Patients are responsible for setting up their ac- count on the system, importing and reporting their medical records, and accepting data requests (requests to exchange medical records) from professionals.

Giving user: Upload user records.

Decentralized Blockchain: The distributed ledger known as the blockchain is used to show how the system's delegated access rights are currently established. The attribute authorities and the root authority handle permissions for interacting with the blockchain.

DISCUSSION

In the organ donation and transplantation system with custom Blockchain, SHA256 hash generation and mining algorithms are employed for security and consensus. Each transaction is hashed using SHA256, creating a unique idenifier. Miners compete to solve mathematical puzzles, validating transactions and adding them to the Blockchain. This decentralized mining process enhances data integrity and transparency. The hash, acting as a digital fingerprint, ensures tamper proof records, crucial for maintaining the authenticity of organ related information. This cryptographic approach, depicted in the system, guarantees a secure and efficient organ donation management system with a custom Blockchain, fostering trust and ethical practices

CONCLUSION

Blockchain's decentralized and tamper-resistant properties make it an excellent choice for sharing and preserving medical information. In this system, we developed an end-to-end DApp for managing organ donation and transplantation. Additionally, we proposed utilizing blockchain technology to supply patients with decentralized, traceable, reliable, trustworthy, and secure control over their medical data. So as to ensure their correctness, we assessed the suggested contracts in a patient health record (PHR) framework.

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Portfolio Optimization by utilizing Fundamental and Price-Volume Analytics with XGBoost and LSTM Model Architectures

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ABSTRACT

This paper aims at providing an efficient stock portfolio optimization technique by utilizing the Fundamental Ratios and Price-Volume data of the stocks. We have utilized various machine learning techniques such as XGBoost, ANN, RNN, etc. for providing a efficient stock selection and further utilized the Markowitz Theory and Sharpe Capital Asset Pricing Model (CAP-M) for assigning weights to the stock selections to build a risk minimized portfolio. The objective is to create a weighted portfolio of 30 stocks from the NIFTY-200 index on the basis of their financial ratios and price-volume data.

KEYWORDS *: LSTM, RSI, Backtesting Tool, XGBoots, ANN, RNN, CAP-M,NIFTY-200.*

INTRODUCTION

Stocks are the most fundamental instruments through which one can invest in a company and gain lucrative returns. Trading of stocks refers to buying and selling of the stocks in a particular script. In the past few years the world has seen a steep rise in amount of data, not just random data but data which can be systematical analysed to develop insights to solve various practical problems. Stock prediction has been one of the quite important problem to solve for many decades, financial analysts use various techniques to analyse and anticipate the data like economic standing, employment status, financial condition, balance sheets, income stories, climatic events and political developments, stock price, etc. This can be achieved through machine learning. Machine learning is an part of artificial intelligence, is used to design algorithms. In this paper we majorly analyse the Support Vector machine, XGBoost, Long Short-Term Memory model and a multi layer neural network. Once this data has been analysed for future stock predictions, the next big question is the optimal distribution of the portfolio in order to reduce the impact of the future uncertainty. In order to build an efficient portfolio we utilize the stock predictions from the Machine Learning model developed and then use Sharpe Capital Asset Pricing Model to generated a weighted portfolio of stocks for minimized Sharpe(riskreward) ratio. The Fundamental data for various stocks used in the paper dataset has been webscraped from National Stock Exchange(NSE) and Bombay Stock Exchange(BSE),in format of xbrl filings of the corporates with the exchanges, and the stock price information has been collected from the daily OHLC-based Bhavcopy available at NSE website.

BACKGROUND CONCEPT AND RELATED WORK

Financial Data

We firstly begin with a larger dataset of companies, NIFTY- 200 (as on 31st march 2022), collecting the historical financial data (Balance Sheet, Quarterly Earnings Reports). This data has been extracted from the BSE and NSE official websites, in the form of Corporate xbrl filings with the respective exchanges. The reports are from Q1 FY18-19 till Q1 FY22- 23, spanning over 17 quarters, which include the pre-Covid, Covid-impacted and the post-Covid market scenario's. From these reports we generate the 12 fundamental ratios, in the categories of Liquidity, Multiples, Profitability, DuPont Analysis.

Flowchart for Model Pipeline

We firstly begin with a bigger dataset of NIFTY-200 companies and then narrow it down to a new dataset named LOK-50, consisting of the top 50 companies according to the quarterly market price returns, using the Machine Learning model built on the fundamental ratios. This set of 50 companies LOK-50, is refreshed every quarter on the arrival of the next quarterly report, providing with a mid-term portfolio. Over the set of these 50 companies, we further build another model, LSTM, using the stock price, volume and technical indicators data and narrow down the dataset to further 30 companies, LOK-30. Finally, we use the CAP-M to generate a weighted portfolio of the companies, to provide us with a risk optimized portfolio, which the best Sharpe (risk-reward) ratio, as shown in Figure 1.

12 KEY FINANCIAL RATIOS

Earnings Per Share

$$EPS = \frac{Net\ Profit\ for\ Equity\ Shareholders}{Number\ of\ outstanding\ Equity\ Shares}$$

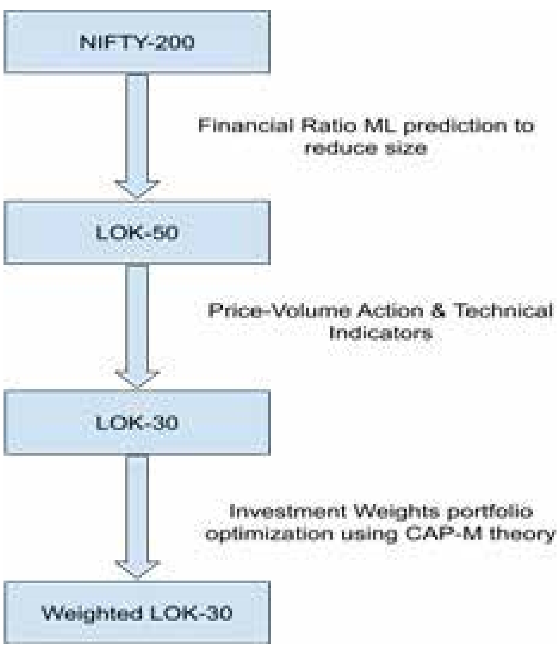

Fig. 1: Pipeline for the proposed Model

Price to Earnings

$$P/E = \frac{Market\ price\ per\ Equity\ Share}{EPS}$$

Price to Revenue

$$P/R = \frac{Market\ price\ per\ Equity\ Share}{Revenue\ per\ Equity\ Share}$$

Price to Book

$$P/B = \frac{Market\ price\ per\ Equity\ Share}{Face\ value\ per\ Equity\ Share}$$

Return on Total Assets

$$ROA = \frac{Net\ Profit\ for\ Equity\ Shareholders}{Total\ Assets}$$

Net Profit Margin

$$N/P\% = \frac{Net\ Profit\ for\ Equity\ Shareholders}{Total\ Revenue}$$

Asset Turnover Ratio

$$AT = \frac{Total\ Revenue}{Total\ Assets}$$

EBITDA Margin

$$EBITDA\% = \frac{EBITDA}{Total\ Revenue};\ where$$

EBITDA = Net Profit + Tax Expense + Interest + Depreciation + Amortization

Debt to Asset

$$D/A = \frac{Total\ Debt}{Total\ Assets}$$

Debt to Equity

$$D/E = \frac{Total\ Debt}{Total\ Shareholder's\ Equity}$$

Debt to EBITDA

$$D/A = \frac{Total\ Debt}{EBITDA}$$

Current Ratio

$$Current\ Ratio = \frac{Current\ Assets}{Current\ Liabilites}$$

TECHNICAL INDICATORS

These indicators are developed from the historical data, hence predicting future from these on individual levels is impossible, but a combination of these together can help one analyse the market sentiment and can help one time ones entry into the stock. Some of the most popular technical indicators combinations used by technical analysts and also incorporated in the model are:

MOVING AVERAGE GOLDEN CROSS

Moving average(MA) is the average of the stock price for the last N days. Moving Average Golden Cross occurs on a stock chart when the Closing price is greater than the Moving Average of 20 periods, which is greater than the Moving Average of 50 periods, which is greater than 200 periods

MA_GC = (CLOSE > MA_20) &

(MA_20 > MA_50) &

(MA_50 > MA_200)

Relative Strength Index and Moving Average

The Relative Strength Index (RSI) is categorized as a momentum oscillator, assessing the speed and magnitude of directional price movements. The strategy used with RSI is, calculate RSI for 14 periods and is its value is greater than 60 then the market would turn bearish, combined along with MA 20, it can help provide greater insights into the market momentum of the stock.

Bollinger Bands Width

Bollinger Bands consist of:

- a middle band being an N-period simple moving average (MA)
- an upper band at K times an N-period standard deviation above the middle band (MA + Kσ)
- a lower band at K times an N-period standard deviation below the middle band (MA - Kσ)

Fig. 2: Zoom-In Functionality

Typically used values for N and K are 20 and 2 respectively. We even construct a Bollinger Band width function from these three values, as follows:

$$BB\_Width = \frac{BB\_Upper - BB\_Lower}{BB\_Middle} \times 100$$

This BB Width along with MA 20 can help us achieve a greater efficiency in identifying better trade opportunities.

TOOLS DEVELOPED

To identify various more combinations of such technical indicators, we have developed two simple GUI Python-Tkinter based tools to help visualize various technical indicators and candlestick patterns over the NIFTY-500 dataset and also to backtest various technical strategies developed over the dataset for a period of 3 years.

VISUALIZATION TOOL

We can plot candlestick charts for various companies among the NIFTY-500 Index from the Year 2002 (or since their listing, whichever is the later), we can add various indicators as can be seen on the left side of the tool. Indicators which are calculated for various periods, require another input on click of the button, which is taken in the form of a pop dialog-box. Another, functionality provided is of Zooming in and out, dragging across and saving the plots. On the change of company, the previous indicator added are saved and then redrawn on the new company data, as shown in Figure 2 and Figure 3.

BACK TESTING TOOL

The backtesting tool is as shown in figures attached below. The tool helps in adding various logics which are combined together to generate 3 reports all-entry.csv, all-exit.csv and total.csv, which consists of trade entry points, trade exit points and various analytic about the total trades executed like End Value, Total Return, Max Drawdown, Total Trades, Win rate, Best trade, worst trade, Profit Factor, Expectency, etc. After the backtesting of the trading logic, we can even visualize the trades, as shown in Figure 4.

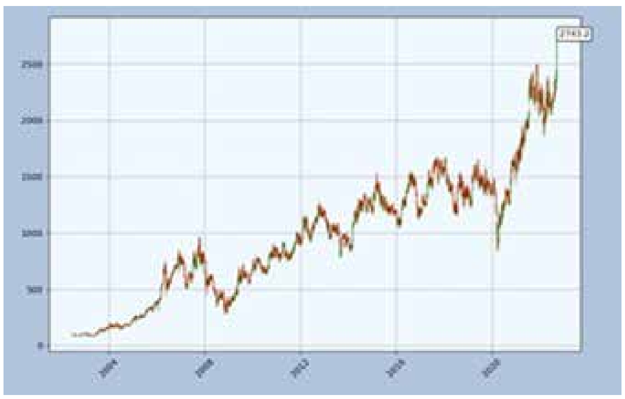

Fig. 3: Various Candle-Stick Patterns Identified

Fig. 4: Visualize a specific stock for a logic

EXPERIMENTS

Fundamental Ratios Model

The model takes in as input the 12 Fundamental Key Ratios and predicts whether the company belongs to the top-50 of the returns company in the specified quarter. The number of trainable parameters has been kept low, as the number of significant input vector is also of the size 12. The Activation function utilized at the at the first 3 Activation layer is tanh and the Activation function utilized at the last layer is Softmax. The final layer uses softmax to predict the probability of whether or not to include the stock with the given financial into top 50 stocks for the quarter or not. The threshold for the probabilty has been found with a brute force method, which comes out to be 0.67, providing with the best trade-off and provides us predictions with an accuracy of 54.5%.

(a) RELIANCE

(b) TATA MOTORS

Fig. 5: LSTM Predictions for few companies

Price-Volume & Technical Indicators Model

We firstly build 200 Long Short-Term Memory models for each individual company, to predict the future on the basis of past 50 memory units. Now, we convert the predictions of the LSTM models into percentage increase predicted in the stock for the next trading session, and then use it as an input to the another model, XGBoost-Classifier which takes into account not only the LSTM outputs but also the outputs of the various Technical indicator strategies, and also the output of the fundamental ratio ANN model to predict the top 30 companies to invest for the next trading session. The output of the LSTM model over a few companies can be seen in Figure 5 .

From the output of this XGBoost-Classifier, we finally get the list of 30 companies to be selected to be in our daily portfolio. Over this list of 30 companies, we apply the CAP- M model, which returns us with two portfolios, one with the Maximum Sharpe Ratio and the other with the minimum volatility portfolio allocation. To generate these portfolios we take into account that we have 100 units to invest and need to achieve best risk-reward ratio, by taking into consideration the risk-free return available in the market, here we have considered the risk-free rate to be 5%.

Table 1: CAP-M portfolio generated

Maximum Sharpe Ratio Portfolio Allocation	
Mean Annualized Return	41.29%
Mean Annualized Volatility	20.93
Minimum Volatility Portfolio Allocation	
Mean Annualized Return	24.66%
Mean Annualized Volatility	18.06

Table 1 shows the average Annualized return and the volatility measure of the daily portfolios generated by the CAP-M model, which has been annualized over 252 days. Volatility signify how rapidly our invested portfolio tends to change in price.

CONCLUSION

The NIFTY-50 weighted index was able to achieve an annualized return of -18% over the same timeframe, during which our proposed model structure was able to achieve a staggering return of 41.29%. Many previous studies have been performed using Machine Learning to predict the stock movement. However, quite a few literature is available on using Fundamental Analytics together with the price-volume movement and technical indicators, which our study tries to build. Our study primarily focuses on:

1) Fundamental Ratios: By scrutinizing fundamental metrics, our model seeks to unearth the underlying financial health and stability of the targeted stocks. These ratios serve as vital indicators of a company's operational efficiency, profitability, and overall financial viability.
2) Price-Volume Movement: The interplay between price movements and trading volume is a cornerstone of technical analysis. By meticulously examining how changes in price are accompanied by shifts in trading activity, our model aims to discern patterns and trends that may signal potential buying or selling opportunities.
3) Technical Indicators: Drawing from a rich toolkit of technical analysis, our study employs a diverse range of indicators. These indicators furnish valuable insights into market momentum, trend strength, and potential reversals, aiding in the formulation of informed investment decisions.
4) Building an optimized portfolio: Recognizing that a well-constructed portfolio is instrumental in achieving sustainable returns, our study culminates in the development of an optimization algorithm. This algorithm takes into account risk preferences, return objectives, and the information gleaned from the aforementioned analyses to construct a diversified portfolio that seeks to strike an optimal balance between risk and return. Through this multifaceted approach, our study endeavors to not only provide a comprehensive understanding of stock behavior but also offer a practical toolkit for investors looking to navigate the intricate landscape of financial markets. By integrating fundamental insights, price- volume dynamics, technical indicators, and portfolio optimization, our model aims to empower investors with a sophisticated framework for making well-informed and potentially lucrative investment decisions.

FUTURE WORK

The proposed future work with respect to the proposed architecture for building is optimized portfolio is utilizing NLP-Sentiment analysis for individual stocks and also trying to better identify correlations between stocks based on the sectors, and incorporating Corporate

Bonds in the portfolio, which provides the Portfolio with a fixed and a variable annual return component.

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IOT based Indoor Air Quality and Smart Energy Management for HVAC System

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ABSTRACT

This paper presents an integrated solution for Indoor Air Quality (IAQ) monitoring and smart energy management for Heating, Ventilation, and Air Conditioning (HVAC) systems using Internet of Things (IoT) technology. The proposed system aims to enhance indoor air quality while optimizing energy consumption in buildings.

The IoT-based IAQ monitoring system consists of sensors deployed strategically throughout the indoor environment to continuously measure various parameters such as temperature, humidity, carbon dioxide (CO2) levels, Smoke level, Gas level. These sensors collect real-time data, which is transmitted wirelessly to a central hub for processing and analysis.

Furthermore, the smart energy management system utilizes the data collected by the IAQ sensors, along with additional inputs such as occupancy status and outdoor weather conditions, to dynamically adjust HVAC settings for optimal comfort and energy efficiency. Machine learning algorithms are employed to predict indoor air quality trends and optimize HVAC operation accordingly, considering factors like thermal comfort requirements and energy costs.

The integration of IAQ monitoring with smart energy management enables proactive decision-making to maintain a healthy indoor environment while minimizing energy consumption. By continuously monitoring IAQ parameters and intelligently controlling HVAC systems, the proposed solution offers the potential for significant improvements in occupant comfort, productivity.

KEYWORDS *: IoT (Internet of Things), Indoor air quality (IAQ), Smart energy management, HVAC (Heating, Ventilation, and Air Conditioning) System, Sensors, Real-time monitoring, Data analysis, Machine learning, Energy efficiency, Thermal comfort, Occupancy detection, Environmental sensing, Building automation, Predictive maintenance, Sustainable buildings.*

INTRODUCTION

In recent years, there has been a growing awareness of the importance of indoor air quality (IAQ) and its impact on occupant health, comfort, and productivity. Additionally, inefficient operation of Heating, Ventilation, and Air Conditioning (HVAC) systems contributes to unnecessary energy consumption and increased environmental impact.

To address these challenges, there is a need for innovative solutions that combine IoT technology, IAQ monitoring, and smart energy management for HVAC systems. By leveraging IoT sensors and data analytics, buildings can be equipped with intelligent systems capable of continuously monitoring IAQ parameters and optimizing HVAC operation in real-time.

This paper introduces an integrated solution for IAQ monitoring and smart energy management for HVAC systems based on IoT technology. The proposed system aims to enhance IAQ while reducing energy consumption by dynamically adjusting HVAC settings based on real-time data and predictive analytics.

The following sections will delve into the details of the proposed solution, including the architecture, components, functionality, and potential benefits. Through this integration of IAQ monitoring and smart energy management, buildings can achieve improved occupant comfort, health, and energy efficiency, contributing to sustainable and healthy indoor environments.

LITERATURE SURVEY

Numerous studies have highlighted the significance of integrating IoT-based IAQ monitoring and smart energy management for HVAC systems in buildings. Here, we review some key findings from existing literature:

1. IoT-based IAQ Monitoring: Several researchers have explored the use of IoT sensors for real-time monitoring of IAQ parameters such as temperature, humidity, CO_2 levels, Smoke, and Gas. By deploying sensors strategically throughout indoor spaces, continuous data collection enables the detection of IAQ issues and trends, facilitating timely interventions to improve indoor air quality.
2. Smart Energy Management for HVAC Systems: Energy consumption in buildings, particularly attributed to HVAC systems, has been a focal point for research aiming to reduce energy usage and operational costs. Smart energy management strategies, including predictive analytics, occupancy-based controls, and demand response, have shown promise in optimizing HVAC operation while maintaining comfort levels for occupants.
3. Integration of IAQ Monitoring with Energy Management: Studies have emphasized the benefits of integrating IAQ monitoring with energy management systems to achieve synergistic effects. By leveraging real-time IAQ data alongside energy consumption patterns, HVAC systems can be dynamically adjusted to optimize both indoor air quality and energy efficiency.
4. Machine Learning and Predictive Analytics: Machine learning techniques have been employed to analyze IAQ and HVAC data, enabling predictive insights and intelligent decision-making. These algorithms can learn from historical data to forecast IAQ trends, anticipate HVAC system performance, and optimize control strategies for energy savings and comfort optimization.
5. Case Studies and Demonstrations: Several case studies and demonstrations have showcased the practical implementation and benefits of IoT-based IAQ monitoring and smart energy management in real-world building environments. These studies provide valuable insights into the performance, scalability, and cost-effectiveness of integrated solutions.

Overall, existing literature underscores the importance of adopting integrated approaches that combine IoT-based IAQ monitoring with smart energy management for HVAC systems. By leveraging advanced technologies and data-driven insights, buildings can achieve improved IAQ, energy efficiency, occupant comfort, and sustainability goals. However, further research is needed to explore optimization algorithms, scalability, interoperability, and long-term performance monitoring of integrated systems in diverse building contexts.

SYSTEM ARCHITECTURE

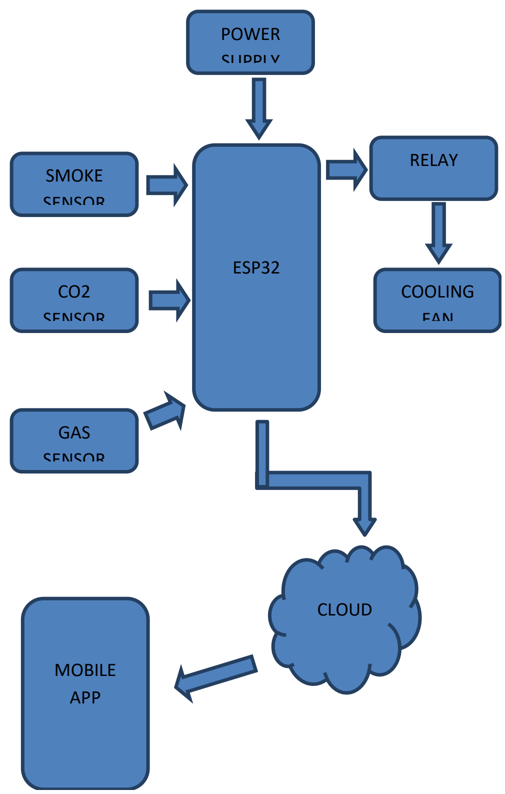

Figure 1: Proposed System Architecture

METHODOLOGY

The proposed system for IoT-based Indoor Air Quality (IAQ) monitoring and smart energy management for HVAC systems consists of several interconnected components working together to ensure optimal indoor environmental conditions while minimizing energy consumption. The system architecture can be outlined as follows:

Sensors: IoT sensors are deployed throughout the indoor environment to measure various IAQ parameters, including temperature, humidity, carbon dioxide (CO2) levels, Smoke level, Gas level. These sensors continuously collect real-time data and transmit it wirelessly to a central hub for processing and analysis.

Central Hub: The central hubserves as the core processing unit of the system. It receives data from the deployed sensors and aggregates it for further analysis. The hub may consist of a microcontroller(ESP32) or a small computing device equipped with communication interfaces for receiving sensor data and connecting to the local network or the cloud.

Data Processing and Analysis: Upon receiving data from the sensors(smoke, CO2, gas sensors), the central hub performs data processing and analysis tasks. Machine learning algorithms may be employed to predict IAQ trends and optimize HVAC operation based on historical data and predefined comfort thresholds.

User Interface: The system may feature a user interface accessible to building occupants, facility managers, or maintenance personnel. This interface provides real-time feedback on IAQ conditions, energy consumption, and HVAC operation status. It may also allow users to set preferences, view historical data, and receive alerts or recommendations for improving IAQ and energy efficiency.

Cloud Connectivity : the system may integrate cloud connectivity for remote monitoring, management, and data storage. Cloud-based services can provide scalability, accessibility, and advanced analytics capabilities, enabling centralized control and monitoring of multiple buildings or facilities from a remote location.

USES

Commercial Buildings

Office Spaces: Implementing IoT-based IAQ monitoring and smart energy management in office buildings can ensure a healthy and comfortable work environment for employees while optimizing energy usage.

Hotels and Hospitality: IAQ monitoring combined with smart energy management can enhance guest comfort and satisfaction while reducing operational expenses in hotels and hospitality establishments.

Educational Institutions

Schools and Universities: IAQ monitoring can help ensure a healthy learning environment for students and teachers by detecting and addressing indoor air pollutants. Smart energy management can optimize HVAC operation in classrooms, libraries, and other facilities to conserve energy without compromising comfort.

Manufacturing and Industrial Facilities

Factories and Warehouses: IAQ monitoring is essential in industrial environments where airborne contaminants and pollutants can affect worker health and safety. Smart energy management for HVAC systems can optimize ventilation rates and air filtration to maintain IAQ standards while reducing energy costs.

CONCLUSION

The integration of IoT-based Indoor Air Quality (IAQ) monitoring and smart energy management for Heating, Ventilation, and Air Conditioning (HVAC) systems offers significant benefits for buildings across various sectors. By leveraging advanced sensors, data analytics, and control algorithms, buildings can achieve improved indoor environmental quality, energy efficiency, and occupant comfort.

Throughout this paper, we have outlined the key components and functionalities of the proposed system, including sensors for IAQ monitoring, central processing units for data analysis, smart energy management modules, HVAC control interfaces, and user interfaces. By deploying such a system, buildings can continuously monitor IAQ parameters, analyze real-time data, and dynamically adjust HVAC settings to optimize energy consumption while maintaining indoor comfort levels.

Furthermore, we have explored several use cases across commercial, residential, educational, healthcare, industrial, and public sectors, demonstrating the versatility and applicability of the proposed solution in diverse building environments. Whether in office spaces, schools, hospitals, or transportation hubs, IoT-based IAQ monitoring and smart energy management can contribute to healthier indoor environments, reduced energy costs, and enhanced occupant satisfaction.

Looking ahead, further research and development in optimization algorithms, sensor technology, and cloud-based analytics will continue to advance the capabilities and scalability of integrated IAQ monitoring and energy management systems. By embracing these technologies and best practices, buildings can play a significant role in promoting sustainability, health, and well-being for occupants and communities.

In conclusion, the adoption of IoT-based IAQ monitoring and smart energy management represents a transformative opportunity for building owners, facility managers, and occupants to create healthier, more efficient, and more sustainable indoor environments for the future.

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Air Canvas Application and Text-to-Speech System using Deep Learning

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ABSTRACT

Air Handwriting is one of the growing technologies in day- by-day life. Air handwriting enables users to write in air by using finger movements. The web camera detects the finger movements and converts them into readable format. This will be the natural way of communication with computer systems. This will remove the need for physical input devices like a keyboard, touchscreen, and digital pen. This paper aims to provide an effective platform for both communication and practice. The existing system has some disadvantages that are overcome in this system. The existing system requires multiple fingers for writing. But using multiple fingers for different tasks like writing, changing color and erasing is a complicated thing to remember. A strong, robust, and efficient algorithm is proposed that will extract all the airwriting trajectories or curves that are collected using a single web camera. The algorithm avoids restrictions on the user's writing without using a delimiter and an imaginary box. The deep learning CNN algorithms are also used for converting handwritten text into user-readable text. Additionally, Optimizing algorithms for efficiency can help ensure smooth and responsive performance.

***KEYWORDS** : Air writing, OpenCv, Artificial intelligence, Optical character recognition, Text-to-speech, Handwritten text, Color tracking.*

INTRODUCTION

Air Canvas application is an emerging technology that enables us to enhance our writing speed and to interact easily with the computer system. Air writing is nothing but writing in mid-air with just our fingers. This technology can be used in different areas like education for learning and teaching purposes. Air writing recognition is done using Deep Learning Technology. Deep learning is a method in Artificial intelligence that teaches computer systems to process information like the Human Brain inspires. This method performs better than other approaches like touch screen typing. Air handwriting is an innovative technology that allows users to write in the air and have their hand movements recognized and interpreted by a computer system. This innovative concept aims to provide a more natural and intuitive form of human-computer interaction, eliminating the need for traditional input devices like keyboards or touch screens.

However, there are challenges associated with air hand- writing, such as variations in handwriting styles, environ- mental factors, and the need for real-time processing. To address these challenges, the system can be trained with diverse handwriting samples to improve accuracy and robustness. Additionally, optimizing algorithms for efficiency can help ensure smooth and responsive performance. It offers a natural and intuitive way for users to interact with digital systems, unlocking new levels of creativity, accessibility, and user interface design.

Problem Statement

The problem at hand involves effectively combining visual and textual elements. Our goal is to enable users to write text on a canvas using Python and OpenCV, extract this text using OCR (Optical Character Recognition), convert it into a PDF document, and improve accessibility by converting the text into audible content using text-to-speech synthesis.

Proposed System

Capture Hand Movement to Draw Characters

Use OpenCV to capture hand movement using the camera. Implement a drawing mechanism where the user can draw characters using hand gestures. Convert the drawn characters into text.

- Convert Drawn Text to Image: Use Pillow (PIL) library to convert the drawn text to an image. Create an image with the drawn text.
- Convert Drawn Text to PDF: Save the drawn text as a PDF file using the reportlab library or other suitable libraries. You can create a PDF document and add the drawn text as content.
- Text-to-Speech Conversion: Use the gTTS library to convert the drawn text to speech. Save the generated audio as an MP3 file.
- Optional: Display Drawn Text and Images: Display the drawn text, image, and the original video feed using OpenCV. Provide a user interface to showcase the results.
- Save Output Files: Save the drawn text image and PDF to specific directories. Save the text-to-speech audio file.
- Cleanup: Optionally, delete temporary files or folders created during the process.
- Run and Test: Run the Python script and test the entire process

Result

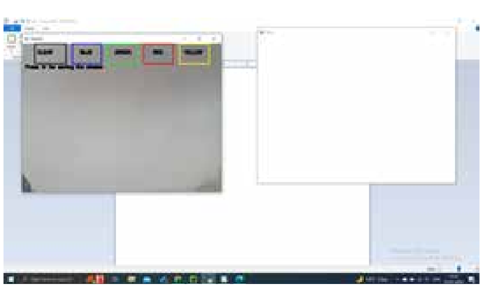

Figure 1.

This is what the user is able to see when the application is running. User can change color by just moving his fingers on that particular button. The text written by user is converted into the plain text by using the paint application.

The Air Canvas application user interface provides users with an intuitive platform for creating digital art using gestures in the air. users can use their fingers to write letters or words in the air in front of the device's camera. The application uses motion-tracking technology to capture these gestures.

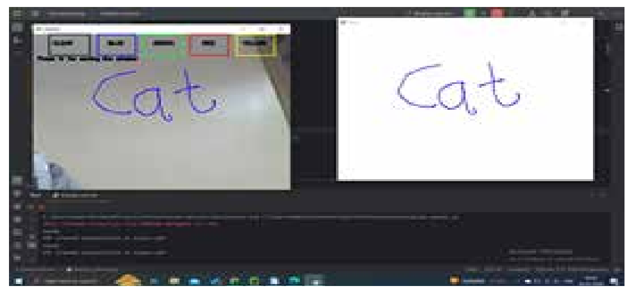

Figure 2.

System architecture

The above figure shows the system architecture of our project. The Air Canvas application is a deep learning-based system designed for creating digital art or drawings in the air using finger gestures captured by a camera.

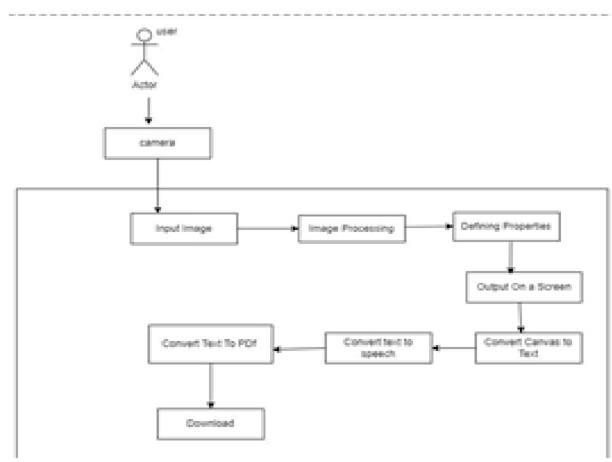

Figure 3.

The system typically follows these steps:

1. Image Capturing or Gesture Recognition: The application captures finger movements using

a web camera. Deep learning models, such as Convolutional Neural Networks (CNNs) analyze these movements in real-time to recognize specific gestures or finger positions.

2. Image processing The system identifies key features from the captured hand movements. This could involve extracting the trajectory, speed, orientation, and shape of the hand gestures, allowing the system to understand the intended drawing strokes.
3. Defining properties: Using the extracted features, the system maps hand gestures to specific actions on a virtual canvas. Deep learning algorithms interpret gestures as drawing strokes, allowing users to create lines, shapes, colors, and other artistic elements by manipulating hand movements in the air.
4. Output on the screen: As the user writes or draws in the air, the system continuously updates the digital canvas in real-time, displaying the artwork or characters as it's being written. This might involve instant feedback to the user regarding stroke thickness, color changes, or other visual aspects.
5. Convert canvas to text: The handwritten characters written by user are continuously converted to plain text by using Deep learning algorithms for Text extractions.
6. Convert text to speech: The converted plain text is then can be converted into Speech or voice by using Text-to-Speech algorithm. This feature is useful to the peoples with some physical disabilities.
7. Converted text-to pdf: Once the drawing is complete, users can typically save their creations in various formats or share them digitally .The converted text is then can be save as pdf for future use by using python libraries like fpdf.

LITERATURE REVIEW

Air writing Recognization Based on Deep Convolutional Neural Network

As per[1], In this system Hand movement is captured using OpenCV[1] through camera input. Techniques such as background subtraction and contour detection are employed to track hand gestures. The user interacts with the system by drawing characters in the air[1]In isolated writing, the letters are written in an imaginary box with fixed height and width in the field of view of an image, one at a time .In connected writing, multiple letters are written from left to right, which is similar to writing on a paper, which are then recognized and converted into text. Hand gesture recognition serves as a fundamental component of these systems, allowing users to express themselves naturally without the need for physical input devices. This work aims to develop a simple yet effective system using a 1D or 2D network that utilizes only the writing trajectory data instead of images[1].

Effective Emotion Transplantation in an End-to-End Text to-Speech System

As per [2] The task of generating natural speech from the input text, i.e., text-to-speech (TTS)[2], is becoming increasingly important, as it is a key module in building human-computer interaction systems[2]. Text-to-Speech Conversion,The gTTS library is utilized to convert the drawn text into speech. This feature enhances accessibility for users with visual impairments and provides an alternative mode of interaction with the system .Text-to-speech (TTS) [2] conversion is a process where written text is turned into spoken words. When the user draws text on the canvas, the gTTS library takes that text and converts it into speech that can be heard. This feature is important because it makes our system more accessible for people with visual impairments. Instead of only reading text on the screen, they can hear it spoken aloud. It also provides an alternative way for all users to interact with the system, offering flexibility and convenience. In simple terms, the gTTS library helps our project speak out the text that users draw, making it easier for everyone to understand and engage with the content, especially those who may have difficulty reading text visually.

PHTI : Pashto Handwritten Text Image Base For a deep Learning Applications

As per[3] In This system m they have created the most comprehensive and the largest dataset so far in the Pashto language[3] The drawn text is converted into an image format using the Pillow (PIL) library. This allows for further manipulation and visualization of the textual content. With Pillow, we can change text into a picture format. This is useful because it lets us do more things with the text, like editing or showing it on a screen. Once the text becomes an image, we can manipulate it further, adding effects or combining it with other images. This step is important because it allows us to work with the text in different ways, making it more versatile and enhancing its visual appeal. Overall, using Pillow to convert drawn text to an image opens up a range of possibilities for creativity and customization in our project. The drawn text can also be saved as a PDF document using libraries such as report lab. This facilitates document creation and sharing, enhancing the versatility of the system.

Virtual Canvas for Interactive Learning using OpenCV:

As per[4]. The purpose of this study is to discuss the usage of computer vision in educational applications. In recent years, air writing has become one of the most challenging and exciting research areas in image processing[4] and pattern recognition[4]The project employs object tracking techniques to construct a motion-to-text converter that might be used as software in the field of education to allow students and teachers to write in the air[4]. Displaying Drawn Text and Images: For enhanced user experience, the system can display the drawn text, images, and the original video feed using OpenCV. This feature adds a visual component to the interaction and facilitates real-time feedback.

Air-Writing Recognition using Deep Convolutional and Recurrent Neural Network Architectures

As per[5] In this system explore deep learning architectures applied to the air-writing recognition problem where a person writes text freely in the three dimensional space[5]. In This System focus on handwritten digits, namely from 0 to 9[5], which are structured as multidimensional time-series acquired from a Leap Motion Controller (LMC) sensor. Virtual Sketch using Open CV as per[6]

APPLICATION

Digital Art Creation

Artists and designers can use the application for creating digital artworks by incorporating text into their visual com- positions.

Document Generation

The application serves as a tool for users to convert their visual creations into readable PDF documents, suitable for generating digital documents or presentations.

Educational Tool

The project's educational value lies in its potential as a learning tool for those interested in computer vision, OCR, and multimedia integration

Human-Computer Interaction (HCI:-)

This technology focuses on motion-to-text converter. Gesture based handwriting can improve the way people interact with computers and digital wearable devices. It can be used for text input, controlling applications, and navigating user interfaces using natural hand movements.

Virtual Reality (VR) and Augmented Reality (AR)

Air handwriting can be used in VR and AR for giving inputand draw diagrams. This can be used for gaming to control the movements of game play virtually.

Accessibility and Assistive Technology:-

Air handwriting can be profitable for individuals with physical disabilities who may face difficulties using traditional input devices like keyboards or touch screens. It allows them to input text and interact with devices using hand or finger gestures.

Healthcare-

In healthcare settings, air handwriting can be used by doctors and surgeons to annotate medical images, take notes, or navigate through digital patient records in a hands-free manner, reducing the risk of being contaminated.

OBJECTIVE

- To design a system that will enhance accessibility for individuals with physical disabilities or limitations.
- To implement Air canvas application using Deep learning that will allow users to write in the air using hand guesters.
- To promote inclusivity and empower individuals to interact with computers and digital devices without the need of any physical input devices like touch-screen or digital pen.

- Create an Interactive Drawing Platform.
- Gesture-Based Text Manipulation.
- Enhance Accessibility.
- Document Generation

METHODOLOGY

Embarking on a journey through the realms of creativity and technology, the project at hand seeks to fuse the power of Python, OpenCV, and various other libraries to create an interactive and multi-dimensional application. Our goal is to enable users to draw text on a canvas, transmute their visual creations into machine readable text, fashion that text into a PDF document, and then bring the written word to life through text-to-speech synthesis. The inception of this project is rooted in the desire to provide a platform where users can seamlessly combine the visual and textual, transcending traditional boundaries between artistic expression and digital functionality.

Leveraging the capabilities of OpenCV, a versatile computer vision library, we aim to construct an intuitive graphical user interface (GUI) that empowers users to interactively draw text on a canvas. This canvas serves as a dynamic space for creativity, allowing users to experiment with fonts, colors, and textual content, providing a visually engaging and interactive experience. The canvas drawing phase, powered by OpenCV's robust drawing functions, sets the stage for a myriad of possibilities. Users can choose from a palette of fonts and colors, customizing their creations with precision. Whether it's artistic expressions, informative diagrams, or handwritten notes, the canvas becomes a blank slate for users to manifest their ideas. The integration of OpenCV ensures real-time rendering and dynamic updates, making the drawing process fluid and responsive. Transitioning from visual expression to machine understanding, the project delves into the realm of Optical Character Recognition (OCR). The drawn text on the canvas is subjected to OCR techniques, primarily utilizing the Tesseract OCR engine.

This phase transforms the visual elements into machine-readable text, bridging the gap between the visual and the textual. The extracted text serves as the foundation for subsequent transformations, unlocking the potential for further manipulation and utilization. With the textual content extracted from the canvas, the project seamlessly transitions to the creation of a PDF document. Leveraging libraries like PyPDF2 or ReportLab, the application aspires to generate a PDF file that preserves the format

CONCLUSION

In conclusion, the Air Canvas application and its integrated text-to-speech system represent a remarkable fusion of creativity and accessibility in the realm of digital art and communication.

The Air Canvas application provides users with a novel platform for expressing their artistic vision through intuitive gesture-based interactions. By harnessing the power of motion tracking technology, users can create stunning digital artwork simply by moving their hands through the air. The application's user-friendly interface, diverse range of brushes and tools, and real-time feedback mechanisms empower users of all skill levels to unleash their creativity and produce captivating compositions.

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An in-depth Review on Next Generation in Smart Mirror

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ABSTRACT

Virtual assistants, cellphones, and wearable help coordinate and optimize daily activities worldwide. Smart assistants prioritize browsing, scheduling, navigating, and other basic human needs. Few smart assistants care about human health. In this re- search, we explore the potential of smart mirrors to detect health risks. Proposed Smart Mirror model features an algorithm-driven smart mirror that functions as a smart assistant. The model includes face recognition authentication, mood identification, and song playing based on mood. The Convolution neural network studies the person's mood and plays the songs over time. Further, the proposed model interactively accepts the voice of the person to give the glimpse of the email inbox for the day and also proposed model can present the daily schedules stored in the database whose details will be published in the upcoming edition of this paper.

KEYWORDS *: Smart mirror, Deep learning, Emotion detection, Convolution neural network.*

INTRODUCTION

Within the dynamic realm of technology, the notion of the "smart mirror" has surfaced as a compelling amalgamation of the ordinary and the exceptional, revolutionizing our perception of both ourselves and the surrounding environment. In the current era characterized by the increasing convergence of digital and physical domains, the advent of smart mirrors has emerged as a noteworthy technological advancement that effectively combines the functionalities of conventional mirrors with cutting-edge computing systems. This scholarly article undertakes a thorough exploration of smart mirror technology, aiming to clarify its origins, development, practical uses, and significant impact on the interaction between humans and computers.

The concept of a reflective surface that possesses capabilities beyond mere self-reflection has captivated innovators, scientists, and technology enthusiasts for an extended period of time. Nevertheless, it was only in recent times that advancements in many technology fields, such as screens, sensors, and software, came together to materialize the concept of a smart mirror. Fundamentally, a smart mirror is a mirror that has been augmented with computational functionalities, allowing it to exhibit data, react to human commands, and offer an immersive platform for engagement. The apparent simplicity of this concept has sparked a surge of invention that is fundamentally transforming various industries and altering the manner in which individuals interact with technology in their everyday lives.

This research aims to provide a thorough and current examination of smart mirror technology, offering a detailed analysis of its evolution, current uses, and potential future prospects. In this analysis, we shall explore the historical origins of this technology, examining its lineage from the realm of science fiction and early experimental endeavors. In the following discourse, we shall delineate the evolutionary path of intelligent mirrors, meticulously recording the technological advancements that have propelled us to the present pinnacle of development. The potential uses of intelligent mirrors are both varied and captivating. In addition to their traditional use as reflective surfaces, smart mirrors have been increasingly adopted across several industries such as fashion, healthcare, retail, fitness, and smart homes. These apps provide the potential to significantly transform our interactions with routine activities, encompassing virtual clothing trials and real-time monitoring of health data. Through a comprehensive analysis of these particular use cases, our objective is to demonstrate the profound capacity of this technology to augment user experiences and streamline intricate procedures.

The capacity of smart mirror technology to reinvent human-computer interaction is a highly exciting element. The conventional interfaces consisting of displays and keyboards are progressively being replaced by more intuitive and immersive modes of interaction. Smart mirrors provide an exceptional platform for investigating innovative methods of interaction, encompassing gesture recognition, voice commands, augmented reality overlays, and haptic feedback. By comprehending the intricacies of this interface, one can acquire significant knowledge regarding the prospective developments in Human-Computer Interaction (HCI) and the potential obstacles and prospects that await. Furthermore, it is imperative to acknowledge the socio-cultural ramifications associated with smart mirror technology. As the integration of these mirrors into our daily routines continues to expand, it gives rise to conversations about privacy, data security, and societal perspectives on self-image and the influence of technology in creating them. The forthcoming critical conversations will be integrated into our analysis, with the aim of offering a comprehensive perspective on the societal implications of smart mirrors.

The objective of this research is to provide a comprehensive analysis of the various aspects of this technology, including its historical background, current uses, and its potential to revolutionize our interactions with the digital realm. Given the continuous expansion of the market and the increasing range of potential applications, comprehending the intricacies of smart mirror technology is not solely an intellectual exercise, but a crucial undertaking for both scholars and professionals aiming to navigate the intricate and promising realm of human-computer interaction.

This literature survey paper dedicates section II to evaluating previous work in structuring a literature survey, while section III provides conclusions and outlines future research directions.

RELATED WORKS

Lakshmi N M et al.[1], proposed the smart mirror, which has been constructed by a Single board minicomputer, is connected to the network via Wi-Fi technology. Weather data is acquired using the Application Programming Interface (API) of the weather cloud. The suggested methodology involves the activation of the system at a predetermined time each morning. Upon activation, the system will display the current date, time, and weather information, accompanied by a welcoming message. Additionally, the system will employ facial recognition technology to identify and acknowledge the presence of the user when they are positioned in front of the camera. The mirror display provides registered users with information regarding the time, date, and weather, accompanied by a voice output. In this particular system, the utilization of ESP Skainet is preferred over ALEXA for the purpose of offline voice recognition. The design of smart mirrors offers several advantages, including ease of use, affordability, compactness, user-friendliness, and suitability for residential settings.

The smart mirror prototype proposed by Ganesh H et al. offers a range of features including the display of weather information, data and time, calendar functionality, camera- based image capturing, multimedia capabilities such as music playback, voice control functionality, and access to local news sourced from the internet [2]. The Raspberry Pi 3 microcontroller is employed as the hardware component responsible for managing the sensors and the smart mirror. The interactive system's central component, responsible for processing information, is referred to as the brain. It utilizes Python scripts to operate the mirror software. The Google Assistant Application Programming Interface (API) serves as a personal assistant that facilitates user interaction with the web. IFTTT is a cost-free online service that enables users to utilize open-source application programming interfaces (APIs) in order to personalize the functionality of Google Assistant. The device bears a resemblance to a conventional mirror. The device is equipped with a screen that has the ability to interface through voice commands and smartphones.

S. A. Desai et al., presents an innovative paradigm that incorporates individualized aspects for practical application in daily life. A variety of fundamental widgets, as well as certain distinctive attributes, have been incorporated. Applications such as Spotify, Google Events, Calendar, and Google Fit are designed to enhance the personalization of the user's experience. In contrast, Time & Date functionality is region- specific, whereas user greetings are universally applicable. In order to avail oneself of these amenities, it is necessary for users to be registered with the mirror in advance. The registration procedure entails the submission of high-quality facial photos for the purpose of Facial Recognition, as well as the establishment of connections between Google and Spotify accounts [3]. Upon the completion of the user's profile setup, the Interactive Smart Mirror will possess the capability to identify the user's facial features, thereby enabling them to gain authorization and utilize all the accessible features and modules. The mirror does not provide the capability to modify the settings and preferences of external applications. Songs have the capability to be played through the Spotify mobile application and subsequently streamed onto a mirror. The present research demonstrates a high level of accuracy, specifically 97.4 %, in the Facial recognition module through the utilization of Convolutional Neural Networks (CNN).

Dr. C.K. Gomathy et al., present smart mirrors have the potential to enhance the user experience for clients when it comes to accessing and engaging with data. Not only do they facilitate the clear visibility of crucial data to clients, but they can also serve as a basis for identifying the whereabouts of delinquents. The intelligent mirror enhances efficiency in data retrieval and minimizes waiting periods. Social security has a significant role in contemporary society [4]. By taking this into consideration, the authors incorporated a comprehensive framework for criminal identification into their discerning cognitive processes. The user's text is incomplete and does not provide enough information to be rewritten academically. The addition of intuitive touch screen functionality, Geo-area capabilities, integration with Alexa, and potentially other features are being considered.

Joshi et al. [5], discuss the potential benefits of smart mirrors in enhancing user interaction and information accessibility. In addition to facilitating convenient access to relevant data for users, these systems can also be integrated with other platforms to function as theft detection systems.

Their smart mirror enhances efficiency and streamlines information retrieval, resulting in time savings.

Merish S A et al. discuss the utilization of Wi-Fi technology for establishing a connection between a single- board minicomputer-based smart mirror and a network. The monitoring display unit presents many types of information, including date, time, and calendar data, as well as weather information obtained from the weather cloud's API. The user has the ability to communicate and engage with their mobile device using a speech synthesis module, facilitated by an application [6]. The smart mirror design has several advantages, including its user-friendly interface, affordability, compact dimensions, ease of use, and its suitability for home applications.

Sahana et al. present the smart mirror provides users with a very conducive ambient environment for interacting with the internet. Users will derive advantages from this in their daily routines [7]. The smart mirror can also be used with a range of commercial and domestic appliances. The utilization of facial recognition technology in the smart mirror might function as a pivotal security mechanism. Individuals have the ability to stay updated on current information and effectively allocate their time through the utilization of the newspaper feed feature. This smart mirror has the potential to assist users in optimizing their activity scheduling. The potential uses of the smart mirror are limited by the existing technologies that can be integrated to deliver the required features.

Biljana Cvetkoska et al., present their findings. The user was positioned in front of the smart mirror by the PAA with a focus on efficiency. The application of the proposed image processing technique has facilitated the diagnosis of health issues with enhanced accuracy and efficiency. In order to gain further insights about an individual's health status, it is possible to incorporate a skin detection analysis [8]. The health status history would enable us to accurately diagnose various conditions and implement preventive healthcare actions with a high level of precision.

According to Ayushman Johri et al., "By combining computing and communication technologies, they were able to create an interactive experience for the Smart Mirror user." They saved time by presenting crucial daily information, but they also focused on additional uses for the gadget, such as a traditional mirror or an emergency trigger alarm system, to broaden its possible applications [9]. This model is the only smart mirror-based device on the market that can provide interactive emergency triggering technology at a reasonable price for customers from a variety of socio-economic backgrounds. With the rate at which technology is evolving, this device provides all of the capabilities a user could possibly require as smart technology becomes more prevalent in daily life. The product's applications are not restricted to the hospitality industry; it may also be used in households for general information and SOS communication, as well as hospitals for patients. Thanks to the voice assistant feature, iPhone users can now perform tasks such as web searches without using their fingers. A touch display, on the other hand,may boost user interaction with the product by introducing more interactive widgets.

Seoungtak Kim et. al., describe a smart mirror technology that allows the healthcare system to compare the user's actions to those in the guide video in real time. The Guide Video, which was made by evaluating the user's joint angles, may show the difference in their joint angles. This enables the user to obtain immediate feedback in their own environment. It culminates in a "Homecare" service that anyone can use from the comfort of their own home. Customers may readily follow the motions at home with this approach without the need for professional experience, allowing them to alter their activities accordingly [10]. It is expected to provide modern persons who struggle with workloads and inactivity with convenience and greater accessibility. The Motion Feedback System approach allows you to print two images at the same time by superimposing one image on top of the other. Nonetheless, this strategy creates a problem in which the present image is somewhat obscured.

Shady Halaby et al., present a simple method to alleviate the issues that people have when getting checked out. As a result, anyone may swiftly and easily check their health at home in less than a minute. Furthermore, because the user can use this mirror on a frequent basis, they have a better chance of avoiding the bulk of flaws that their body may have [11]. As a result, this smart medical mirror is a successful product that will undoubtedly capture the target audience and achieve this goal, given that the project's goal was to minimize the number of people who do not have regular medical check-ups.

Kazutake Uehira et al., describes an Internet of Things smart mirror that tracks emotions over time. Their system is made up of four main components: posture recognition, which assesses the user's movement speed and energy; voice emotion detection; facial expression recognition; and a chat bot, which acts as the user interface for welcomes and chats [12]. The primary purpose of the gadget is to detect early signs of depression in the elderly and give long-term therapy to aid telemedicine and healthcare for older individuals who live alone.

Dabiah A. Alboaneen et al. presented a demonstration of several applications for smart mirrors. The primary focus of the research revolved around the applications of field-based smart mirrors. Sports, academics, fashion, medicine, and various other disciplines are encompassed under this range. The majority of these research, accounting for 57.5% of the total, utilized smart mirrors in the general sector. Conversely, the sports and academic domains had the lowest percentage, with only 5% of all research incorporating smart mirrors in these areas. Smart mirrors have the potential to be employed as a tool for remote learning [13]. In addition, the mirror possesses the capacity to consolidate into a singular stratum that harmonizes all tiers. In addition, it is possible that the map itself may include integrated navigation features.

CONCLUSION AND FUTURE SCOPE

Around the world, wearables, telephones, and virtual assistants aid in the coordination and optimization of daily activities. Navigation, scheduling, browsing, and other necessities of life are given top priority by smart assistants. Health is not a concern for many intelligent assistants. We investigate the possibility of using smart mirrors to identify health hazards in this research. An algorithm-driven smart mirror that serves as a smart assistant is a feature of the suggested Smart Mirror model. The model has mood identification, face recognition authentication, and mood- based music playing. The songs are gradually played by the Convolution neural network as it learns about the listener's mood. Additionally, the suggested model can display daily schedules that are recorded in the database and interactively accepts a person's voice to provide a preview of their email inbox for the day.

This idea can be enhanced to work as an interactive mobile application and it can also be integrated as the augmented reality tool.

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Smart Crop Protection System from Animals using PIC

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ABSTRACT

In agricultural settings, crops are frequently subjected to damage by various local wild lives such as buffaloes, cows, goats, and birds, resulting in considerable financial setbacks for farmers. Erecting barriers around entire fields or maintaining continuous surveillance is impractical for farmers due to resource constraints and the need for round-the-clock vigilance. Hence, we propose the implementation of an automated crop protection system against wildlife intrusions, leveraging a microcontroller from the PIC family. This innovative system integrates a motion sensor designed to detect approaching wild animals."

"As these situations arise, the sensor promptly alerts the microcontroller, triggering a swift response. Subsequently, the microcontroller initiates a deterrent mechanism designed to discourage animals from encroaching on the cultivated area, thereby safeguarding the crops and minimizing potential losses for the farmer.

KEYWORDS *: Arduino, Wi- Fi modules, Load cells, Database infrastructure.*

INTRODUCTION

In agricultural settings, crops are frequently subjected to damage by various local wild lives such as buffaloes, cows, goats, and birds, resulting in considerable financial setbacks for farmers. Erecting barriers around entire fields or maintaining continuous surveillance is impractical for farmers due to resource constraints and the need for round-the-clock vigilance. Hence, we propose the implementation of an automated crop protection system against wildlife intrusions, leveraging a microcontroller from the PIC family. This innovative system integrates a motion sensor designed to detect approaching wild animals."

"As these situations arise, the sensor promptly alerts the microcontroller, triggering a swift response. Subsequently, the microcontroller initiates a deterrent mechanism designed to discourage animals from encroaching on the cultivated area, thereby safeguarding the crops and minimizing potential losses for the farmer.

BLOCK DIAGRAM

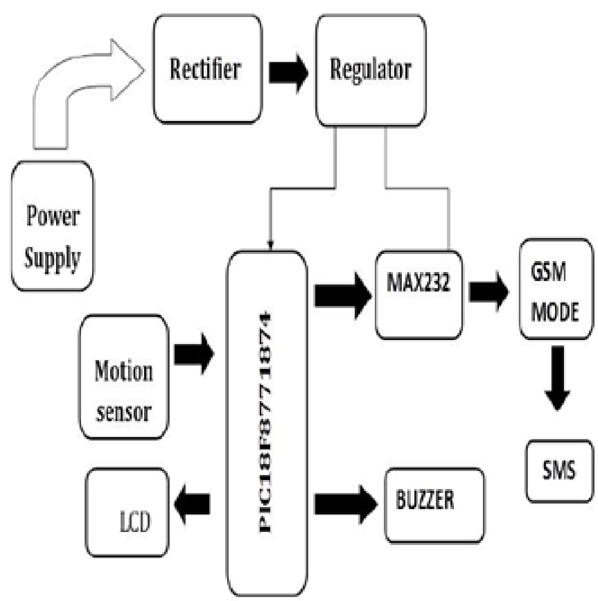

Fig: Block Diagram

PROBLEM STATEMENT

Proposal focuses on utilizing PIC microcontrollers, motion sensors, and GSM technology to monitor agricultural fields. The system's operation involves motion detection triggering actions such as activating a buzzer, sending SMS alerts, and placing calls to the owner. The PIC microcontroller coordinates inputs from the GSM module and motion sensor, ensuring prompt responses to potential threats like animal intrusion and smoke detection. Additionally, relevant information is displayed on an LCD screen to provide farmers with comprehensive and immediate feedback.

COMPONENTS USED IN PROJECT

- PIC Micro controller
- Buzzer
- GSM Module
- LCD Display
- Crystal Oscillator
- Resistors
- Capacitors
- Transistors
- Cables and Connectors
- Diodes
- PCB and Breadboards
- LED
- Transformer/Adapter
- Push Buttons
- Switch
- IC
- IC Sockets

SOFTWARE SPECIFICATIONS

M PLAB

MC Programming Language: C

PIR SENSOR

PIR Sensor In a PIR-based motion detector (usually called a PID, for Passive Infrared Detector), the PIR sensor is typically mounted on a printed circuit board containing the necessary electronics required to interpret the signals from the pyro-electric sensor chip. The complete assembly is contained within a housing mounted in a location where the sensor can view the area to be monitored. Infrared energy is able to reach the pyroelectric sensor through the window because the plastic used is transparent to infrared radiation (but only translucent to visible light). PIR Sensor Working Principle The passive infrared sensor does not radiate energy to space. It receives the infrared radiation from the human body to make an alarm. Any object with temperature is constantly radiating infrared rays to the outside world. The surface temperature of the human body is between 36° C - 27 ° C and most of its radiant energy concentrated in the wavelength range of 8 um-12 um. What is the Range of PIR Sensor? Indoor passive infrared: Detection distances range from 25 cm to 20 m. Indoor curtain type: The detection distance ranges from 25 cm to 20 m. Outdoor passive infrared: The detection distance ranges from 10 meters to 150 meters. Outdoor passive infrared curtain detector: distance from 10 meters to 150 meters.

TRANSISTOR

The flow of electrons onto the plates is known as the capacitors Charging Current which continues to flow until the voltage across both plates (and hence the capacitor) is equal to the applied voltage Vc. At this point the capacitor is said to be "fully charged" with electrons. A transistor can act as a switch or gate for electronic signals. In practice this means we use transistors as electronic switches that turn electronic circuits on or off. This is a basic function that we use in digital logic circuits, such as those found in computers, where we use transistors to represent the ones and zeros of binary code. We can also use transistors to control the power supply to different electronic components. The transistor acts as a switch to turn on and off the current flow. In addition, we can use transistors to adjust the voltage level, which allows for the efficient use of power in electronic devices. One of the most important uses of transistors is as an amplifier. We can use transistors to amplify weak signals, such as the output from a microphone, to levels that can drive a loudspeaker.

PIN OUT

Features of PIC16F877A

The PIC16F877A CMOS FLASH-based 8-bit micro controller is upward compatible with the PIC16C5x, PIC12Cxxx, and PIC16C7x devices. It features 200 NS instruction execution, 256 bytes of EEPROM data memory, self-programming, an ICD, 2 Compactors, 8 channels of 10-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, an asynchronous serial port that can be configured as either 3-wire SPI or 2-wire I2C bus, a USART, and a Parallel Slave Port. High-Performance RISC CPU Lead-free; RoHS-compliant Operating speed: 20 MHz, 200 ns instruction cycle Operating voltage: 4.0-5.5V Industrial temperature range (-40° to +85°C) 15 Interrupt Sources 35 single-word instructions All single-cycle instructions except for program branches (two-cycle)

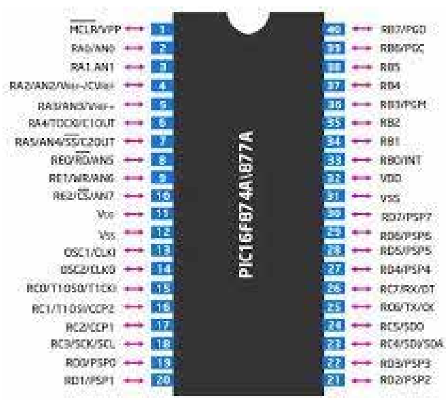

Fig: Pin out

CIRCUIT DIAGRAM

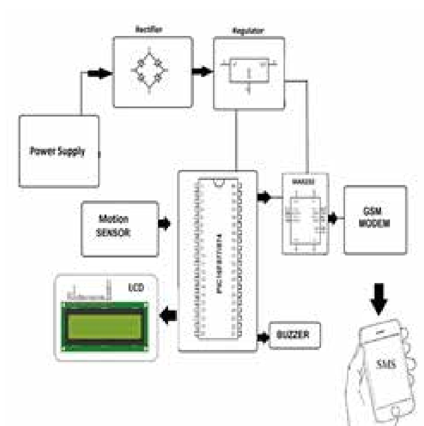

Fig: circuit diagram

PIC MICRO CONTROLLER

The PIC micro controller, short for Peripheral Interface Controller, is a family of micro controllers developed by Microchip Technology. PIC micro controllers are widely used in embedded systems, and they come in various flavors with different features and capabilities. Key features of PIC micro controllers include: RISC Architecture: - PIC micro controllers typically use a Reduced Instruction Set Computing (RISC) architecture, which simplifies the instruction set for faster and more efficient operation. Flash Memory: - They often have Flash memory for program storage, allowing for reprogramming and flexibility in application development. Peripheral Integration: - PIC micro controllers are known for their integrated peripherals like timers, UART, SPI, I2C, Analog-to-digital converters, and more, providing a range of functionalities in a single chip. Low Power Consumption: - Many PIC micro controllers are designed with low power consumption, making them suitable for battery-powered and energy-efficient applications. Wide Range of Applications: - PIC micro controllers find applications in various fields, including industrial automation, automotive systems, consumer electronics, medical devices, and more. 6Development Tools: - Microchip provides a comprehensive set of development tools, including compilers, debuggers, and programmers, facilitating the coding and testing process. Variety of Models: - PIC micro controllers come in different series and models, catering to specific requirements and performance levels. Understanding the basics of PIC micro controllers is essential for engineers and developers working on embedded systems and electronic projects. They offer a robust platform for creating efficient and compact control solutions in diverse applications.

POWER SUPPLY CIRCUIT

Each of the blocks is described in more detail below: Transformer - steps down high voltage AC mains to low voltage AC. Rectifier - converts AC to DC, but the DC output is varying. Smoothing - smoothest the DC from varying greatly to a small ripple. Regulator - eliminates ripple by setting DC output to a fixed voltage. Bridge rectifier: A bridge rectifier can be made using four individual diodes, but it is also available in special packages containing the four diodes required. It is called a Full-wave Rectifier because it uses the entire AC wave (both positive and negative sections). 1.4V is used up in the bridge rectifier because each diode uses 0.7V when conducting and there are always two diodes conducting, as shown in the diagram below. Bridge rectifiers are rated by the maximum current they can pass and the maximum reverse voltage they can withstand (this must be at least three times the supply RMS voltage so the rectifier can withstand the peak voltages

ADVANTAGES

The advantages of the proposed system can be summarized as follow:

- Highly-flexible
- Fit and Forget System
- No need of human effort
- High security is provided

FUTURE SCOPE

In the future, there will be very large scope; this project can be made based on wireless networks. Wireless sensor network and sensors of different types are used to collect the information of crop conditions and environmental changes and these in- formation is transmitted through network to the farmer that initiates corrective actions. Farmers are connected and aware of the conditions of the agricultural field at anytime and anywhere in the world.

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Recent Trends in Plant Leaf Disease Recognition: A Literature Survey

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ABSTRACT

The detection and classification of plant leaf diseases is the subject of this extensive review work, which synthesizes findings from several research sources using methods including image processing, deep learning, and machine learning. The analysis encompasses many studies dedicated to identifying and categorizing plant diseases, specifically focusing on methodologies involving ML algorithms, DL networks, and advanced image-processing techniques. Emphasis is placed on the critical role of these technologies in preserving crop productivity through early disease detection in agriculture. The review thoroughly examines various papers incorporating state- of-the-art approaches, including SVM, BPNN, Convolutional Neural Networks (CNNs), and other innovative models. Additionally, detailed investigations are presented into the features extracted during the process, including color features, shape features, texture features, and more.

KEYWORDS : *Leaf disease, CNN, SVM, BPNN, ML.*

INTRODUCTION

In Indian agriculture, an ongoing effort, the goal of sustainable intensification is to raise agricultural productivity per acre while protecting the fragile balance of the ecosystem and natural resources. Modern farming methods, made possible by technology, enhance productivity. A critical aspect of this effort involves the early and accurate analysis, a pivotal factor in mitigating their impact [1]. Addressing the challenges posed by plant diseases, particularly in remote areas with limited access to plant disease experts, requires innovative solutions. There is a need for automated, accessible, affordable, and trustworthy methods that can detect plant diseases without requiring expert judgment and laboratory examination. Agriculture is vital in India, supporting approximately 58% of rural income [2]. Tomatoes, a popular food crop, play a crucial role, and recognizing and categorizing diseases in tomato plants is essential to prevent significant losses in quantity and yield.

Advanced technology, such as image processing, addresses these challenges through various approaches and algorithms. When a tomato plant contracts a disease, manifestations first appear on the plant's leaves. Agricultural biodiversity, essential for providing food and raw materials, faces continuous threats from pathogenic organisms, soil conditions, temperature fluctuations, and changes in moisture levels [3]. These factors contribute to plant diseases that impact crop growth and the livelihoods of those dependent on these crops. Unfortunately, many farmers still rely on manual methods for disease identification, hindering productivity and overall agricultural sustainability. The agriculture sector is turning to cutting-edge technologies. These advancements leverage plant leaf images to detect diseases early. Image processing, involving stages and classification, has a crucial function in enhancing the quality of these images and extracting valuable information for accurate disease detection.

Research in this domain has yielded promising results, with a remarkable 97% classification accuracy in disease detection, surpassing other periodicals [4]. With the idea of a loss function, machine learning is a more helpful tool than conventional image processing. Guided by the loss function ML models through predictions, enabling more accurate outcomes without explicit guidance. The adaptability of ML finds application not only in agriculture but also in various fields and traffic prediction (Google Maps).

The versatility of ML approaches opens avenues for developing new algorithms. Deep learning networks, with their ability to learn intricate patterns in data, surpass ML in flexibility. Integrating feature extraction and classification through multiple processing layers enhances DL's capabilities, especially in handling unstructured data. Various DL approaches, Including convolutional neural networks (CNNs) and recurrent neural networks (RNNs), have become critical agricultural instruments for identifying illnesses in plant leaves. This project aims to delve into the intricate world of plant leaf disease classification, leveraging the power of advanced technologies to revolutionize disease detection in Indian agriculture, promoting sustainability, and ensuring food security.

LITERATURE SURVEYS

Review of Plant Disease Detection

A comprehensive analysis of the findings explores plant identification and the diagnosis of crop diseases. The objective is to evaluate the efficiency of current models in identifying illnesses in various crops. This study adopts a holistic approach to survey scientific activities related to plant disease detection. The analysis and comparison of multiple deep learning and machine learning strategies are undertaken to address the challenge of disease detection in crops. The article provides an overview of diverse plant leaf diseases, methodologies for disease detection, and dataset metrics used to evaluate the efficiency of current detection frameworks and implementation environments. This introduction also discusses current limitations in plant leaf detection and outlines potential avenues for future research.[5]

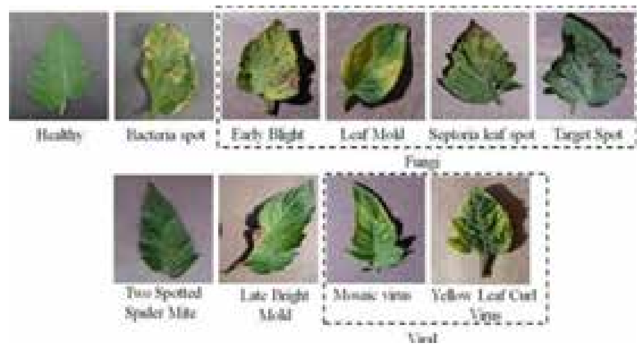

Fig. 1. Sample images of different plant diseases

The architectural field heavily relies on measures for preventing and controlling plant diseases. Early and accurate diagnosis plays a crucial role in disease control and proves beneficial, eliminating the need for manual inspection of each farm plant. Recognition of the condition involves a combination of image processing and machine learning methods. This research explores existing technologies, providing an in-depth analysis of the strengths and weaknesses of each detection method. The current system is scrutinized, and an innovative method is proposed in light of the results.

The suggested design extracts plant leaves' images' color, texture, and intensity properties using a Gabor filter and a watershed segmentation technique. These extracted features are then compared to medical imaging training data. A disease-related labeling classification method is employed, and the test image is analyzed [6].

This study investigates the application of machine learning, deep learning, and image processing in identifying diseased plants across various agricultural species. A literature review of seventy-five publications highlights the need for assistance in processing unstructured visual data. It emphasizes the requirement for high-level engineering to achieve accurate identification in current models. The study advocates diverse methods for plant disease identification, including using drones and mobile apps for early-stage detection in expansive fields and the prospect of investigating multiple leaves in a single frame in future research [7].

Machine Learning Approach

Plants play a crucial role by providing sustenance and oxygen for human life. The occurrence of plant diseases during the period between planting and harvesting can lead to significant losses in crop yield and market value. However, such detection processes typically involve considerable human resources, additional processing time, and a comprehensive understanding of plant diseases. Machine learning emerges as a valuable tool for leaf disease detection in plants, leveraging its ability to analyze data from various perspectives and categorize it into predefined groups. This method involves evaluating the morphological characteristics of plant leaves, encompassing aspects such as color, intensity, and size. The present study comprehensively examines various plant diseases and surveys the diverse machine- learning classification approaches developed for detecting these diseases in plant leaves [8].

Detecting leaf diseases early is crucial for crop productivity, and a promising solution is offered through computer vision-based classification. While deep learning is a popular approach, it demands extensive datasets and time. This paper proposes a faster method utilizing Gist and LBP features for leaf disease classification. Gist captures global features, while LBP effectively handles local features. The combination yields significant results in classifying various plant diseases across different plants. The images undergo pre- processing, and the concatenated feature matrix is input into various machine-learning models, with SVM proving the most effective for plant leaf classification [9].

This work examines various methods for classifying plant leaf diseases and identifies that most studies have relied on Support Vector Machine (SVM) algorithms, even though these models could perform better when the training data is noisy and the target class overlaps. To address these issues, a multifaceted machine learning approach was proposed: "Deep learning," the model is taught to classify information instantly based on visual cues; "Fine-tuning" techniques applied to various neural network architectures; and finally, "comparative evaluation," to determine which neural networks perform best at providing a classification [10].

This investigation of disease employs a sequential four-part process. The four steps involved are pre-processing, leaf segmentation, feature extraction, and classification. Image segmentation identifies and differentiates healthy leaf tissue from damaged tissue as part of pre-processing. The k-nearest neighbors (KNN) method, a supervised, guided method for resolving classification and regression problems, is an advanced machine learning algorithm. Treatment is advised throughout the final stages of the disease. The diseases primarily harm plants that are still alive. This research aims to demonstrate the application of image processing to develop a system for identifying leaf diseases in tomato plants. It employs color, bound, and texture to detect crop problems and quickly return accurate results to the farmer [11].

Increasing agricultural productivity sustainably requires fast and accurate detection of illness in crop leaves. This study reviews recent crop leaf disease prediction literature using IP, ML, and DL methods. Significant improvements were made in predicting crop leaf diseases using these methods. This article comprehensively reviews the published literature on the topic, discussing datasets, numbers of images and classes used, methods, models of convolutional neural networks (CNNs), and the general results that can be achieved by employing different methods. Suggestions for the most effective algorithms in everyday use are made, covering mobile/embedded, robotic, and unmanned aerial vehicle settings (UAV) and the performance measurements employed to improve [12].

Plants' nutritional, medicinal, and other benefits to humans are widely recognized, making them indispensable. Consequently, boosting agricultural output is crucial. The widespread occurrence of bacterial, fungal, and viral diseases significantly contributes to lower agricultural productivity. Diagnostic methods must first be applied to prevent and treat plant diseases. To this end, many different ML and DL approaches were developed and evaluated by scientists. This study compiles the many studies on plant disease identification using ML and DL-based techniques into a unified whole. The transition from ML to DL techniques in plant disease recognition research is presented in this overview. Additionally, a large number of plant disease databases are carefully investigated. The current systems' problems and challenges are also addressed [13].

Data extraction and disease classification from plant pictures using an auto-color correlogram filter is the primary subject of this paper. The model's emphasis on picture pre- processing and the extraction of information aids the classification task. By exploiting the hidden layers between inputs and outputs, DL makes learning even the most complex patterns relatively easy. Other machine learning techniques struggle to accurately portray the mediator representations of the data; hence, this is a must. Since DL includes more parameters for estimation, it requires more data for training than other learning methods. Improved performance and the ability to identify complex patterns across plant datasets are outcomes of the suggested methodology [14].

Deep Learning Approach

With the global population on the rise, there is a pressing need to expand the food supply proportionally while safeguarding crops against various lethal illnesses. Historically, the diagnosis of plant diseases relied on the visual acumen and experience of farmers and plant pathologists. The conventional procedures, being labor- intensive, time-consuming, and often imprecise in diagnosis, result in significant financial losses in the agricultural industry. Subsequent research explored machine learning techniques for identifying plant diseases; however, there needed to be more room for improvement in results and speed for widespread adoption. Recently, convolutional neural networks (CNNs) have emerged as a breakthrough in computer vision, demonstrating automatic feature extraction and the ability to produce effective outcomes quickly with limited datasets. This study reviews various methodologies and state-of-the-art algorithms aiming for accurate and timely disease detection and classification analysis, a significant obstacle in diagnosing plant leaf diseases [15].

Identifying plant illnesses early on is critical as they hinder the development of affected plants. Plant Disease Identification and Classification, utilizing Machine Learning (ML) models, is growing with promising prospects, mainly due to recent advancements in Deep Learning (DL). Various visualization techniques and custom-built DL architectures are implemented to identify and categorize plant diseases. The effectiveness of these designs and methods is assessed through various metrics. This article reviews how different DL models can be employed to depict plant diseases and identifies research gaps for achieving clarity in detecting plant diseases before symptoms become apparent [16].

For disease identification, a convolutional neural network model is suggested by this study. Using deep learning, the CNN model identified potato leaf illnesses with a 97.66% success rate. The inquiry used 5,932 images depicting rice and 1,500 images illustrating healthy and diseased potato leaves. The deep learning CNN model exhibited superior accuracy compared to prior state-of-the-art models, surpassing SVM, KNN, Decision Tree, and Random Forest approaches. This was assessed through diverse performance metrics, including accuracy, precision, F1 score, recall, and more. [17].

Given the crucial role of the agricultural sector in our daily lives, it is imperative to establish procedures for identifying leaf diseases in agricultural plants. Plant leaf diseases are a primary cause of crop failure, and their early detection is increasingly crucial. To aid farmers in comprehending plant diseases. The study employs image pre-processing and data augmentation strategies to enhance image quality for subsequent processing. YOLOv3 categorizes leaf diseases in pepper, bell pepper, potato, and tomato plants. The study suggests two separate classifiers: a pre-processor using a median filter and data augmentation trained with YOLOv3 and an extractor using a Resnet50-based network. This two-stage categorization process achieved a 94.1% success rate in detecting the most prevalent disorders [18].

The agricultural sector, crucial for the global food supply, relies on early detection. This paper reviews recent research, emphasizing the importance of large, varied datasets, data augmentation, transfer learning, and CNN activation map visualization for accurate disease recognition. Challenges include the need for more robust models adaptable to diverse datasets and establishing real-world plant disease datasets.

The paper surveys various disease classification techniques and introduces an image segmentation algorithm for automatically detecting and classifying plant leaf diseases. Tested on species like Jute, Grape, Paddy, and Okra, the algorithms show efficiency and early-stage disease identification with minimal computational efforts. [19].

This study systematically examines various classification methods developed for agricultural disease detection. Crop quality and quantity in agriculture are at risk if plant diseases are not detected early. The review explores traditional machine learning methods and delves into the latest deep learning-based approaches. Each paper details the agricultural diseases targeted, the models employed, the data sources utilized, and their overall performance based on performance metrics. Compared to other disease diagnosis methods, the review identifies that Deep Learning achieves the highest accuracy and highlights the key elements influencing the effectiveness of deep learning-based products. The study aims to catalog all such methods to expedite the plant disease diagnostic process while maintaining high accuracy [20].

Plant leaf diseases present classification challenges in agriculture, impacting the sector's ability to ensure food safety. While convolutional neural networks are effective, they often require extensive training data and parameter tuning. This research introduces a specialized deep-transfer learning model to provide an efficient framework for classifying various leaf diseases in plants and fruits. Model engineering enhances feature discrimination and processing speed, employing SVM RBF kernel parameters. The study analyses six image collections of leaves from Plant Village and UCI datasets, demonstrating the model's robust classification potential with over 90,000 categorized images. The findings suggest practical applications for future advancements in agriculture for diagnosing leaf diseases [21].

Ensuring organic crop security is challenging, requiring in-depth knowledge of cultivated plants and the pests, diseases, and weeds that affect them. By utilizing deep learning models trained on particular convolutional neural network designs, this approach can discern plant illnesses and contrasting images of damaged and healthy leaves. The study utilizes images from various cameras and sources, demonstrating that detectors based on deep learning outperform other methods in accurately identifying disease categories across plant species. This approach stimulates new lines of inquiry in agriculture, particularly in organic systems where healthy plants can fend off pests and diseases more effectively [22].

Even though crop diseases substantially threaten worldwide food security, precise and prompt identification continues to be a formidable task in numerous regions. Smartphone-assisted disease diagnosis has become feasible due to recent advances in computer vision enabled by deep learning and the widespread availability of smartphones. Fourteen crops and 26 diseases were recognized using a secret test dataset using a deep convolutional neural network trained on 54,306 photos of damaged and healthy plant leaves with 99.35% accuracy. Smartphone-assisted, worldwide crop disease detection is a step closer, thanks to deep learning models trained on an increasing number of publicly available image datasets [23].

A country's economic success relies heavily on its agricultural sector. However, plant diseases pose a significant danger to the quality and productivity of agriculture. The timely identification of plant diseases is of paramount importance for the well-being and development of the world. Manual agricultural disease inspection is challenging due to inaccuracies and resource constraints. This study introduces the DeepPlantNet system for automatically diagnosing and classifying plant pathologies. The suggested framework outperforms previously used methods with an average accuracy of 97.89% for eight-class classification schemes and 99.62% for three-class classification schemes. Experiment results on plant disease datasets demonstrate the efficacy and dependability of the proposed framework for disease detection and classification [24].

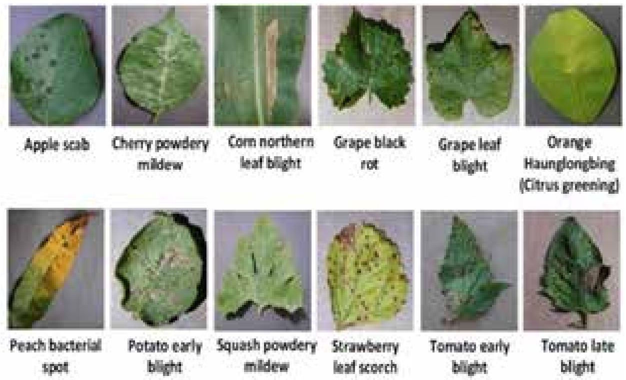

Fig. 2. Plant Disease with different plants

Image Processing Approach

This research provides a complete literature review on plant leaf disease detection. Traditional methods, such as manual visual quality inspection, need more objectivity and consistency. Furthermore, these methods are associated with disproportionate processing durations and require a high level of competence in phytopathology. Consequently, the adoption ailment diagnosis has become prevalent.

The study comprises three main sections. The first part involves a thorough algorithm-based assessment, comparing significant algorithms and works developed using image processing and AI-based techniques. The subsequent section contrasts various frameworks found in the literature with a subsequent discussion on the reliability of the results. Based on the completed review, a comprehensive. The results of disease identification and classification are explained. The paper discusses the results and challenges of employing image processing for plant leaf detection [25].

This overview presents these advancements and emphasizes that improving the recognition rate can be achieved by utilizing larger datasets for model training and validation. Addressing the issue of plant leaf disease necessitates the continual development and application of novel and enhanced deep-learning algorithms, ensuring greater diagnostic accuracy in categorizing agricultural plant illnesses.

Numerous systems have been developed and employed for categorizing illnesses affecting plant leaves. Neural networks, such as CNN, stand out due to their adaptability and feature extractor properties, making them ideal for classifying plant diseases. In contrast to earlier models like Naive Bayes, K- Nearest Neighbor, SVM, RFC, etc., CNN can learn additional image characteristics, offering superior output. Given CNN's superiority in learning and extracting features from images, it emerges as the best option for studies including image processing, ML, and DL [26].

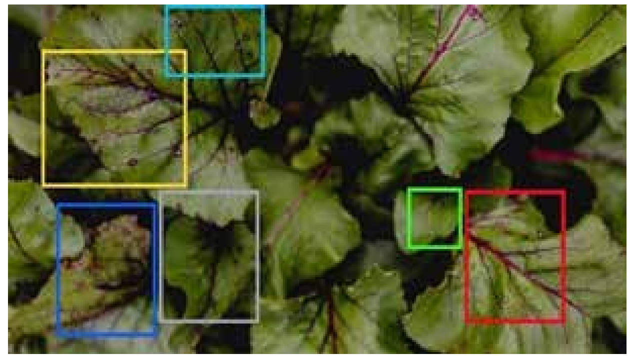

Fig. 3. Image-based Plant Disease

In addition to negatively impacting crop yields, plant diseases impose considerable financial burdens on businesses and governments. Contemporary large-scale agricultural monitoring emphasizes the identification of signs indicative of plant diseases. The evolving landscape of disease control strategies poses substantial challenges for farmers. Traditional identification methods have traditionally relied on visual assessments by experts. This study underscores the significance of a direct approach for detecting plant leaf diseases, aiming to enhance agricultural practices significantly. Enhanced disease management is achievable through early information on crop health and timely detection, leading to increased harvest yields. This approach's merits and drawbacks are thoroughly examined in this paper, encompassing image capture image processing. [27].

CNN Technique

Economic health is directly linked to agricultural output susceptible to diseases impacting yield and quality. Automatic systems for detecting plant changes offer farmers the advantage of noticing and responding to unusual signs in plant growth. This research presents an automatic detection method and categorization of plant leaf diseases, employing image processing and feature extraction algorithms to define cropped plant images.

An enhanced CNN model, developed and applied to a dataset of approximately 20,600 images, improves prediction accuracy and the ability to distinguish between false positives and true positives through optimization. The suggested method demonstrates an increased prediction accuracy of 93.18% for three species with twelve diseases [28].

This research provides insights into plant disease detection utilizing various algorithms, proposing a CNN-based technique. Simulation research using sample photos assesses time complexity and infected region size, employing image processing. Training the model with 15 examples, including twelve diseases affecting plant leaves, results in a test accuracy of 94.80% [29].

Swift detection and recognition of crop diseases are crucial for maximizing food production and minimizing losses. Deep learning algorithms, particularly CNNs, have proven effective for accurate plant disease identification. This paper conducts a literature analysis on the application of CNNs to plant disease diagnosis, outlining current trends and identifying knowledge gaps. A systematic review of 121 papers published over the past decade sheds light on cutting-edge developments and highlights areas requiring further exploration [30].

Neural networks simulate human learning, marking the initial step towards artificial intelligence. This study discusses the history and current use of neural network models, emphasizing identifying and classifying plant diseases based on visual cues. ANN and CNN emerged as popular network models. Automatic plant disease detection can eliminate the need for high-priced domain specialists, benefiting farmers by increasing food yields and boosting GDP [31].

Advancements in technology, including drones, IoT devices, faster computing speeds, data analysis, and machine learning, address the identification problem swiftly. While numerous techniques exist for identifying and categorizing plant diseases, commercially available technology for efficient and effective illness diagnosis still needs to be improved. The proposed machine learning model, applicable on a large scale through IoT devices, mobile phones, drones, and cameras, achieves a 94.6% accuracy rate in identifying sick plants when trained on the plant village dataset. The paper concludes with an in-depth study of the model and its final results [32].

A diverse dataset was collected in the analyzed research during the feature extraction process. This encompassed details related to color, shape, and texture alongside energy, variance, mean, geometry, and standard deviation metrics. Figure 4 illustrates the frequency of utilization of various extracted features in the analyzed studies [7].

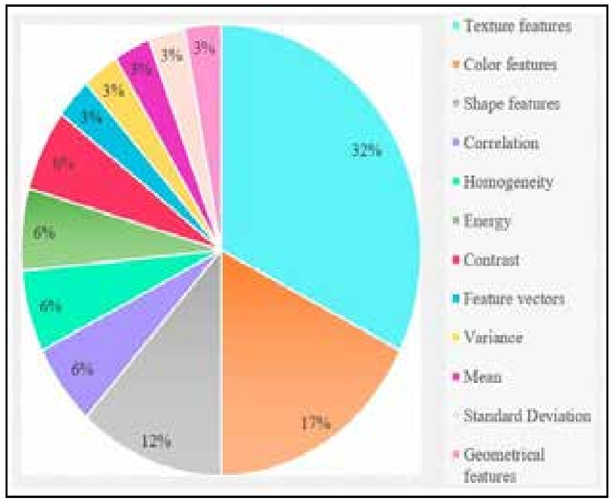

Fig. 4. Utilize various extracted features in % (% in descending order).

Fig. 5 illustrates the diverse methods employed in categorizing plant diseases across the reviewed papers. Noteworthy techniques encompass SVM, BPNN, multi-class SVM, SqueezeNet, AlexNet, ANN, VGG-19, ResNet, DenseNet, and various other networks. Specifically, five studies employed SVM, and eight utilized convolutional neural networks for plant disease identification, as depicted in the figure. Additionally, the VGG16 model, DenseNet, and GoogleNet were featured in two investigations, while DCNN and AlexNet were employed in three. Notably, the diagnostic methods such as backpropagation, multi-class SVM, feed-forward BPNN, two SVMs, SqueezeNet, CNN with GAP, CNN based on LVQ, NasNet, DM optimizer, autoencoders, VGG, ResNet, inception-v3, and optimal mobile network- based CNN were each applied only once among the scrutinized studies [7].

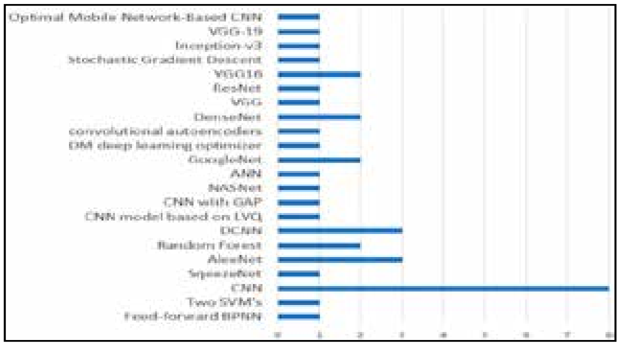

Fig. 5. Various techniques are utilized for classification.

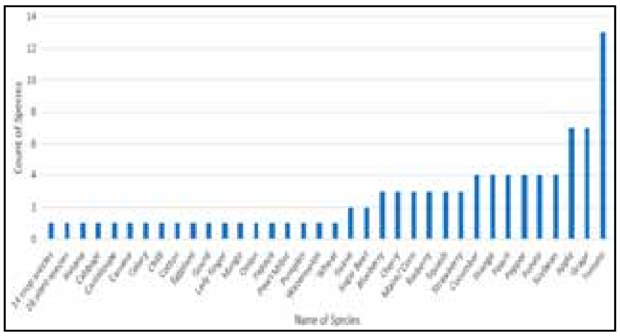

Fig. 6. Species for which diagnosis was performed

In Figure 6, thirteen studies focused on classifying tomato diseases, while seven addressed disease classification in apples and grapes. Cucumber, orange, peach, pepper, potato, and soybean diseases each garnered four reviews. In contrast, guava and sugar beet diseases received two reviews each. Multiple studies concentrated on distinct plant diseases, such as those affecting chili peppers, papayas, cotton, wheat, and pearl millet. Fig. 6 provides a detailed breakdown of the plant species for which diagnostics were conducted in the reviewed studies [7].

CONCLUSION

This review consolidates and synthesizes knowledge on the Detection and Classification of Plant Leaf Diseases, providing insights into the evolving research landscape in this critical domain. Integrating ML, DL, and image processing techniques signifies a paradigm shift in approaching challenges posed by plant diseases in agriculture. The observed trends in model selection, feature extraction, and the focus on specific plant species underscore the dynamic nature of this field. Identified challenges, such as robustness in model performance and the necessity for real-world datasets, point towards directions for future research. Stakeholders, including researchers, practitioners, and policymakers, can derive valuable insights from this overview of the state-of-the-art and future possibilities in plant disease detection and classification.

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College Management Chatbot System

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ABSTRACT

Chatbots are robots used to facilitate faster and more accurate interactions between people. Today, chatbots are attracting a lot of attention in various fields. Chatbots have the ability to recognize sentences and answer questions. This project provides a chatbot for school management where users can log into the chatbot and perform all school activities. It keeps all school activities up to date, doesn't require students to be present, and the word order is similar so users can review questions and understand the words used to provide the correct answer. Many natural language techniques such as parsing, stemming, word segmentation and filtering are used in this chatbot for school management.

KEYWORDS : *Chatbot,Virtual assistant, NLP techniques, Sentiment analysis, Porter stemmer algorithm, Word order similarity algorithm.*

INTRODUCTION

A chatbot is a computer program designed to support and facilitate human interaction. Chatbots enable communication between humans and machines based on words or commands.

LLMs like ChatGPT provide a way to create interactive and powerful humanoid robots This experiment shows how integrating humanoid robots into ChatGPT can increase people's trust. In this study, LL.M. To investigate the impact of trust, what appears to be an intelligent robot assistant that can communicate with human workers and is robust to different languages [3].

Chatbots are designed to work without humans. Chatbots use various NLP technologies and artificial intelligence algorithms. The school management robot project will be developed using artificial intelligence algorithms. A chatbot will be a web application that will analyze user questions and provide corresponding answers.

Users can ask questions to the chatbot and it will automatically answer the questions. The main purpose behind university administration chatbots is to save the time of students and teachers. The chatbot will use artificial intelligence to answer questions.

Radio recognition, also known as CR, is an evolution of radio communications technology that can detect active access in the wireless spectrum and change the non-transmission state, present in many direct network communications and improving network performance[10].

By using chatbots, users do not need to visit the university to ask or ask questions. Users must register and then log in to access the chatbot. After registering, users can ask the chatbot any questions about the university. The chatbot will respond to the user through a well-functioning graphical user interface (GUI).

Users can ask questions about the university using this web application. The school management chatbot will provide security for everyone's information as users will need to create their own ID and password. Manage chatbots in universities. Users can update all school related events.

The development of A.I ChatGPT is required to translate instructions to the robot to perform the task. It uses advanced technology and uses extensive language structures to create flexible instructions. It can be used to open applications of intelligent chatbots to interpret multi-step instructions [1].

PROJECT RELATED WORK

Chabot School of Management can be viewed as a data entry that attempts to answer natural questions by answering them. Chatbot selects and filters the most appropriate answers using terms found in natural language tools (such as analysis, classification, word segmentation).

Chabot pre-processes the sentences provided by users to reduce them to simple structures that can focus on the chatbot's current questions. The goal is to encourage customers to get exactly what they want by providing helpful information on questions.

The project describes the approach to the idea of creating a chatbot that can be used throughout education to keep students updated on all school activities.

This article basically explains how to create a chatbot that can be used to answer users' or students' university-related questions.

Chatbots accept input from the user and after analyzing the input gives products suitable to the user's questions. Chatbots are mainly used to enable communication between people and machines. The administrator provides some information to the machine so that the machine can recognize the sentence and decide the answer to the question on its own.

The database used in this project is MySQL. When connecting a chat application to the database, it will not have to interpret the message and how to respond to it. Therefore, representation knowledge and the use of SQL in the functional model are required. The data model created based on the discussion model will be tested with the help of various scenarios. The conversation with the chatbot will be controlled to return to default mode. This was done so that some additional information could be added to the repository as it had not been modeled before. If the clause entered in the file does not match, it is remodeled.

ARCHITECTURE

Admin

Administrators feedback frequently asked questions from students in the knowledge base so that the chatbot can respond to user questions faster.

If there is no question in the file the question will be answered by the Admin Guide.

User Login

Users create their ID and password to access the Chatbot. After creating a profile, users enter the Chatbot and can ask their questions to the Chatbot using GUI. le as this is used to find the meaning of any word in the world database.

Chat-Bot Responding System

The chatbot answering machine first takes the user's question as input and then runs algorithms on it to analyze and answer the question.

a.NLP Technique

When a user asks a question to a chatbot, the chatbot uses various NLP techniques to check the meaning of the complaint. Use part-of-speech tagging and Wordnet dictionary to check understanding, then use sentiment analysis to check hearing First I disagree based on their assessment.

Search Queries in Database

Once you detect a negative message, look for information about responses to user complaints . Since many users may ask the same question in different ways, the exact answer to the question must be determined in the knowledge base.

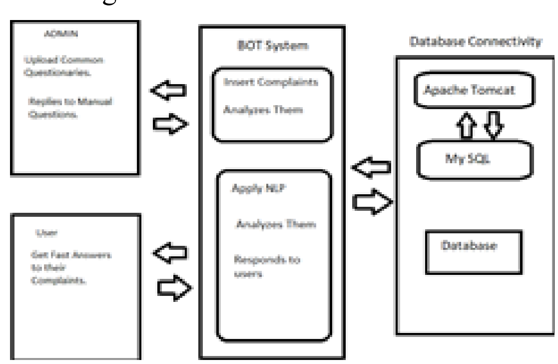

Figure 1: Chatbot Architecture

Answer The Queries

As mentioned above, when the user files a complaint, the level of disagreement and the user's actual problem are determined. Then check the repository for such issues. It means that if an answer is found, the answer will be sent to that user. If a particular question cannot be found in the repository, it will be answered by the admin. When he/she answers the question the response is sent to the user. These questions are stored in the database along with their answers, when these questions are asked the answers are retrieved directly from the database. Because this manager doesn't need to answer the same questions.

ALGORITHMS

Porter Stemmer Algorithm

Porter Stemmer algorithm is used to extract words from the English language. Elimination of the result is important to reach knowledge.

Word Order Similarity between Sentences

T1 : A dog Jumps over Fox.

T2 : A fox Jumps over Dog.

Some words in both sentences are the same. So using bag of words the machine will give the same answer but because there are some differences between the sentences but this is different but can be seen by machines by humans. word matching algorithm is used in the chatbot system to detect small differences in sentences. Chatbots can provide accurate answers to users' questions.

NLP Techiques

Parsing

Parsing technology is used to provide structure to text links so that the chatbot can understand complaints more easily.

Stemming

Stemming is one of the NLP techniques used to return individual words to their roots.

Tokenizing

Tokenization technology is used to break the phrase or phrase into smaller units; this will be easier to provide and can be easily identified by chatbots.

Mining :

Chat Conversations between chatbot and human are analyzed in order to identify if these interaction will be able to identify the users topic of interest and can provide user satisfaction.Users Input are Analyzed using Text Minning.

1.Analytic Process 2.Data Overview 3.Topic Extraction:

This Methods will be helpful to show various ways in which interaction data between human and chatbot can be used to en- hance the companies knowledge about need of their user as well as user satisfaction[2].

CONCLUSION

We created Chabot, which any organization can use to help users ask questions. When the question is saved in the database, an automatic token is created and given to the user via SMS. Natural language processing technology is used to identify, tokenize, root and filter queries. The output is fed into an algorithm that calculates the strength of the sentence. Choose the strength of the dispute; This will help prioritize questions so that service providers can resolve them.

In this way the plan will help many organizations to provide satisfaction to fewer customers. It will save a lot of time for university administration, university students and teachers.

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Study of Different Sensors used in IoT

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ABSTRACT

Technology is advancing in various fileds. The paper focuses on addressing customer needs and emphasizes the importance of time in the real world. However, people often spend a significant amount of time in supermarkets, facing issues like long queues at the billing section and difficulty in calculating the total cost of purchased items.

To tackle these problems, the paper proposes a solution known as the "Smart shopping trolley with automated billing." The IoT kit includes components like RFID tags, an RFID reader, LCD display, and Bolt ESP8266. The process involves consumers placing items in the trolley, where the RFID reader scans the RFID tag of each item, displaying the value on a digital display panel. Once the consumer completes their shopping, the bill is sent to the counter section, saving time and allowing consumers to know the total cost of their purchased items early on.

KEYWORDS *: LCD display, Shopping trolley.*

INTRODUCTION

A comprehensive review of sensors encompasses an exploration of various sensor types, ranging from traditional to cutting-edge technologies, such as temperature sensors, pressure sensors, and proximity sensors. The paper delves into the working principles of these sensors and discusses advancements in sensor technologies, including the integration of MEMS, nanotechnology, and quantum sensing. It highlights the diverse applications of sensors across industries such as healthcare, automotive, agriculture, and environmental monitoring. The review emphasizes the role of sensors in smart systems and the Internet of Things (IoT), detailing their contributions to smart cities and connected devices.

Wireless sensor networks, energy harvesting, and sensor fusion techniques are explored, shedding light on their importance for remote monitoring, power optimization, and enhanced data accuracy. Challenges in sensor technologies, including calibration, reliability, and security, are discussed alongside potential future directions, providing insights into the evolving landscape of sensor research and development. and to provide a thorough understanding of the current state and future trends in sensor technologies.

TYPES OF SENSOR

Sensors are devices that detect and measure physical or chemical phenomena and convert them into electrical or digital signals. The main function of a sensor is to provide information about its surroundings or environment.

1. Temperature
2. Pressure
3. Proximity
4. Light
5. Motion
6. Humidity
7. Gas
8. Sound
9. Image

10. Biometric
11. Force
12. Magnetic
13. Radiation Sensors
14. Inertial Sensors

TEMPERATURE SENSORS

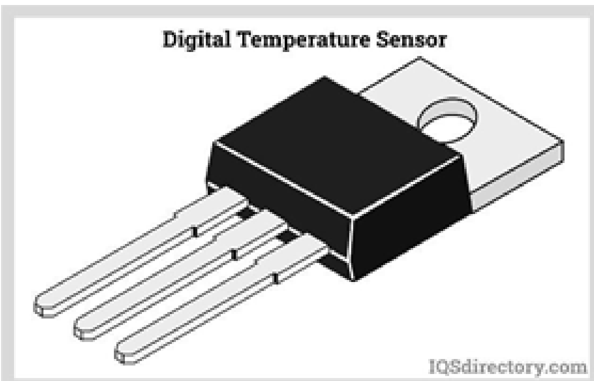

Fig 1. Digital Temperature Sensor

Temperature sensors serve the purpose of gauging the extent of warmth or chilliness in an object. The functionality of a temperature meter hinges on the voltage traversing the diode. The alteration in temperature is directly proportionate to the resistance of the diode.

As the temperature drops, the resistance decreases, and conversely, it increases as the temperature rises. The diode's resistance is measured, and this measurement is translated into temperature units, which are then presented in numerical format on readout units. In geotechnical monitoring applications, these sensors find application in determining the internal temperatures of structures like dams, bridges, and power plants.

Incorporating a temperature sensor into a control or compensation circuit necessitates an output in a practical format from the detection circuit. Analog circuits typically yield resistance as the output. To integrate the temperature measurement into a digital control and compensation setup, it must be converted into a digital format suitable for processing by a Microcontroller Unit (MCU). This is commonly achieved by interpreting the measurement as a voltage through the utilization of an analog-to-digital converter (ADC).

PRESSURE SENSORS

Fig 2. Pressure Sensor

Pressure sensors are like special tools that can sense and show us when the force on a liquid or gas changes. Imagine a closed box with air inside, and we want to know if we're squeezing or releasing the air inside. A pressure sensor helps us see and keep track of these changes. It's like a helpful tool that lets us know when things are getting squeezed or relaxed, whether it's in a closed box or even in the open air around us.

Strain Gauge Pressure Sensors

These use a flexible diaphragm that deforms under pressure, causing a change in resistance in a connected strain gauge.

- Piezoelectric Pressure Sensors: These generate an electrical charge when subjected to pressure, based on the piezoelectric effect.
- Capacitive Pressure Sensors: These measure changes in capacitance between plates, with one plate being flexible and deforming under pressure.

PROXIMITY SENSORS

Proximity sensors are like magic eyes that can find objects without actually touching them. Unlike some other devices that need to touch things to know they're there, proximity sensors use special tricks to feel the presence of objects without any physical contact. This means they won't scratch or damage the objects they're checking.

Proximity switches work using a principle called inductive coupling.' They create a magnetic field, and when something comes into this field, it messes up the magnetic field, causing the switch to turn on. There are three main types of proximity switches: nductive, capacitive, and photoelectric.

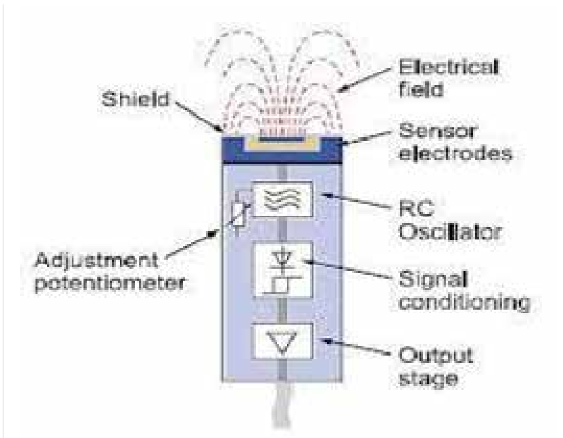

Fig 3. Proximity Sensor

LIGHT SENSORS

Fig 4. Light Sensor

A light sensor circuit is a basic setup that turns on when it senses light. It consists of a photoresistor and a transistor. When light shines on the photoresistor, it transforms the light energy into an electrical signal, which then activates the circuit.

A light sensor circuit activates when light is detected by the circuit. It is a simple circuit including a photoresistor followed by a transistor. When light strikes the surface of the photoresistor, light energy is converted into an electrical signal and thus, the circuit is operational.

The Light Sensor is an analog sensor, and it returns values in the range of 0 to 4095. Higher values indicate that the sensor is in a darker area, and lower values indicate lighter areas. Note: Remember that it is important to calibrate your Light Sensor by calculating a threshold value.

Light sensors measure illuminance, which can be used to measure more than the brightness of a light source. Because the illuminance decreases as the sensor moves away from a steady light, the light sensor can be used to gauge relative distance from the source.

Light sensors are commonly used to detect ambient light and can be used to control the switches of electronic equipment. This includes automatic lighting, safety systems, and automatic curtains.

Light sensors are also used in lighting control systems. These sensors measure the amount of ambient light present and adjust the electric lights accordingly.

MOTION SENSORS

Fig 5. Motion Sensor

These sensors can feel the warmth from people and animals. If the sensor notices more warmth, like someone coming close, it tells the home security system. Then, the security system makes a loud noise to alert you that someone might be around when they shouldn't be.

A motion sensor, serving to detect movement or changes in the physical environment, operates using different principles. The most common type, Passive Infrared (PIR) sensors, identifies changes in infrared radiation when warm objects, like humans or animals, enter their field of view, triggering a response. Other motion sensors include Ultrasonic sensors emitting ultrasonic waves, Microwave sensors analyzing microwave reflections, and Dual Technology sensors combining multiple technologies for enhanced accuracy. Motion sensors find applications in security systems, activating alarms upon unauthorized movement, and in lighting control, managing the illumination of spaces based on detected motion. Despite their utility, motion sensors face challenges such as the potential for false alarms, especially in outdoor settings where animals or environmental factors can inadvertently trigger the sensor. Strategic placement and sensitivity adjustments help mitigate these challenges, making motion sensors integral to security, automation, and energy conservation in various technological applications.

SOUND SENSORS

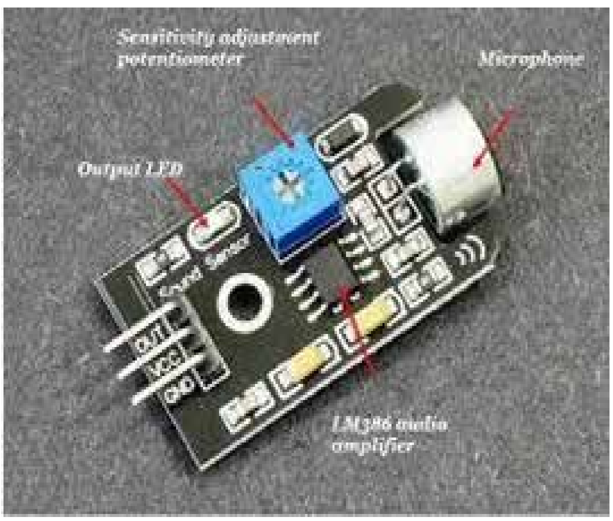

Fig 6. Sound Sensor

Imagine a sound sensor as ea rs for a machine. This sensor listens to sounds around it and turns them into signals that the machine can understand. It has a tiny board with a microphone and special circuitry. sound, it measures how loud it is and sends a signal to the machine using a chip. This helps the machine know when there's noise around. In measuring sound, the main tool is the microphone. Think of it as ears for machines. These microphones can hear different frequencies, from what we humans can hear to even sounds that are too high or too low for us. They help us understand and measure all sorts of sounds in our surroundings.

A sound sensor, utilized for detecting and measuring sound levels in various settings, functions by converting sound waves into electrical signals through a microphone or piezoelectric element. These devices are integral in applications like noise monitoring in industrial environments, security systems for detecting unusual sounds, and home automation systems responding to specific sound patterns. There exist analog sound sensors, providing an output proportional to sound intensity, and digital sound sensors offering a digital output signal based on predetermined thresholds. Despite their usefulness, challenges include sensitivity to ambient noise, necessitating additional signal processing, and calibration to ensure accurate measurement. Overall, sound sensors play a vital role in modern technology, contributing to safety, security, and automation in different domains.

GAS SENSOR

Gas sensors are like electronic noses that sniff out and recognize different gases. They're often used to find harmful or explosive gases and measure how much of them is in the air.A gas sensor, essential for identifying and measuring the concentration of gases in different environments, plays a critical role in ensuring safety and environmental monitoring. These sensors operate on various principles, each contributing to their versatility in gas detection. Chemiresistive sensors, for instance, detect gases by measuring changes in electrical resistance, while infrared sensors rely on the absorption of infrared light by gases. Catalytic sensors monitor temperature changes resulting from gas-catalyst interactions, providing another effective detection method. Photoionization detectors use ultraviolet light to ionize gas molecules, generating an electric current proportional to gas concentration. Additionally, metal oxide gas sensors track changes in the conductivity of a semiconductor when exposed to specific gases. The applications of gas sensors are extensive, ranging from industrial safety measures to environmental pollution detection and home safety systems. Despite their usefulness, gas sensors face challenges such as calibration requirements and sensitivity variations. In conclusion, gas sensors, with their diverse detection methods, significantly contribute to maintaining safety and environmental well-being in various settings.

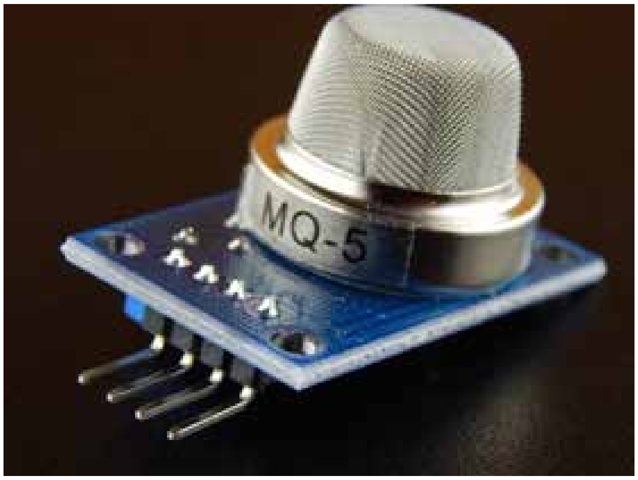

Fig 7. Gas Sensor

CONCLUSION

RFID (Radio-Frequency Identification): RFID tags and readers can be used to track and manage items placed in the trolley. Ultrasound Sensors:

Ultrasonic sensors can be used to detect obstacles and measure distances. They are helpful for implementing collision avoidance systems, ensuring that the trolley can navigate through a space without bumping into objects. Wheel Encoders: Wheel encoders can be used to measure the rotation of the wheels, allowing for precise control of the trolley's movement and position. Camera and Computer Vision Cameras combined with computer vision technology can be used for more advanced applications, such as object recognition, barcode scanning, and even autonomous navigation. This Specific Sensors Used For smart trolley system types project and Additionally, integration with a microcontroller or a central processing unit is crucial to gather data from these sensors and make intelligent decisions based on that information.

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Animal/ Object Recognition and Monitoring System using ML

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ABSTRACT

This paper involves the study of Object Detection and Image Recognition using CNN , a dataset is created especially for Leopard, using thousands of images, the dataset is trained for our model using ESP32 CAM module image is captured and processor compare with dataset if it match with dataset then output is generated. The results are obtained with CNN network.

KEYWORDS *: CNN, Object detection, Image recognition, ESP32, Tensor flow.*

INTRODUCTION

The "Leopard Detection Using Machine Learning and Alarming System" aims to develop a system that can accurately detect leopards using a combination of hardware and software components. The project utilizes an ESP32-CAM module for image capture, an Edge Impulse website for machine learning-based leopard detection, and a 4-inch school gong bell with ULN2003 and Relay Module for alarming purposes. The "Leopard Detection Using Machine Learning and Alarming System" project combines hardware and software components to create an effective system for detecting leopards in a given area. The ESP32-CAM module [6] captures images, which are processed and transmitted to the Edge Impulse website for machine learning-based detection. Upon detection, the system activates the 4-inch school gong bell to provide an alert. This project has potential applications in wildlife conservation and safety for human populations in areas where leopards may pose a threat.

The coexistence of humans and wildlife in shared habitats presents a unique set of challenges, particularly in regions where potentially dangerous animals, such as leopards, roam freely. As urbanization continues to encroach upon natural habitats, encounters between humans and wildlife are becoming increasingly common. [3]

In order to mitigate potential conflicts and ensure the safety of both humans and wildlife, innovative solutions are required. The project titled "Leopard Detection Using Machine Learning and Alarming System" represents a significant step towards addressing this critical issue. Leopards, the crucial role leopards play in maintaining ecological balance in their habitat. However, their presence near human settlements can pose significant risks to local communities. In areas where leopards are known to inhabit, the need for effective detection and alert systems is paramount.[1] Traditional methods of detection, such as human patrolling and camera traps, while valuable, often fall short in terms of real-time responsiveness and accuracy.

In recent years, advancements in technology, particularly in the fields of artificial intelligence and hardware development, have opened up new possibilities for wildlife conservation and human-wildlife conflict mitigation. The integration of machine learning algorithms with edge computing devices has enabled the creation of systems capable of real-time animal detection and response. The primary objective of the "Leopard Detection Using Machine Learning and Alarming System" project is to develop a comprehensive system that combines cutting-edge hardware and software components to achieve accurate and timely leopard detection. By harnessing the capabilities of an

ESP32-CAM module for image capture, leveraging the power of machine learning through the Edge Impulse platform, and employing a physical alarming mechanism with a 4-inch school gong bell, this project aims to revolutionize the way we approach wildlife detection and alerting.

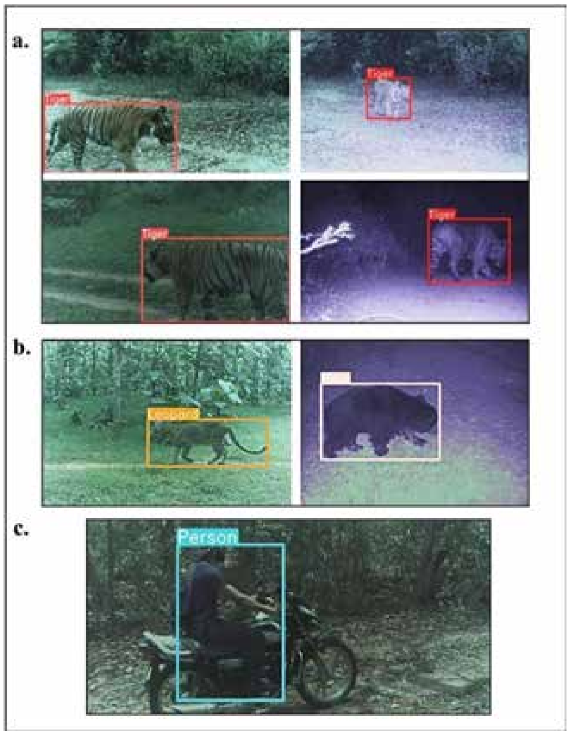

Fig: Real time detection. [8]

The "Leopard Detection Using Machine Learning and Alarming System" project holds immense promise for wildlife conservation and human safety. By seamlessly integrating hardware and software components, it offers a comprehensive solution to a critical issue faced by communities living in close proximity to leopard habitats. This invention not only enhances the safety of humans but also helps to the conservation efforts aimed at protecting these magnificent creatures.

In the subsequent sections of this report, we will delving into the detailed components of the project, including the hardware setup, software implementation, data processing, and the machine learning model development process. [5] Additionally, we will explore the potential applications, scalability, and future enhancements of the system. Through this comprehensive study, we aim to provide a thorough understanding of the "Leopard Detection Using Machine Learning and Alarming System" project and its implications for wildlife conservation and human well-being.

The crucial role leopards play in maintaining ecological balance in their habitat stems from their status as apex predators.. However, their presence in close proximity to human settlements can pose a significant threat to both human populations and livestock. [4] Developing effective methods for early detection and alerting of leopard presence is essential for mitigating potential conflicts and ensuring the safety of both wildlife and humans.

In response to this need, the project "Leopard Detection Using Machine Learning and Alarming System" leverages cutting-edge technology to create a system that can accurately detect leopards and provide timely alerts to concerned parties. By integrating the ESP32-CAM module, Edge Impulse website, and a 4-inch school gong bell with ULN2003 and Relay Module, and Tensor Flow. [9] The human-leopard conflict is a persistent issue in regions where these big cats share habitats with human communities. Encounters with leopards can lead to livestock loss, economic setbacks for farmers, and, in extreme cases, pose a direct threat to human lives. Traditional methods of monitoring and detection often fall short in providing timely warnings, necessitating the development of more advanced and efficient systems.

(CONVOLUTIONAL NEURAL NETWORK) CNN

A Convolutional Neural Network is a type of artificial Neural network that is particularly well-suited for tasks related to image recognition and processing. CNNs [7] play a crucial role in analyzing visual data.

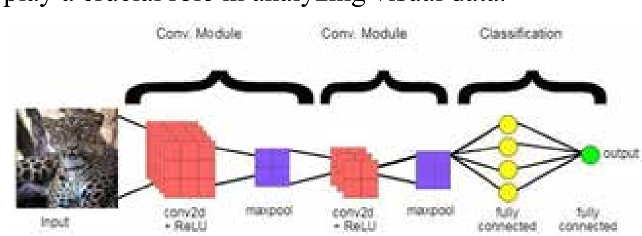

Fig: CNN layers

Convolutional Layers: CNNs use convolutional layers to automatically learn various patterns and features from input dataset. These layers consist of filters (also called kernels) that slide across the input image, detecting patterns or features. These patterns can range from simple edges to complex textures.[2]

Pooling Layers: After convolutional layers, pooling layers are often used to down sample the spatial dimensions of the input volume, reducing computation in the network and helping to make the learned features more invariant to scale and orientation changes.

Flattening and Fully Connected Layers: The convolutional and pooling layers are generally followed by one or more fully connected layers. These layers take the high-level filtered information from previous layers and use it to classify the input into different categories. This layer produces the output of the network.

Training: In the training phase, the CNN learns to recognize patterns and features by adjusting its internal parameters through a process called back propagation. This involves adjusting the weights and biases of the network based on the error between predicted and actual outputs.

Fig : Dataset

RESULT AND DISCUSSION

This study design shows solution towards wild animal attacks. In which the module gives alarm when wild animal observed in the range of ESP32 CAM module.

CONCLUSION

This framework is helps to monitor the activity of animals and detecting wild animals. This approach helps to save the animals from human hurting and humans from animal attacks. This framework also generates alert when wild animal is detected.

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Wireless Charging Pad for Multiple Devices

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ABSTRACT

This paper represent the design and working of wireless charging pad for multiple device which is use to charge the device such as mobile, smart watch, ear bud, Bluetooth etc. wireless means the device that do not have any type of wire to charge our device. We know the life of battery of mobile phone is always major problem for people so, they always complaint about their life of battery. They do not have long battery life so, they have to charge their phone many times.by using wireless charging pad we can charge our device anywhere and anytime. In wireless charging pad there is new concept to charge our device without any charger we can charge it automatically. In this there are two circuits one is transmitter and second is receiver. In this the transmitter circuit have AC to DC rectifier circuit after that it is modulated by pulse width modulator circuit. By using Faradays" law of mutual induction in which PWM is connected to the primary coil of transmitter and the secondary coil is get induced electromagnetic interference then AC to DC bridge circuit is used for connect the pin of charger to mobile. Microcontroller is used for avoid the overcharge the battery.

KEYWORDS *: Mutual inductance, Mobile phone, Wireless charging.*

INTRODUCTION

The concept of transfer the wireless power was realized by Nikolas tesla, which could make the some change in the electronic engineering field that is helpful for remove the use of conventional copper cable and long current carrying wires. Wireless charging pad for multiple devices are most convenient and easy to use. They allow you to charge the multiple devices at a time such as mobile phones, smart watches, ear bud, Bluetooth, etc. which does not required the multiple cables, it is a great way to keep all your devices powered up. Wireless charging eliminates the cable which are required for charge the mobile phone and other appliances. Wireless charging allow easy to use battery charging of mobile devices providing any hassle with plugs as well as cable only place the your mobile phone on charging the pad then it charge automatically. The concept of this project demonstrates the purpose of wireless charging system. The efficiency of the system is generally calculated by distance between the coils. The wireless charging system allows the people without wire charge their mobile phone without plugging in the mobile adaptor. The system is demonstrated using charging pad where user just needs to place their adapter to charge the mobile.

INTRODUCTION OF WIRELESS TECHNOLOG

The working principle of wireless charger is generally based on the concept of mutual inductance .There are different type of technologies of wireless charger that are classified into non-radiative coupling based charging and radiative RF based charging. There are three technique which is consist the former namely inductive coupling, magnetic resonance coupling and capacitive coupling .wireless chargers are super cool way to charge your device without any cords or cables .they use electromagnetic field to transfer the power from the charging p pad to device .All you have to do is place your phone or any other gadgets on the charging pad then it will be charge without wire .suppose, you have to charge the multiple at a time then put in on charging pad it will reduce clutter .There are different shape and size of wireless charger. From charging pads to stands, and can be used with smart phone, smart watches and wireless ear buds. The wireless technology makes our life more convenient and easier. .Imagine you are sitting on chair and reading a newspaper and automatically charging your mobile phone by placing it on a table without any need of wireless charger. The most common method of wireless charging is inductive coupling. .Inductor generally induced the current to produce the magnetic field. This technique is generally based on the electromagnetic induction .With wireless technology we can enjoy the freedom of mobility and convenience .wireless technology uses the different type of method like radio waves, infrared signal which is required to transmit the data and communication between the device.

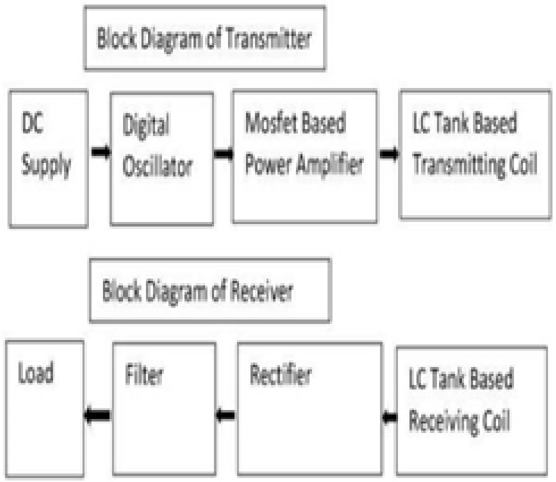
RELATED WORK

Wireless charger is one of the good topics of transfer the inductive power. We know that if the distance between the primary side and the secondary side and secondary increases then efficiency is decreased. As a result, without any contact with wire better contactless transfer control mechanism and better quality of metal with high mutual coefficient is necessary. The capacitor is used in the primary side and secondary side to increase the transfer efficiency. Prof. Siddhesh N. Upasani, Miss. Gauravi Rajput, Miss. Petare Utkarsha Suresh , Miss. Kangane Sushmita."Wireless charging pad for multiple devices", 2017. Has given overall historical background, different issue of technology. It also gives different type of wireless technology and also engineering application are discussed for understanding which is better and which is required for application. The authors also shared arguuments on engineering challenges and development of charging by using the wireless mode. Venkata Thota Pruthvi Merugu Kavitha, Phaneendra Babu Booba, D Mohan Reddy, „Design of a wireless charging system for Mobile and Laptop application‟, 2018. In this paper a Universal wireless charging system (UWCS) is designed, in which copper coils are connected series in fashion by means of electronic switches. It provides the better structure of coil for UWC system for laptop and mobile application. Chung-Yu Wu , Life Fellow, Sung-Hao Wang, Li-Yang Tang, „CMOS High Efficiency Wireless Battery charging system with Global Power Control Through Backward Data Telemetry for Implantable Medical DEVICES‟ ,2020. This paper give the detailed information about high-efficiency CMOS wireless charging of battery system with voltage tracking through PLSK(pulsed load- shift keying) backward data elementary technology is designed. Kuan-Ting Lai, Member ,IEEE, Fu- chiung Cheng, Seng- Cho T. Chou, Yi-chun Chang, Guo-Wei Wu, andnJung –cheng Tsai,‟ Any Charge: An IOT based wireless charging Service for the Public‟,2019. In this paper we have research the mobile phone become necessary for the modern life that is used for different activity such as text message, gaming payments, video streaming. All of these tasks consume the significant power of the battery which is important for public charging services. In ISTP Journal of Research in Eletrical and Electronic engineering (ISTP-JREEE) (I0CRESM 2014), "Wireless Power

Transmission for Mobile and Vehicle" Vithyaa.M, Marthandan.R has been creating the basic principle of wireless charging. It is not only for mobile but also for vehicles and it also provides the mechanism for paper. This literature survey helps in deciding the main goal of our project. It also provides problem definition of some extent.

SYSTEM DESIGN

In the wireless charging, the block diagram consist the two sections first one is the transmitter section and second is receiver section .The transmitter section is responsible for generating an alternating magnetic field. It mainly include the power source such as adapter it provide the electrical energy. This electric energy is then converted into high- frequency AC power by an oscillator. The AC power is amplified and sent to a coil. This coil generates the magnetic field. On the other hand the receiver, consist of coil that capture the energy is then converted into electrical energy using rectifier circuit. The Rectifier circuit convert the AC power into DC power which is used for charge the device battery. The power management system ensures efficient charging. It includes components like voltage regulator, current limiter, and temperature sensor. All of these component help to regulate the charging process and protect the device from overcharging or overheating and optimal charging efficiency. The overall block diagram of wireless charging illustrates how the transmitter generates the magnetic field.



METHODOLOGY

The figure shows wireless charging pad for the multiple devices. At the Transmitter side and Receiver side it requires the copper coil. In the transmitter side DC power supply which is also called as DC to DC converter. This DC converter is a power supply that uses the DC voltage as input instead of AC voltage. The main function of DC power supply is to produce a regulate voltage for electronic device. Digital oscillator having the capability of producing electronic oscillator in the form of signal wave. Digital Oscillator convert the one form of power supply into another form of power supply. The coil of transmitter is connected to the 230V, AC 50HZ power supply. AC power is converted into the 12 V. There are such as LC oscillator, wien bridge oscillator crystal oscillator. Crystal oscillator which is also called modern oscillator is operating at high frequency range. The digital oscillator is connected to the MOSFET based power amplifier. MOSFET (Metal Oxide Semiconductor Field Effect Transistor) is a technology of process the digital signal. When voltage is applied to the gate electric field is generated that changes the width of channel region. In the transmitting coil of LC tank the capacitor store the energy in the electric field and the inductor store the energy in the magnetic field. At the Receiver side Rectifier convert the alternating current into direct current by using on or more PN junction diode. The filter circuit is capable of while attenuating the other frequencies and the load device is used for set the resistance value different type of Oscillator. There is different type of methodologies used in the wireless charging pad for multiple devices .the most common method is inductive charging. Inductive charging uses electromagnetic field to transmit the power from the charging pad to the device. It uses the copper coil in the charging pad which generate alternating magnetic field.

HARDWARE

The photograph of project is shown in figure The mobile phone getting charged with android application. The hardware of transmitting and receiving section along with the coils can be seen as well. In the wireless charging it include the hardware component such as voltage regulator, Copper Wire, MOSFET, Diode, Capacitor, Resistor and LED current limiter temperature sensor. All these component helps safe and efficient charging. Different wireless charging standards, such as Qi may have specific hardware requirement and specification. The hardware component of the transmitter and receiver remain consistent across different wireless technology.

ADVANTAGES

- With a wireless charging pad, you can charge the multiple devices at the same time without the need for separate charging cables.it simplifies the charging process and reduce the cable clutter.

- You can charge multiple devices, such as your smartphone, smart watches and wireless ear buds, all at once on a single charging pad.
- .It saves time and ensures all your devices are ready to go when you need them.
- The mobile phone can charge anywhere anytime.
- Different models of device can also use the same charger.
- For the contact free device it provide the better product durability.
- Wireless charging pad usually have built in safety features to protect your device from overcharging and overheating.
- Wireless technology helps to the lifespan of your device.

APPLICATION

1. It can efficiently use to power the different home appliances without cable.
2. In consumer electronic there are many application of wireless charging.
3. In the wireless technology it would lead to a number of new applications in any vast field making everything wireless.
4. On large scale it can be used in charging of car batteries. Charging station help to fulfil this feature when practically applied.
5. Without cable we can charge the home appliances.

CONCLUSION AND FUTURE SCOPE

Wireless charging pad offer a clutter-free and convenient way to charge multiple devices simultaneously. They eliminate the need for adapters and charging cable making it easier to keep your entire device powered up. As for the future scope we can makes improvement in the charging efficiency, faster charging speed and compatibility with a wider range of devices. The integration of smart features, such as intelligent device detection and optimized charging algorithms, could enhance the overall charging experience.

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Pattern Fabric Defects Finding Using Regular Band & Distance Matching Function

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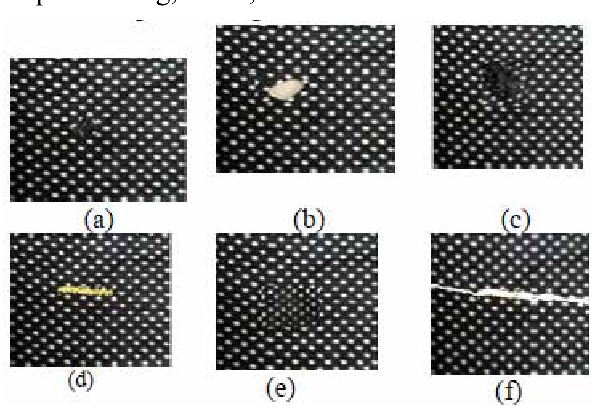
ABSTRACT

To detect patterned fabric problems, the proposed work combines the regular band technique with a distance matching function. The usage of regular bands defines the regularity of patterned fabric. The present work created a modified distance matching function that can be utilized to calculate the periodic distance of repeating units in patterned fabrics in both horizontal and vertical directions. This strategy offers greater precision in identifying flaws such knots, thick and thin bars, holes, broken ends, and multiple threading than earlier methods.

INTRODUCTION

Fabric defect identification play a critical role in preserving quality throughout the fabric industry manufacturing process. In the past, visual inspection was done by a human, which causes inaccuracy because of human fatigue. As a result, accuracy and efficiency were lower with traditional inspection methods.

In order to tackle the aforementioned issue, automatic fabric defect identification is required to boost manufacturing rate and quality [13], increasing the product's efficiency. Figure 1 illustrates the various types of fabric flaws that can result from machine malfunctions or spoilage, including holes, broken ends, multiple knitting, knots, and oil strain.



Many fabric issues, including a) broken ends, b) holes, c) knots, d) multiple threads, e) oil strain, and f) thin bars, are shown in Figure 1.

These defects generate revenue losses by lowering the quality of the product [1][12]. There are two types of fabric: patterned and non-patterned. For the inspection of patterned textures, several methods have been devised [5]. The spatial distribution of the pixel values is shown using statistical analysis. Using a variety of techniques, Ngan [5] described regularity analysis for patterned texture [9][10]. According to the concept of spatial relationship, each pixel in a picture should be dependent on and vary in value steadily with its neighboring pixels.

RELATED WORK

The texture of patterned fabric is repeated in units. One pixel in an image should depend on and continuously change in value in relation to its neighboring pixels according to the concept of spatial relationship. [5][8]. Numerous techniques have been devised for examining the printed fabric. The auto correlation function provides spatial frequency. The autocorrelation function calculates a pattern's periodic length on a plot by applying the regularity approach[22][8]. Primitive textures with large sizes do not perform well in the Co-occurrence matrix. Fabric defect detection was described by Chan & Pang [6], however it is not a good fit for fabric defect identification because of the absence of spatial information. Kumar Ajay The Gabor filter approach, which has computational complexity but provides both frequency and spatial information, was described in [1][11][18][14]. A multi-resolution signal decomposition technique is wavelet representation [24]. Wavelet transforms (WT) [2][25][8] rely on wavelets, which are discrete signals with a finite duration and changing frequency. After detection, the WGIS approach provides an outline of the problematic locations; however, the discovered results are coarse. The spectral technique, or Direct Thresholding (DT) [36, 38][8] For patterned texture, the Bollinger Band approach is a shift-invariant technique. After identification, the Bollinger Band can show the locations of defects. When compared to WGIS and DT methods, the Bollinger Band approach is quicker, but it cannot identify flaws if there is just a tiny color variation from the texture pattern [36, 37, 8]. Fabric flaw identification and texture categorization are two applications for the local binary pattern (LBP) feature [41]. It is multi-scale and rotationally invariant; to find defects, the reference and test feature vectors were compared.

PROPOSED METHOD

Using a distance matching function, we have extracted a repeated pattern in the suggested work, and this period is used to detect fabric defects. Using the regularity technique, faults are found using the Regular band. Any flaw is equivalent to a signal abnormality. The signal value's standard deviation shows whether there is any irregularity. The standard deviation's maximum and minimum values represent the regular signal's tolerance threshold for normal variations. Should a flaw be discovered, it will surpass this threshold of tolerance. There are two phases to the RB method: training and testing.

Training Stage

Step 1: Preprocess

Histogram equalization comes after color to grayscale image conversion in image preprocessing. As seen in Fig. 2, the equalization process eliminates any noise in the image to maximize thresholding efficiency.

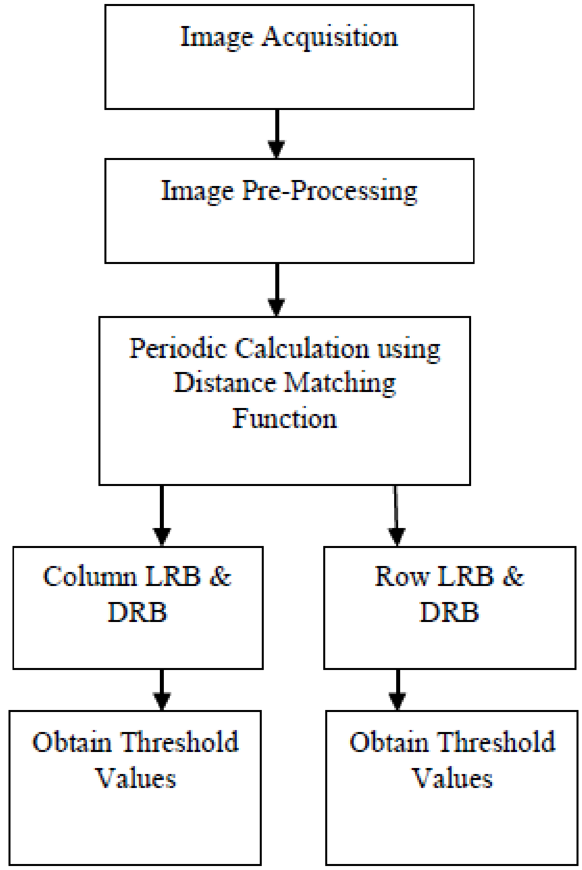


Fig 2. The training process of proposed algorithm

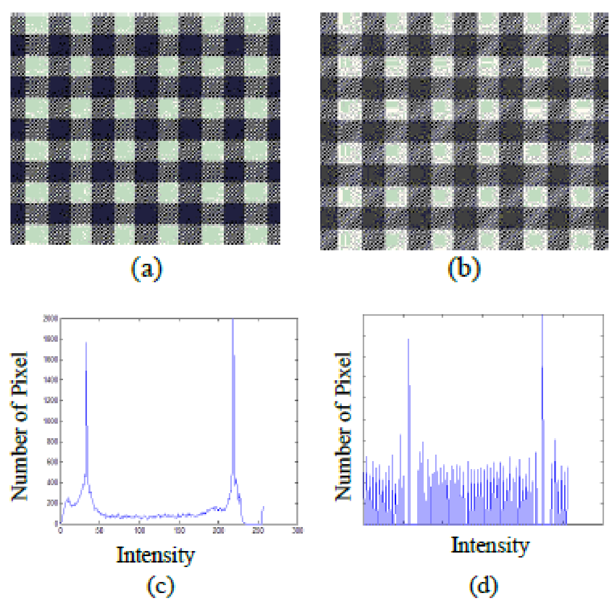


Fig. 3. Image Preprocessing a) Grayscale image b) Equalized image c) Grayscale image d) Equalized image

Step 2: Adapted Distance Matching System : Finding the competing unit's repeating distance using the distance matching algorithm while accounting for the similarity of surrounding patterned fabric units. [7][16].

"Sum"(p) = ∑_(x=1)^M ∑_(y=1)[f(x,y)-f(x,y+p)]–[^(N-p)^2 (1)

"Sum"_λy (p) = ∑_(y=1)^N ∑_(x=1)[f(x,y)-f(x+p,y)]^(M-p)^2 (2)

P's maximum value is calculated by taking into account the minimum one fold repetition of the patterned unit and dividing it by the total number of rows and columns. Equations [13][15](3-6) are used to compute the initial forward and reverse distances.

$$D_1(p) = Sum_{\lambda x}(p+1) \quad - Sum_{\lambda x}(p) \tag{3}$$

$$D_2(p) = Sum_{\lambda y}(p+1) \quad - Sum_{\lambda y}(p) \tag{4}$$

$$D_1(p-1) = Sum_{\lambda x}(p) - Sum_{\lambda x}(p-1) \tag{5}$$

$$D_2(p-1) = Sum_{\lambda y}(p) - Sum_{\lambda y}(p-1) \tag{6}$$

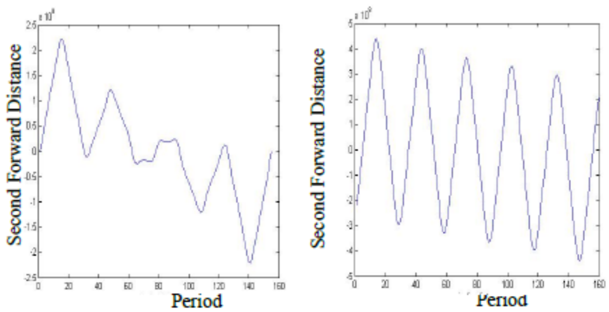


Fig 4. a) 2 nd forward distance in rows b) 2 nd forward distance in coloumn

Step 3:Regular band Calculation

$$\mu_{r_n} = \left(\frac{\sum_{j=1}^{r_n} x_{ij}}{n} \right) \tag{7}$$

The standard deviation's maximum and minimum values represent the regular signal's tolerance threshold for normal variations. Should a flaw be discovered, it will surpass this threshold of tolerance.

$$\delta_{r_n} = \sqrt{\frac{\left[\sum_{j=r_1}^{r_n} (x_{ij} - \mu_{r_n})^2\right]}{n}} \tag{8}$$

The standard deviation is denoted by δ_(r_n).

Regular Band Calculation: Light Regular Band (LRB) and Dark Regular Band (DRB)[5] are computed on both rows and columns for each image.

$$L_{r_n} = (\mu_{r_n} - \delta_{r_n}) + \mu_{r_n} \tag{9}$$

$$D_{r_n} = (\mu_{r_n} + \delta_{r_n}) - \mu_{r_n} \tag{10}$$

Step 4: Obtain threshold Values

The regular band's LRB and DRB are used to compute four threshold values: These values indicate the bounds of regularity for an image of non-defectively-pattered fabric.

$$LRB_{max} = \max(L_{r_n}) \tag{11}$$

$$LRB_{min} = \min(L_{r_n}) \tag{12}$$

$$DRB_{max} = \max(L_{r_n}) \tag{13}$$

$$DRB_{min} = \min(L_{r_n}) \tag{14}$$

Testing Stage

With the exception of applying the threshold learned in the testing picture for fault identification, as shown in Fig. 4, the testing stage and training stage are comparable.

First Step: Image preprocessing

Second Step : Adjusted Matching Distance Formula

Third Step : Standard band computation

Fourth Step : Detecting defects with thresholding

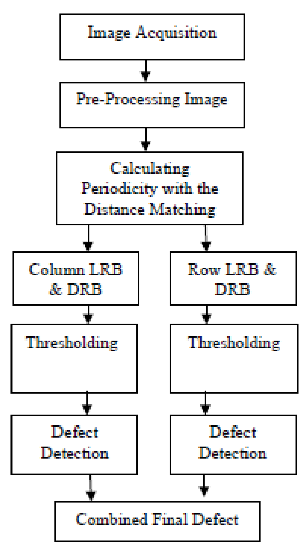


Fig 5. The Suggested Algorithm's Testing Procedure

EXPERIMENTAL RESULTS

MATLAB R2015b is used to implement this method. The TILDA textures database[42] is the subject of extensive research to identify the hole, thick bar, knot, thin bar, and oil strain depicted in Figure 5. As indicated in Table 1, the algorithm's performance is evaluated.

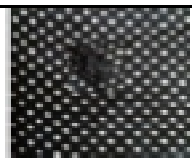
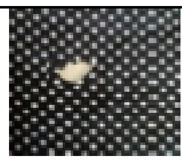
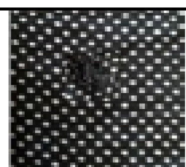
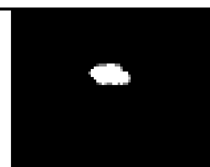
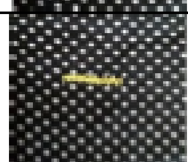
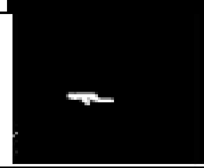
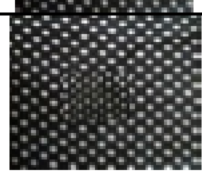
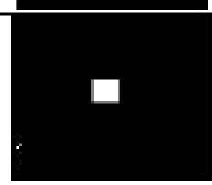
Type of Defect	Image	Regular + Distance Matching
Broken end		
Hole		
Knot		
Multiple thread		
Oil strain		

Fig 6. Using the suggested technique, defects on patterned cloth were found

Table 1. Cross Validation Accuracy in %

Various Methods	Broken end Defect	Hole Defect	Knot Defect	Multiple thread Defect	Oil Strain Defect
DT Method	82	87	85	80	89
WGIS	84	89	88	84	91
Bollinger Band Method	91	90	93	92	95
Regular Band Method	94	95	96	96	94
Regular + Distance Matching	95	96	98	97	96

CONCLUSION

We have presented a supervised pattern fabric defect detection method in this research that makes use of modified distance matching function regularity analysis. The moving average is computed using the period obtained from the distance matching function. LRB, and DRB. Our approach can effectively identify holes, broad bars, thin bars, oil stains, and various netting faults and is resistant to variations in illumination. Both borderline and mild color variation issues are detected by regular band. Since the Regular Band technique relies on supervised learning, it is not suitable for detecting faults in intricately patterned materials and requires a significant amount of time.

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An Attribute-based Access Control System for Cloud Storage with Blockchain

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ABSTRACT

The RBAC framework is a system that defines basic techniques for accessing resources. Access control systems in computer security regulate access to important resources including data protection, computers, computer systems, and storage areas. ABAC policies include several attributes such as subjects, resources, and environment that are part of the request. There are certain criteria about qualities that define their attributes. The system utilizes Blockchain technology to provide innovative methods for publishing rules that grant access to data and resources. It employs the Ethereum Virtual Machine (EVM) to enable the decentralized transfer of these rights among users using smart contracts, ensuring self-enforceable policies in smart computing. This article presents a system that implements role-based access control using Smart Contracts (RBAC-SC), which leverages smart contract technology to manage organizational roles. Ethereum is a secure, versatile, and flexible Blockchain platform that is available for free. As a result, smart contracts were developed. In our suggested paradigm, policies and rights exchanges are encrypted blocks of data kept on the cloud, allowing users to add policies along with data or resources and subjects at any time. And can confirm the current individuals with authorization to access the data or resource. This approach enables distributive audit to prevent parties from cheating by falsely claiming rights under the policy.

KEYWORDS : *RBAC, ABAC, CP-ABE, Cloud storage, Blockchain, Virtual machine, Cloud service provider.*

INTRODUCTION

RBAC is a flexible architecture often used for access control inside organizations, but roles may also be used in a trans-organizational context. Take, for example, the fact that students often have the option to purchase books at discounted prices. The implementation of role-based access control via the use of smart contracts (RBAC-SC), trans-organizational RBAC systems that makes use of Blockchain technology and smart contracts, is something that we recommend.

LITERATURE SURVEY

In [1] patients have control over their medical records due to blockchain technology. Smart contracts on the Ethereum blockchain empower patients to manage their data securely in a decentralized, immutable, transparent, traceable, and trustworthy manner. We also investigate the generalization components of our method and provide a security analysis. The limitations of the proposed method are specified. We publicly provide the smart contract source code on GitHub.

In [2] IPFS offers a blockchain-powered secure access to and storage system for electronic medical records. We developed an attribute-based encryption system to securely store and efficiently share electronic medical records in an IPFS storage setting. We use the non-tamper able and traceable features of blockchain technology to securely store and search for medical data. Our method provides targeted protection against specific keyword attacks, as supported by the security evidence. Our method is effective and feasible, as shown by performance analysis and real data set simulation tests.

Health records are being managed using blockchain technology [3]. A patient-focused, fully decentralized approach that can identify data theft, prevent data alteration, and empower patients to manage access. Blockchain technology is the most efficient solution for addressing all problems and fulfilling all requirements. Smart contracts in healthcare might further streamline processes. Exploring its extensive scope, I anticipate more research and practical implementations.

A way for exchanging and protecting medical data using blockchain technology [4]. A plan for exchanging and protecting medical data was created using the hospital is private blockchain to advance the electronic health system. The system may fulfill many security needs such as decentralization, openness, & tamper resistance. Doctors may securely store and access medical data or obtain patient history data while maintaining privacy. The recommended technique is implemented using PBC and OpenSSL libraries.

In [5] HealthyBlock is a blockchain-powered IT framework for storing electronic medical records that is resilient to network failures. A patient who poses a direct threat to others, leading to significant public health costs for governments. Utilizing blockchain networks to develop electronic medical record (EMR) systems is a suggested solution, but many overlook connectivity failures, common in developing countries, that can result in data integrity issues. A patient care prototype was created for a hospital network using the Healthy Block architecture. The assessment showed that patients' EMRs are efficiently maintained in a unified, updated, and secure manner, independent of the healthcare provider's network they engage with.

According to [6] the novel methodology allows patients to provide private keys to users, reducing security difficulties caused by the scheme's attribute authority, in contrast to previous similar ways. The new system utilizes blockchain to handle keys, so mitigating the risk of a single point of failure that is often associated with centralized key management.

An effective consortium blockchain designed for the sharing of medical information [7]. a novel commercial strategy for sharing medical information on a blockchain-powered platform Our system leverages the advantages of blockchain technology for the storage and transfer of medical data. Participants of the dispersed network may store, share, and accurately verify information. Additionally, a new consensus process & a universal anonymous sharing mechanism are introduced. These methods enhance the effectiveness and safety of sharing medical data among users. To prevent manipulation and fraud, the information and transaction records may be stored in a decentralized way.

According to [8] a consortium blockchain will be established to provide a distributed system by leveraging current Electronic Health Records (EHRs) via the use of Hyperledger Fabric. We use a proxy re-encryption approach to maintain a patient's privacy throughout data transport. We developed and used many chaincodes to manage the agreed-upon business logic of the network's member companies.

The patient identification based on blockchain in healthcare [9]. As far as we know, there is no existing literature that covers the same topics. Consequently, they include vital details on the patient's privacy and identity. To create a robust and reliable Electronic Health Record (EHR) and Personal Health Record (PHR) that form the foundation for various healthcare services, it is essential to carefully manage decentralized management, privacy, scalability, and data flow.

Utilizing blockchain technology to safeguard the confidentiality of electronic health records [10]. Blockchain technology will regulate information access using cryptographic technologies and decentralization. It will achieve a balance between data privacy and information accessibility. The primary objective of this research is to outline the data security and confidentiality problems in electronic healthcare.

Table 1: Comparison Table

Author and Year	Title	Proposed Approach	Advantages	Disadvantages
Cheng JC, et.al IEEE 2018 [11]	Blockchain and smart contract for digital certificate	A system was suggested for generating dynamic e-certificates with a smart contract on the Ethereum blockchain.	Easy generate the e-certificate and provide security in blockchain.	1: cant update default written smart ontract. 2: much expensive when work with ethereum blockchain
Davidson, S., De Filippi, P., & Potts, J. 2016 [12]	Disrupting governance: The new institutional economics of distributed ledger technology (Davidson et al. 2016)	An analysis of Backfeed, an Ethereum-powered platform designed to establish innovative commons-based collaborative economies.	The new governance capabilities that blockchains bring have the potential to offer far greater improvements to total factor productivity and economic welfare .	Economic analysis is at risk of fundamentally misunderstanding the long run consequences of distributed ledger technology.
Johansen, SK. 2017 [13]	A comprehensive literature review on the Blockchain as a technological enabler for innovation (Johansen, 2016)	The Blockchain technology to function as a technological enabler for innovation and the required factors for success.	The system improves the understanding of technology.	It is essential to keep advancing the technology as research suggests that the system has not yet achieved the critical degree of technological advancement.
Glaser, F., & Bezzenberger, L.[14] 2015	Beyond cryptocurrencies - A taxonomy of decentralized consensus systems	A comprehensive taxonomy of decentralized consensus systems in order to provide a tool for researchers and practitioners.	The approach also takes into account the volume of literature in the area as a crucial component in assessing the sophistication of the notions.	There is still a gap in understanding the Business Transformation in Organizational Innovation.
Pazaitis, A., De Filippi, P. and Kostakis, V. [15]	Blockchain and Value Systems in the Sharing Economy: The Illustrative Case of Backfeed	An abstract economic model of decentralised collaboration using blockchain technology.	Blockchain technology has the potential to support the creation of commons-oriented ecosystems inside a sharing economy.	Empirical investigation is always necessary to verify a theoretical model, regardless of its correctness.

PROPOSED SYSTEM

The System architecture for Attribute Based Access Control for Cloud integrated with Blockchain in which participants are as given below:

1. Data Owner (DO): A Data Owner (DO) is any anyone, even those without authorization, who has data intended for uploading and sharing. A Data Owner establishes an access policy that allows only users with corresponding attribute sets to decrypt and access the unencrypted data.

2. Cloud Service Provider (CSP): CSP is a partially trusted environment that manages data storage.

3. Attribute Authority (AA): An Attribute Authority (AA) is in charge of assigning a group of users a certain set of attributes, referred to as a domain, and distributing cryptographic keys to them. An AA may register users inside its domain and provide the attribute keys of its domain to users. Attribute assignment is a primary function of an AA, in addition to generating users. The system may assign characteristics to users from other domains, so a user established by AA can acquire attributes from AA. Each AA in our system is considered semi-trusted, meaning it may be interested in the value of a plaintext but does not want to tamper with it.

4. Data User: A data user is a designated person seeking to access encrypted data. The user enrolls in an Attribute Authority and acquires one or several attribute sets. When the attribute sets meet the requirements of an access policy linked to a cipher text, the end user may access the cipher data. By inputting the correct key, they can decode the cipher text and obtain the plaintext.

5. Distributed Blockchain: The Blockchain serves as the decentralized record that reflects the current status of authorized access privileges inside the system. The Root Authority & the Attribute Authorities manage permissions for interacting with the Blockchain.

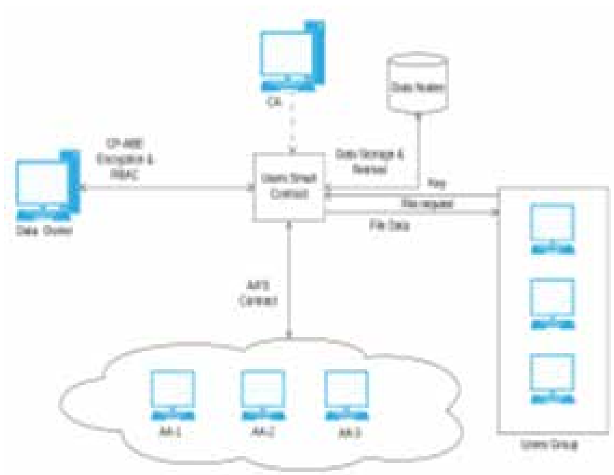

Figure 1: Proposed System Design

RESULTS

Calculate the matrices to assess accuracy for the system's performance assessment. Fig. 2 displays the time needed for the consensus process in the direction of authenticate the Block-chain across 4 nodes. The x_axis represents the size of the Blockchain, while the y_axis represents the time needed in milliseconds for 4 nodes.

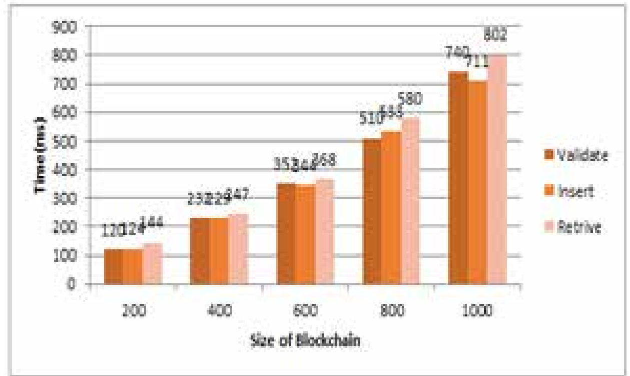

Figure 2: Milliseconds needed (required) in a P2P network

The second experiment assesses the proposed system's smart contract validation using a consensus technique across various numbers of peer-to-peer nodes.

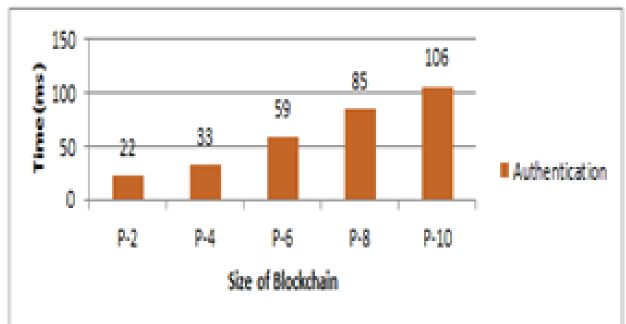

Figure 3: In Blockchain, the amount of time needed for a smart contract.

CONCLUSION

This study primarily focuses on developing a software organization prototype that enforces an access control model for data stored in untrusted settings. Algorithms with suitable complexity, functionality, and implementation have been chosen for the system. The main advantages of an access control system include the ability to customize access policies for encrypted data without the need for duplication among numerous participants, define dynamic access policies, implement access policy changes without requiring action from other system members, and ensure the integrity of transaction information through blockchain technology and smart contracts. We used blockchain technology to record file sharing and revoking transactions among users. Within a cloud environment, various applications, data files, services, and resources are shared among multiple users in a group, making it challenging to identify individual user actions. It is essential to track these changes to detect any potentially malicious activities by a user within the group. Therefore, This prototype can be enhanced to secure data and shared resources in the cloud for groups of users collaborating on shared data or resources. It can also be used to monitor changes made by each user within the group on shared applications, data, services, and resources. Additional research is needed to investigate the optimal integration of an access control system inside blockchain technology.

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Enriching Student Tracking System in College Bus using Face Recognition through Deep Learning

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ABSTRACT

The majority of university students commute between locations using the bus that the administration of the university provides. In order to improve the quality of bus services, analysis is needed to determine factors like the number of passengers and personal information about students or unknown individuals. This research study aims to construct a face recognition system based on student faces using convolution neural networks and the opencv environment. Additionally, it tests and validates the built system's performance for face categorization and passenger evaluation. Additionally, this system can use the Internet of Things to store passenger information in a MySQL database. This system uses the camera on a mobile phone with the assistance of the Droid Cam application, which supports libraries used for face recognition and classification, like OpenCV and face recognition, which is enhanced by the Convolution neural network model. In order to record the data in the database, this project can recognize the faces of the passengers as soon as they board the bus and identify whether they are students or unidentified individuals.

INTRODUCTION

One of the essential requirements in the majority of institutions and universities is attendance. This attendance is typically taken in order to accurately count the number of persons or pupils seated in a specific classroom or other practice space. The conventional approach to take attendance involves a lecturer or teacher manually counting each student while recording their necessary information, such as their name, status, and serial number. This procedure takes a long time, and maintaining the data that has been gathered is challenging. As a result, we can digitize and streamline the attendance process while maintaining accuracy. Through the use of image processing techniques, our project will digitize the process of collecting attendance. Additionally, it will use IOT to automatically update faculty databases in real time. Our idea is primarily software-based, thus there aren't many physical components. In order to continuously scan every student's face, we first use a stationary camera that is placed over the entrance to each classroom. pioneering application of methods for determining a person's identification is through face recognition, a topic that has seen significant research in recent years. One common biometrics research topic is face recognition from photos. Knowing picture analysis is one of the most helpful uses of face recognition. Owing to a few particular issues with face recognition, computer vision experts as well as psychologists and neuroscientists were interested in the field since advancements in face identification could provide insight into how the human brain functions. Even though there are numerous biometric techniques for identifying people, such as retinal scanning and finger analysis, they still require human collaboration. On the other hand, face image-based human identification does not require it. Because face recognition differs from other biometric techniques in that it does not require human collaboration, it is therefore essential for determining an individual's identification.

Even so, there are numerous technologies available for identifying faces in pictures. Numerous studies will identify more effective components that boost precision and efficiency.

Pose, occlusion, lighting, and other variables generally affect efficiency and require a substantial processing capacity to retrieve from a huge image dataset. It might cause attention to shift toward enormous image datasets and novel algorithms that improve accuracy while lowering processing burdens. The ultimate goal is to recognize human faces from image datasets in an efficient manner. Research has been conducted in the field of biometric face recognition to identify individuals based on their facial features from a group photo. Face recognition has a wide range of applications and is frequently utilized in biometric systems and security-related applications. Face detection, face recognition, and training of discovered faces are the three main building blocks of a face recognition system.

LITERATURE REVIEW

[1] H Qi et al. introduce LBAS_Resnet50, a real-time face detection method based on blink detection. The model employs ResNet50 as the basis network structure and feeds the texture information extracted by the LBP approach into it in order to boost the recognition process's tolerance to lighting. Then, by employing BiLSTM to gather context information, it is simple to extract time series features to improve the accuracy of real-time recognition. To improve the robustness of the model, SPP pooling is used in conjunction with the channel attention approach to extract important feature information and assign weights.

[2] In contrast to other various identifying methods like the fingerprint, iris scanner, and RFID, Anirudha B. Shetty etal. offer an identification approach in facial recognition as one of the key uses. Accurate facial recognition could be improved by the clear image and appropriate posture. The face recognition system serves as the foundation for the current work, which compares the two methods, Local Binary Pattern Classifiers and Haar Cascade. It finds that the LBP classifier is less accurate than the Haar cascade classifier. This will assist individuals in selecting the optimal algorithm for their task. The inability of the classifiers to recognize children's faces is a drawback. This could be used in the future. Emotion estimate from face expression analysis is currently a popularly researched computer vision task, according to Carmen Bisogni et al.

[3]. On the other hand, the dynamics of pertinent face features are used to classify expressions. Even with the encouraging accuracy findings obtained under controlled and favorable conditions, there is still a significant performance loss in processing faces taken at a distance, which entails low-quality images. Specifically, the majority of methods and associated computational models exhibit considerable instability when dealing with the often tiny number of relevant pixels under these circumstances. Section 2 of this research paper is devoted to a review of previous publications, referred to as a literature survey. Additionally, the section Proposed methodology, which has a number of three, provides a general description of the implemented procedure. The findings of the experiment are discussed in Section 3. Section 5 brings this paper to a close and leaves room for future improvements.

[4] A facial recognition attendance system based on deep learning is presented by Khawla Alhanaee et al. By employing three convolutional neural networks that have already been trained and fed data, system are able to use transfer learning.

The system performed exceptionally well in terms of high prediction accuracy and manageable training time when compared to alternative methods. SqueezeNet, GoogleNet, and AlexNet are the three networks that attained validation accuracy of 98.33%, 93.33%, and 100%, in that order. The suggested method could be used to door access and attendance systems at numerous establishments, including airports, universities, schools, and the public and commercial sectors. By looking at more pre-trained CNN models and adding more data from human facial images, this work can be furthered. Examining how to use these models for masked face human identification tasks is intriguing.

[5] According to Nico Surantha et al., Facial recognition systems, particularly those lacking liveness detection, are susceptible to face spoofing attacks, in which malevolent actors attempt to obtain access by posing as another person. Liveness detection is used in face

recognition-based attendance systems to stop the taking of individual attendance from people who are not actually there. Because they may be easily moved to any suitable area as needed, portable devices are more practical and efficient for running attendance systems. Implementing liveness detection will be difficult since portable devices have limited processing power. The liveness detection technology used must be lightweight in order for the attendance system to continue operating on portable devices. The processing time of every face that is submitted to the system will be affected by the addition of a liveness detection step. Several CNN models that have already been trained were employed in this study's tests. Pre-trained models with training for both object and face recognition were employed.

ARCHITECTURE

The architecture for enriching the student tracking system in college buses through face recognition using deep learning involves several key components. Firstly, a robust data collection and preprocessing module gathers a diverse dataset of facial images of students boarding and exiting the bus, followed by preprocessing steps to standardize image quality and reduce variations. Next, a feature extraction and representation module utilizes pre-trained deep learning models to extract rich hierarchical representations of facial features. These features are then fed into a face recognition model training module, where a model is developed and trained to discriminate between different faces, optimizing its ability to accurately identify individuals. Integration with the bus tracking system involves developing an interface to receive real-time video feed from onboard cameras, implementing face detection algorithms to detect faces, and using the trained face recognition model to match detected faces with known student identities stored in the system.

Real-time processing and decision-making modules handle continuous video streams, performing face recognition to determine student identities and make decisions such as logging attendance or granting access.

In parallel, security and privacy measures are paramount, with encryption of facial data during transmission and storage, as well as secure authentication mechanisms to prevent unauthorized access. Finally, a monitoring and reporting module provides real-time monitoring of student attendance and bus utilization, generating reports and analytics to support decision-making regarding bus routes and schedules. This architecture seamlessly integrates deep learning-based face recognition technology into the college bus tracking system, offering enhanced accuracy, security, and efficiency in student tracking and management, ultimately improving the transportation experience for students.

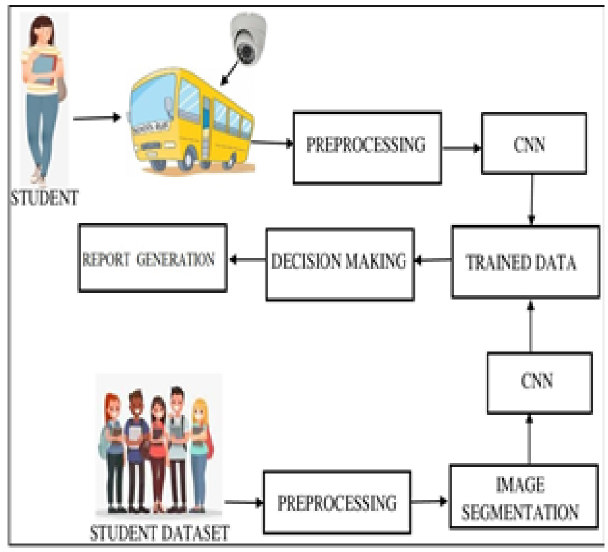

Figure 1. System Architecture

Step 1: Frame Capturing and Preprocessing :

This is the first stage in the proposed design. To enable the camera to record a live video stream, an open CV library is installed.

Step 2: Image Segmentation :

For the training purpose for which the validation and training generators are being used. The training generator initially sets the image's target size as 48 × 48, the batch size of 32, the color mode of RGB, and the category class mode is set.

Step 3: Convolution Neural Network :

This is the main part of the proposed method, and it's in charge of identifying and detecting facial features. The convolutional Neural Network module receives the original images as inputs. This model is trained using the input images that were collected, preprocessed, and segmented in the earlier stages of the process.

Data Collection and Preprocessing

This component involves collecting a dataset of facial images of students boarding and exiting the bus. Data preprocessing techniques such as normalization, resizing, and augmentation are applied to ensure consistency and quality across the dataset.

Feature Extraction and Representation

Utilizing pre-trained deep learning models (e.g., VGG, ResNet) to extract features from facial images. These features capture unique characteristics of each student's face, enabling effective representation for recognition.

Face Recognition Model Training

Developing and training a face recognition model using the extracted features. Training involves optimization of the model's parameters to accurately discriminate between different faces. Techniques like triplet loss are employed to enhance the model's ability to recognize individuals.

CONCLUSION AND FUTURE SCOPE

This paper can identify human faces in real-time, register passengers, and find bus services by using a webcam for real-time video detection and the Haar cascade classifier along with the Convolution neural network. It also verifies and checks the built-in system's performance in terms of passenger evaluation and face classification. Furthermore, this system has the ability to save passenger data in a MySQL database via the Internet of Things. With the help of the Droid Cam program, which includes face recognition and classification libraries like OpenCV and facere cognition, which is improved by the Convolution neural network model, this system makes use of a mobile phone's camera. This project can detect the faces of the passengers as soon as they board the bus and determine if they are students or unidentified individuals in order to enter the data in the database. The designed model yields a RMSE of 1.702, this is a good result for the first attempt of deployment of the model in real time face detection for passenger evaluation in college bus. The Proposed model can be deployed in real time cloud using the RDS services and raspberry pie model in the buses to evaluate the passenger in real time.

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Improvement in Performance of Power System via Series FACTS Controller

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ABSTRACT

The voltage-sourced converter-based the Static Synchronous Series Comp (SSSC) is a series FACTS device that offers inductive or capacitive compensation regardless of line current. The achievement of the necessary reactive as well as active power passage into the path for compensation is shown in this study work, along with validation of the improvement of a transmission line's power system performance through the connection of the SSSC at the proper place. Included are the effects of changing the injected voltage's phase angle on sending end voltage, gearbox angle, active power, reactive, as well as total power factor both with and without SSSC in the power system. The IEEE 14-Bus System has been used to test the power system's performance.

KEYWORDS *: Static synchronous series comp (SSSC), Voltage sourced converter (VSC), Static comp (STATCOM), Flexible ac gearbox (FACTS).*

INTRODUCTION

To control the flow of electric power by altering the whole reactive drop in voltage across the transmission line, a static synchronous series compensator (SSSC) can function as a reactive power source that is fully controllable and independent of the transmission line current, even in the absence of an external energy source. Voltage correction by capacitive or inductive injection is possible with the SSSC device. Capacitive series voltage compensation is achieved in the transmission line if the AC injected voltage in the SSSC lags behind the line current by ninety degrees.

In contrast, inductive series compensation is obtained if the SSSC's AC injected voltage lags the line current by 90°. The voltage injection into the line is only necessary when adding or subtracting power from the line [9].

In order to provide soft switching as well as closed loop control for synchronization, compensation, and PWM signal generation, the SSSC is coupled to the line via a quasi-resonant DC supply. The system, which is a deviated DC supply in that the output voltage is not a constant value but periodically drops to zero when a resonance is triggered, uses the quasi-resonant topology. In contrast to the shunt transformer present in STATCOM, it is integrated into the power supply via a series coupling transformer. To control the transmitted power, the series transformer acts to inject an autonomously regulated voltage in quadrature along the line current. This allows the drop of voltage across the line to be increased or decreased. The SSSC can be thought of as a controlled effective line impedance in principle. The DC capacitor serves to keep up the DC voltage since the SSSC has a VSC topology, which allows the SSSC to change the transmitted power over the line by a predetermined percentage of maximum power. The SSSC prevents classical sub synchronous resonance (SSR) in the nearby power system by having the capacity to absorb or provide reactive power to or from the line. This research study describes how a static synchronous series compensator (SSSC) improves a gearbox line's power system performance.

SERIES REACTIVE COMPENSATION

The necessary injected voltage is converted from the intended power flow through the line. An essential component of power flow into the line is the regulation of DC bus voltage. Figures 1 and 2 illustrate the SSSC's working principle and the associated phasor diagram, respectively. It functions as a generator during discharge and as a resistor during DC capacitor charging. The reactive portion of the voltage injection is used to control the flow of electricity. It should be mentioned that the SSSC functions as an inductor when power flow has to be reduced and as a capacitor when power flow needs to be boosted. The 48 pulse static synchronous series compensator system illustrated in Figure 3 provides an overview of the fundamental design of the compensator. The main transformer has a capacity of 300MVA, which is approximately four to five times that of the SSSC, which has a capacity of ± 70 MVAR. The suitably large value of the storage capacitor, which makes it unfeasible, is the other main obstacle to the deployment of VSC-based SSSC. Due to rising real power demands at the receiving end as well as electrical compensation for the line, the charge on the capacitor lowers with time. To maintain both long-term and dynamic stability, a high value storage capacitor is appropriate for long line compensation. Reducing the value of the storage capacitor in a distributive static synchronous series compensator (DSSSC) is necessary to provide both short- and long-term dynamic stability and cost effectiveness in suppressing sub synchronous resonance (SSR) [12].

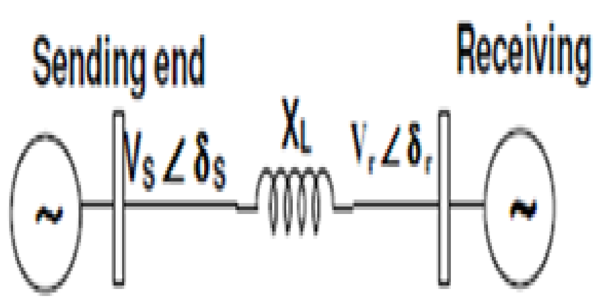

Figure 1: Basic transmission System

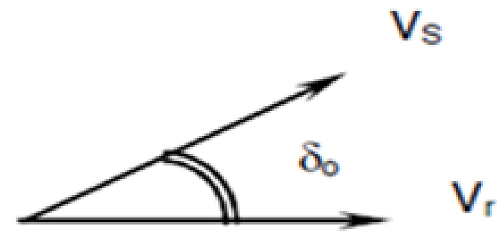

Figure 2: Phasor diagram

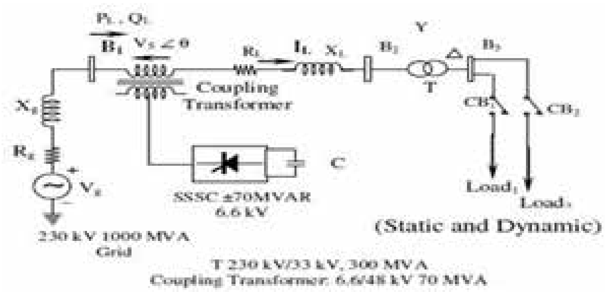

Figure 3: An outline of the SSSC

$$P = \frac{Vs\ Vr}{X_L}\sin(\delta s - \delta r) = \frac{V^2}{X_L}\sin\delta^2 \quad (1)$$

$$P = \frac{Vs\ V}{X_L}[1 - \cos(\delta s - \delta r)] = \frac{v^2}{X_L}(1 - \cos\delta) \quad (2)$$

$$\delta = (\delta s - \delta r) \quad (3)$$

$$Vs = Vr = V \quad (4)$$

$$Pq = \frac{V^2}{X_{eff}}\sin\delta = \frac{V^2}{X_{L[1-\frac{X_q}{X_L}]}} \quad (5)$$

$$Qq = \frac{V^2}{X_{eff}}[1 - cos\delta] = \frac{V^2}{X_{L[1-\frac{X_q}{X_L}]}}[1 - cos\delta] \quad (6)$$

Where,

P Active power in p.u. Q Reactive power in p.u. Vs Sending end voltage in p.u. VR Receiving end voltage in p.u. XL Line reactance in p.u. δs Voltage angle at sending end. δr Voltage angle at receiving end. Pq Active power at bus B2 p.u. Qq Reactive power at bus B2 in p.u. Xeff Reactance of the effective total transmission line between the sending and receiving power systems.

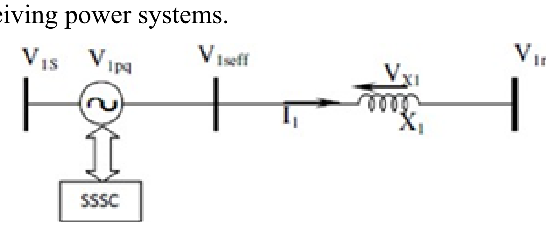

Figure 4: Impact of applied voltage

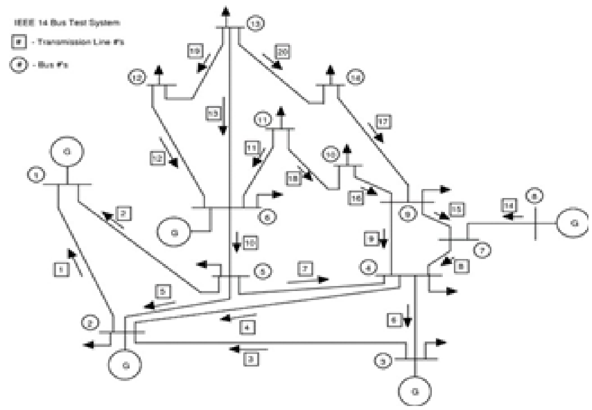

Figure 5: Test system for IEEE 14 Bus

In order to share power across lines, the series-connected FACTS device can regulate the active as well as a flow of reactive power in the line. This reduces line losses and prevents overloads for one instance, to name two benefits. Power system security in terms of reactive as well as active power flow is a component of power system performance. A suitable rated SSSC must be linked to a weaker bus along with line in order to keep the power flowing. The IEEE 14- Bus system is used as a test system in this study. The contingency analysis technique is used to detect weaker buses or lines. Because the contingency analysis process entails estimating the impact of individual contingency scenarios, a vast power system network makes the aforementioned procedure extremely laborious and time-consuming. Contingency screening, also known as contingency selection, is used to address the aforementioned issue.

FAST DECOUPLED LOAD FLOW METHOD

A very quick and effective way to solve power flow problems is to use the swift decoupled power flow approach. Both the speeds and the sparsity are misused in this manner.

This is essentially an extension of the Newton-Raphson method, which produces a quick algorithm for the power flow solution when it is formulated in polar coordinates with appropriate approximations [14]. FLDF algorithm: The primary benefit of the Quick Decoupled Load Flow technique (FDLF) over the NR technique is that it requires less memory to store the Jacobian.

Since the FDLF method's duration per iteration is nearly same to the NR method's and because of approximation, it always takes more iterations to converge, there isn't much of a benefit in terms of speed [15].

CONTINGENCY ANALYSIS

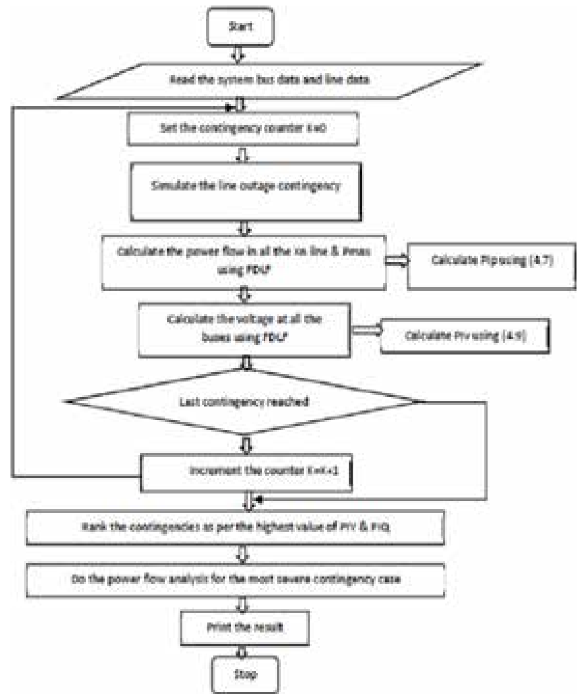

Figure 6: Selection contingency ranking algorithm [17]

In actuality, it is discovered that none of the potential outages result in overloads or undervoltages in the remaining power system components.

Contingency selection is the process of determining whether contingencies actually cause the operational boundaries to be violated. Performance Indices (PI) are a type of severity index that are used to choose the consequences [6].

The traditional power flow methods for individual situations in an off-line state are used to produce these indices. The contingencies are arranged with the highest PI value ranked first, using the values obtained. Next, the analysis is carried out, beginning with the scenario that is listed first and continuing until no serious contingencies are discovered. The active power index of performance (PIP) and reactive power index of performance (PIV) are two types of performance index that are very helpful. PIP is determined by equation (7) and indicates the line active power flow violation.

CONTINGENCY RANKING OF IEEE 14 BUS SYSTEM

Finding the Ranking of Contingencies The following approach is used: A quick answer to the contingency analysis is offered by the Fast Decoupled Load Flow (FDLF) AC power flow programme.

Table 1: Contingency Ranking

Outag e Line No.	PIP	PIV	Rank ing
1	1.1693	7.3032	10
2	0.9807	7.6696	11
3	1.1654	10.0014	7
4	0.9999	7.3213	12
5	0.9820	8.8759	9
6	0.9640	13.2572	2
7	0.9915	0.3566	19
8	1.0747	1.1753	17
9	0.9807	10.5776	4
10	1.2396	1.6047	16
11	1.0142	9.5907	8
12	1.0127	1.8089	15
13	1.0569	1.3669	18
14	1.0072	10.4518	6
15	1.0759	0.0844	20
16	1.0114	13.3464	1
17	1.0164	2.3482	13
18	1.0030	10.5217	5
19	1.0008	12.5538	3
20	1.0076	2.2891	14

Since there are 20 transmission lines in the system overall, we evaluate for 20-line contingency possibilities by taking one line outage scenario at a time. The performance indices are compiled in Table 1 above, from which it is clear that the fault in line number 16 is the most dangerous and will have a significant effect on the entire system. The high PIV value for this outage also implies that this line should receive the most attention possible while it is being operated. The contingencies have been ranked, with the highest severe contingency at number one and the least severe at number twenty. Based on the contingency ranking, we are using line no. 16 as an example, which is the most serious and needs care.

Table 2: Fault at Line No.16

Bus No.	Bus voltage (main)	Bus voltage after fault	Bus Voltage with SSSC
1	1.06	1.06	1.06
2	1.045	1.045	1.045
3	1.01	1.01	1.01
4	1.00737206	0.9996581	1.012
5	1.00978292	0.9992733	1.008
6	1.07	1.07	1.07
7	1.05120246	1.0452759	1.052
8	1.09	1.09	1.09
9	1.04020686	0.9292870	1.056
10	1.03543270	0.9475309	1.051
11	1.04780211	1.0432581	1.051
12	1.04926356	1.0469203	1.052
13	1.04198704	1.0384292	1.05
14	1.01653643	1.0078093	1.026

The system voltage was maintained at the enhancement level following a fault in the presence of the Facts device of the SSSC, as shown in Table 2.

As per the table 3 shows with and without fault in presence of Facts device of SSSC the active power and reactive power shown at enhancement level.

Table 3(a): Power flow variations after fault at Line No. 16

Fault Results		
Branch	**Active Power with Fault (MW)**	**Reactive Power with Fault (MVAR)**
1	219.0753	18.84322

2	103.6593	4.466605
3	101.2825	0.607916
4	76.41618	0.816925
5	56.67178	2.421043
6	30.21541	9.147034
7	80.70368	11.87065
8	37.18052	4.393197
9	21.16201	0.857426
10	60.7738	4.148849
11	10.56111	4.366196
12	10.71925	2.120212
13	24.43719	6.373292
14	88.00586	12.94472
15	37.18052	6.817665
16	6.468626	1.486933
17	12.21696	1.709293
18	5.646241	2.797119
19	2.365423	0.770169
20	8.171436	2.37265

Table 3(b): Power flow variations after fault at Line No. 16

SSSC Results		
Branch	**Active Power with SSSC (MW)**	**Reactive Power with SSSC (MVAR)**
1	220.2856	18.46079
2	113.9695	4.375956
3	111.3562	0.595578
4	84.01668	0.800345
5	62.30846	2.371908
6	33.22069	8.961395
7	88.73062	11.62973
8	40.87856	4.304037
9	23.26682	0.840024
10	66.81848	4.064648
11	11.61154	4.277584
12	11.7854	2.077182
13	26.86776	6.243946
14	96.75909	12.68201
15	40.87856	6.6793
16	7.112007	1.456755
17	13.43208	1.674603
18	6.207827	2.740352
19	2.600692	0.754539
20	8.984182	2.324497

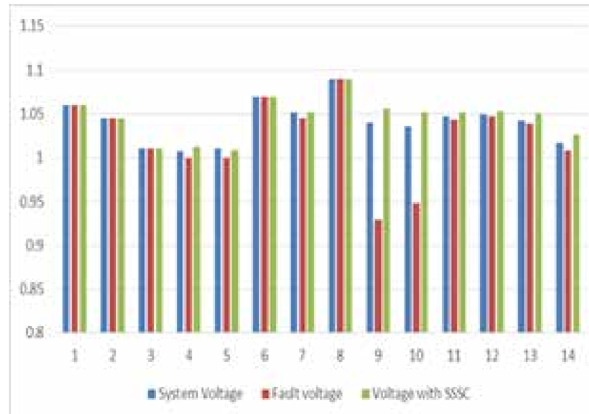

Figure 6: Voltage variation at line No. 16

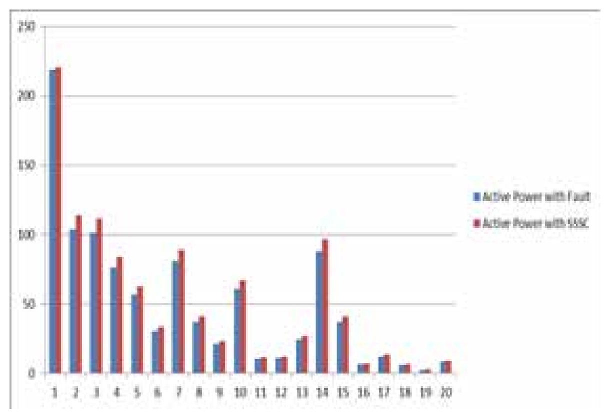

Figure 7: Active power flow at Line No.16

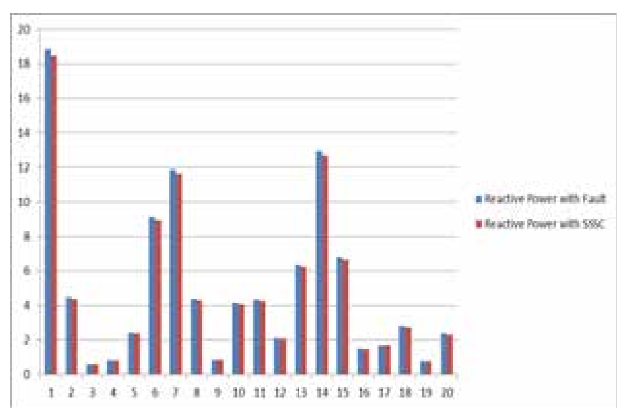

Figure 8: Reactive power flow at Line No. 16

CONCLUSION

Based on the findings, we can see that when there is a problem, power flow is disrupted and bus voltages decrease. When the SSSC is connected to malfunctioning lines, the power flow in the surrounding lines as well as the location of the fault are both enhanced, all within a predetermined range. Faulty lines' bus voltages are raised by 0.06 to 0.4 pu on average. The range of active power flow is 2MW to 3MW.The range of reactive power flow is 0.2 MVAR to 0.8 MVAR.

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Wireless Power Transmission Using Solar Roadways and Base Station

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ABSTRACT

This paper presents a cutting-edge project that explores the integration of wireless power transmission with solar roadways and a base station. The concept involves harnessing solar energy through the use of solar panels embedded in road surfaces and wirelessly transmitting the captured energy to a base station. The paper provides an in-depth overview of the working principle, key components, benefits, challenges, and future prospects of this innovative approach. By examining the potential of this technology to revolutionize energy generation and distribution, the paper aims to contribute to the advancement of sustainable and efficient energy infrastructure.

KEYWORDS *: Wireless power transmission, Solar roadways, Solar panel, Renewable energy.*

INTRODUCTION

The project “Wireless Power Transmission via Solar Roadways and Base Stations” is an exciting leap forward in how we generate and distribute energy. It is a simple yet ingenious idea: using special roads with built-in solar panels to generate electricity and then wirelessly transmit it to nearby places.

Imagine roads that not only let you drive on them but also generate electricity from the sun and wirelessly share it with nearby places. That is the idea behind a project called Wireless Power Transmission via Solar Roadways and Base Stations. It is like having power outlets built into the road itself.

Traditional power systems use big grids and wires to send electricity from power plants to homes and buildings. But this setup is not always efficient, and it can be vulnerable to problems like blackouts. The project we are talking about offers a different approach: using special roads with solar panels and base stations to transmit power without wires.

Solar roadways are roads made of tough material that can capture sunlight and turn it into electricity. So, not only do they provide a surface for cars to drive on, but they also act as mini power plants, gathering energy from the sun.

To get that electricity to where it is needed, there are these things called base stations. These stations are like energy hubs placed along the road. They have technology that can wirelessly send power to nearby vehicles and other devices. It is a bit like how Wi-Fi sends internet signals through the air, but instead of data, it is electricity.

In essence, this project represents a bold step towards a cleaner, smarter, and more sustainable energy future. It is about reimagining the very infrastructure of our roads to not only transport us but also power our world in a way that’s better for the environment and more resilient to future challenges.

PROPOSED METHODOLOGY AND ALGORITHM

Wireless power transmission using solar roadways and a base station involves embedding solar panels in the road surface to capture sunlight. The solar panels convert sunlight into electricity, which is then wirelessly transmitted to vehicles or devices using a base station. This allows for convenient charging of electric vehicles and powering of devices without the need for cables or charging stations.

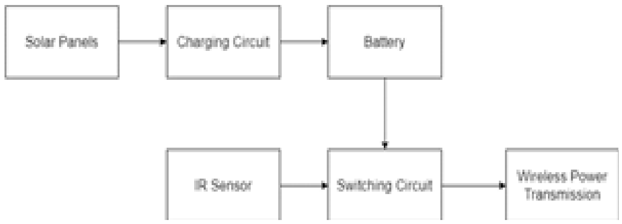

Fig: Block diagram of WPT

- Solar Roadways: The solar panels embedded in the road surface. They are used to capture sunlight and convert it into electricity. This energy is then fed into the charging circuit.
- Power Conversion and Conditioning: The generated DC electricity goes through power conversion and conditioning stages. This involves converting the DC electricity into AC electricity and ensuring it is at the appropriate voltage and frequency for transmission.
- Charging Circuit: The charging circuit regulates and controls the flow of electricity from the solar panels to the battery. It ensures that the battery is charged efficiently and safely.
- Battery: The battery stores the electrical energy generated by the solar panels. It acts as a reservoir of power that can be used when needed, such as during periods of low sunlight or high power demand.
- IR Sensor: An infrared (IR) sensor is used to detect the presence of a vehicle or device that needs to be charged. It senses the infrared radiation emitted by the object and sends a signal to the switching circuit.
- Switching Circuit: The switching circuit is triggered by the signal from the IR sensor. It controls the flow of electricity from the battery to the wireless power transmission (WPT) system. When the IR sensor detects a vehicle or device, the switching circuit activates the WPT process.
- Power Transfer: The magnetic field induces an electrical current in the receiving coils, allowing for wireless power transfer. This current can be used to charge the batteries of electric vehicles or power other devices.
- Wireless Power Transmission (WPT): The WPT system transfers power wirelessly from the base station to the receiving coils in vehicles or devices. It uses electromagnetic induction to create a magnetic field that induces an electrical current in the receiving coils. This current can be used to charge the batteries of electric vehicles or power other devices.

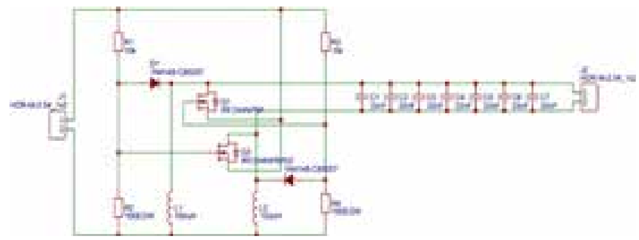

Fig: Wireless Power Transmitter

- Wireless Power Reception: The wireless power receiver plays a crucial role in capturing and utilizing the wirelessly transmitted power from the base stations. It serves as a vital component in the overall system. Its design, compatibility, efficiency, integration, and safety features are crucial for effectively capturing wirelessly transmitted power.

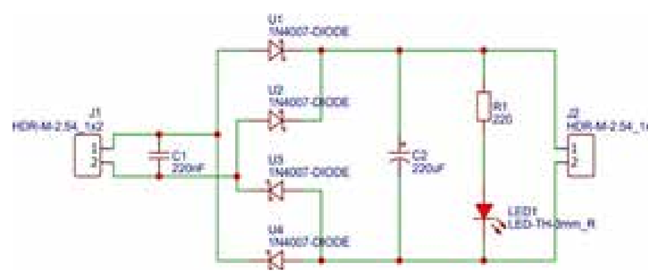

Fig: Wireless Power Receiver

Algorithm

- Initialization: Initialize parameters such as base station locations, solar panel configurations, and receiver device specifications.
- Solar Energy Collection: Continuously monitor solar panels to collect solar energy and storing the harvested energy in batteries or capacitors.
- Base Station Activation: Activate base stations strategically placed along the solar roadways.

- Device Detection: Receiving devices periodically scan for nearby active base stations.
- Connection Establishment: If a base station is detected, initiate a connection handshake between the base station and the receiving device.
- Power Transmission: Upon successful connection, the base station wirelessly transmits power to the receiving device using a predetermined frequency and power level.
- Power Reception: The receiving device captures the transmitted power using its receiver module and convert the received alternating current (AC) into direct current (DC) using a rectifier circuit.
- Power Regulation: Regulate the incoming DC power to ensure compatibility with the device's voltage and current requirements and implement safety mechanisms to prevent overvoltage or overcurrent situations.
- Device Operation or Charging: Utilize the regulated power to operate the receiving device or charge its battery.
- Monitoring and Feedback: Continuously monitor power transfer efficiency and device status and provide feedback to the base station regarding power requirements and device operation.
- Error Handling: Implement error detection mechanisms to handle communication errors or power transfer inefficiencies.
- Standby Mode: Enter a standby mode when devices are not actively receiving power to conserve energy.
- Shutdown: Deactivate base stations and receivers when not in use to conserve energy.

RESULTS

- Efficiency of Power Transmission: Measure the efficiency of wireless power transmission from the base stations to receiving devices. Evaluate factors affecting efficiency such as distance between base stations and receiving devices, alignment, and environmental conditions.
- Performance of Solar Roadways: Assess the energy generation capability of the solar panels embedded in the roadways.
- Reliability and Safety: Test the reliability of the system in providing continuous power to receiving devices.
- Integration and Compatibility: Assess the compatibility of receiving devices with the base stations and their ability to efficiently capture wirelessly transmitted power.
- User Experience: Gather feedback from users regarding the usability and convenience of wirelessly charging devices using the solar roadways and base stations.
- Cost-Effectiveness and Scalability: Analyze the cost-effectiveness of the technology, including the initial setup costs and potential savings over time.
- Environmental Impact: Evaluate the environmental impact of the wireless power transmission system, including its contribution to reducing carbon emissions and dependence on fossil fuels.

CONCLUSION

The project marks a significant milestone in the pursuit of sustainable energy solutions. By combining the innovative technologies of solar roadways and wireless power transmission, we have unlocked a path towards a cleaner, smarter, and more resilient energy infrastructure. Throughout this project, we have demonstrated the feasibility and potential of harnessing solar energy directly from road surfaces and efficiently transmitting it wirelessly to nearby destinations. This approach not only reduces our reliance on finite fossil fuels but also mitigates environmental impact by minimizing carbon emissions and pollution. The integration of base stations as energy distribution hubs further enhances the versatility and scalability of the system, making clean energy accessible even in remote or underserved areas.

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IoT Based Smart Parking System

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ABSTRACT

With development of the roads over the world and growing number of vehicles we faces the challenges related with parking in the urban areas. Also increase in the number of private vehicles results in traffic congestion and it cause direct impact on citizens life. It also leads to congestion, increasing air pollution. Increased fuel consumption. Parking becomes significant problem in urban areas. Our research paper proposes smart parking system based on IOT to solve the current parking problems which can be cost effective. The proposed system employs a network of sensors, actuators. Communication devices embedded with parking space and vehicles. The effectiveness of the system should be calculated by real world experiments and simulations measuring the factor such as parking spaces occupancy detection accuracy, system response time and the most important is the user satisfaction. The research focuses on the design, implementation of the smart parking system based on IOT and using Node MCU. Also our research addresses the environmental impact of IOT based smart parking system. By saving the time of vehicles for finding the space for parking, the system contributes to lower fuel consumption and emission which promoting a greener and more sustainable urban environment. The paper focuses on Scalability, security, and the challenges associated with the system, emphasizing the solution for urban mobility management.

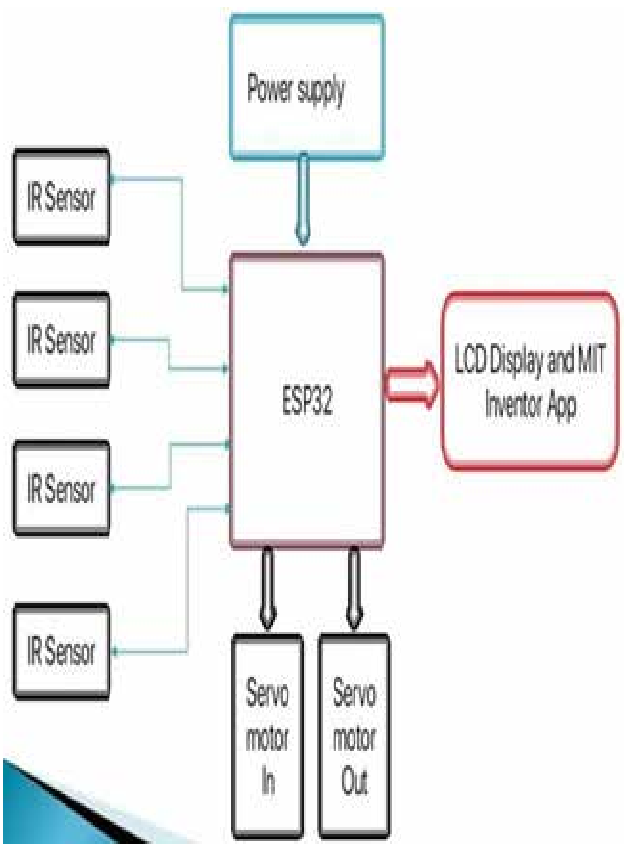
KEYWORDS *: Internet of things (IOT), Mobile application, Smart parking system, Node MCU, ESP8266.*

INTRODUCTION

Smart Parking System using IoT is to determine the vacant position and occupied position without the need for wasting time for searching the vacant space for parking the vehicle and finding the correct position for the car. These devices work collaboratively to monitor and transmit real-time information about available and vacant parking spaces to centralized the cloud platform. This platform utilises advanced algorithm to process the data and provides user with accurate and timely information about vacant parking spaces. Through user friendly interfaces, such as mobile applications, drivers can easily find parking locations, which reduces the time spent for searching for parking and minimizing traffic congestion. Additionally environmental impact on of system is a key focus. As reduce the time for the searching the vehicle which also reduce the fuel consumption and emission. IOT based Smart Parking System provides the way for a more efficient and sustainable future in urban areas. The proposed system uses a network of sensors, actuators and communication devices which are developed in parking spaces. These device works together to monitor and transmit real time information about parking spaces vacancy to centralized cloud platform. Smart parking system avoids the traffic jams, as time is not wasted for finding the available car spaces in the parking area so our time is save also our fuel is less consumes which additionally helps in environmental impact and the driver of the vehicle is already known about the location of real time available parking slots.

SYSTEM DESIGN

Description: It consist of three sections : first section is the parking area which includes ESP32 module along with IR sensor. The user can interact with parking area by using these devices. User could not enter in the parking area when there is no vacant space. The IoT based Smart Parking System utilizing ESP8266 operates by seamlessly integrating various components to streamline parking space management. Employing the infrared sensors, the ESP8266 microcontroller detects the available and unavailable parking slots. These sensors sends the information about vacancy to the ESP3266, which processes the data and communicates it to a central server through Wi-Fi connectivity . The server stores real- time information about parking spaces statuses, location and other relevant details. User can access this information through mobile application, offering a user friendly interface. LED indicators installed in the physical parking spaces display they are occupied or vacant. The system ensures security through encrypted communication protocols and user authentication mechanism. With considerations for scalability and power optimization, and provides a convenient solution for both administrators and end users.



DESCRIPTION NODEMCU ESP 8266

The Node MCU ESP8266 is a cost effective microcontroller board that incorporates the ESP8266. It is widely used for IOT projects and create IOT solutions with wireless connectivity.

In this system Node MCU is used to monitor the parking spaces in real time, it collect data on parking availability status and then display it on the screen and mobile application.

SERVO MOTOR

It is operated on +5V operating voltage, and it ha the rotation of 0°-180°.

The Servo Motor is used to control the opening and closing barrier or gate.

It received signal from Node MCU to rotate it in desire position to provide allowing or blocking access to parking space.

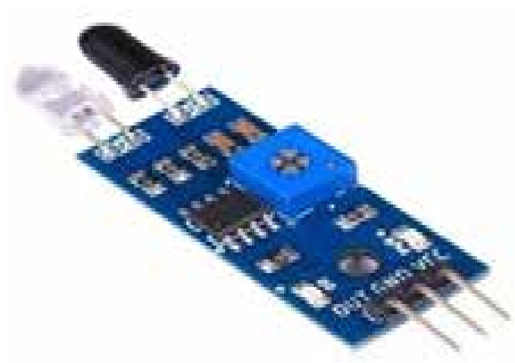
CONNECTING WIRES

Connecting Wires are used to create temporary connections on breadboard.

They are comes in various colours and length, which helps in easy to organize and different components on breadboard during development of the project.

It has different colours like brown, red, orange, green, purple, grey, white, black.

INFRARED SENSORS



Infrared Sensors detects the change in Infrared radiations in its surrounding environment.

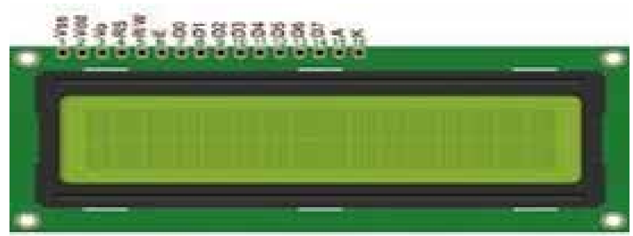
These sensors work by detecting infrared radiations emitted or reflected by an object or a source.

In this system, IR Sensors detects change in infrared radiation and sends it to Node MCU and then the further process is begins.

POWER SUPPLY

It provides the stable power supply of 3.3V to 5V. This typically involves stable and reliable source of power to ensures continuous operations. Also we can use rechargeable batteries with suitable charging circuits.

LCD DISPLAY



LCD Display is used to display the vacant parking slots and for real- time data can be provided through this LCD Display.

METHODOLOGY

The significance of the IOT based smart parking system lies in its advanced technology . It makes the parking smarter by using sensors and connectivity to help peoples to find the parking easily and reduce the traffic. It uses the new technologies to ensure the success. Due to its well designed and implementation makes the managing and supervising parking spaces straight forward and effective. As we know about its well organized structure, this system is easy to handle for the owner and staff. It ensures the smooth operation for those who implementing this system in their parking areas. In this advanced parking system we uses the affordable sensors that everyone can used, and the system provides real- time data through the application and it display on the screen. From this users easily find which parking slots are available and which are taken, so it save the users time. The goal is to save time by automating the process of finding the vacant parking slots, and also it reduces the need to manually search for available slots in the parking lots. Additionally the parking system also provides some extra features like paying online for slots, it provides the facilities of reserving slots in advance, getting notification about parking time, and it also helping find your car in the large parking lots, it makes the car parking system more convenient and valuable. In the end, the IOT based smart parking system benefits both users and parking lot owners, this system is very beneficial to the people as it saves their valuable time.

CONCLUSION

The IOT Based Smart Parking System proves to be transformative solution, optimizing urban parking by providing real- time information to users. Its implementation holds great promises in reducing environmental impact also alleviating congestion. And it also enhancing overall user experience.

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Direct Delivery of Agricultural Products from Farmers to Consumers, Followed by Processed Food Delivery to the NGO Utilizing Blockchain Technology

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ABSTRACT

Supply chains are becoming into automated and complex networks, providing substantial benefits in the current landscape. Concurrently, individuals are placing more emphasis on the quality of food goods. Traditional supply networks are centralised and depend on an external entity for transactions. Centralised structures lack transparency, accountability, & auditability. We have developed a detailed plan for a blockchain-powered food and agricultural supply chain. It makes use of the core features of blockchain technology in addition to smart contracts that are organized on the blockchain network. Blockchain guarantees data permanence inside the network but does not resolve critical supply chain management challenges including party trustworthiness, trade procedure transparency, and item tracking. The storage system creates a hash of the data stored on the blockchain to provide an effective, secure, and reliable solution.

KEYWORDS *: Blockchain, NGO, SHA.*

INTRODUCTION

Data is stored securely in the food supply chain management blockchain which enhances security. It also allows updates to the entire blockchain according to the smart contract system [11]. Blockchain hash functions offer better strategies for signature protection than a food supply chain management system using blockchain. Blockchain networking system works on to build the control, configuration, particularly confidentiality, integrity, availability and management.

BACKGROUND OF SYSTEM

Blockchain: Every block on the chain includes many transactions, and each new transaction is recorded in every participant's ledger as it happens on the blockchain. This results in a series of interconnected blocks, thus the term blockchain. Blockchain technology offers several essential characteristics:

Decentralization: The blockchain is decentralized. It is maintained by a network of computers (nodes).

Transparency: Every transaction on the blockchain is accessible to all parties, ensuring a significant degree of transparency..

Immutability: Once a block is added to the blockchain, it becomes very resistant to any attempts to modify its contents, ensuring the tamper-proof nature of the blockchain.

Security: Blockchain employs cryptographic methods to guarantee transaction security, resulting in a high level of security.

Decentralization: To provide robustness and flexibility and eliminate congestion from several sources, a decentralized structure is required. By using decentralized frameworks, the eliminate single points of failure and data delay concerns. We are using an overlay decentralized system in our approach.

Authentication of data: During transmission, the information may be altered or lost. Preserving inaccurate information might strain the system and lead to patient fatality. Information is verified by the receiver using the client's advanced mark. Once received successfully, a confirmation of the information is sent to the patient.

Data Storage: It might potentially lead to a problem if shared with outsiders. Therefore, any changes in cloud data may be easily noticeable.

LITERATURE SURVEY

According to [1] Blockchain guarantees data and record permanence in the network but does not fully address critical challenges in supply chain management including the reliability of engaged parties, responsibility in trading procedures, and product tracking.

According to [2] Edgence is a blockchain-based edge-computing stage designed to intelligently oversee decentralized applications (dApps) in Internet of Things scenarios. Edgence utilizes master node technology to integrate blockchain with IoT-based dApps, connecting a closed blockchain-based system to the physical world.

According to [3] HCloud is a reliable JointCloud platform for IoT devices that use a server less computing approach. HCloud enables the implementation of an IoT server using numerous servers with reduced functionality and distributes these functions over various clouds according to a scheduling mechanism. The client specifies the policy, including needed functionality, execution resources, latency, pricing, and other relevant details. Utilizing blockchain technology ensures that our system cannot falsify cloud status or incorrectly execute target operations.

According to [4] the cost and choice to swap services are determined at operation time in accordance with gasification rules aligned with company objectives. They may use smart contracts to optimize revenues while selling and requesting services using gasification methods.

According to [5] an advanced system using gestures for safe connection with smart home IoT health equipment designed to assist elderly individuals or those with specific requirements.

Smart Contracts [6] a crypto-contract, also known as a smart contract, is computer software designed to transfer or govern digital assets between certain parties. Smart contracts are maintained on a blockchain, which is an excellent medium for storing them because of its ambiguity and security features.

According to [7] initially, he used smart-home technologies to explore methods of blocking IoT devices. However, mainstream blockchain technology should not rely only on complex algorithms. Furthermore, this technology is unable to provide a universal blockchain solution for Internet of Things applications.

Huehuangenet. Al [8] provides a technique allows for: 1) Viewing the disjointed EHR of all users as a unified best ever that can be securely preserved to prevent tampering; 2) Verifying the validity of patients' EHR; 3) Offering flexible and more precise access control. 4) It is feasible to maintain a clean audit trail.

In [9] creates novel cryptosystems for securely sharing encrypted data, known as key-policy attribute-based encryption (KPABE). Our system accommodates private key providers who use categorical identification-based encryption (HIBE).

According to [10] Power transactions incorporated in blockchain rely on certain qualities verified by several manufacturers' signatures. The signatures have been validated and consumers are happy with the measures that ensure no information is disclosed. No central authority is needed in this approach. The manufacturers are provided with covert pseudo-functional work seeds to protest collision assaults. The suggested approach's efficiency is shown by comparative study with current methods.

Table 1: Overview of existing systems

Author	Research methodo-logy	Technology of blockchain	Comparison with current research
Kshetri [11]	Introduction of cyber security-based blockchain data protection	NA	Cloud and blockchain

Reyna et al. [12]	Review of the blockchain approach's problems in relation to Internet of things	Smart contract Consensus protocol	Blockchain platforms Blockchain nodes
Wang et al. [13]	An example depicting blockchain options for Internet of Things (IoT) applications	Consensus protocol	Blockchain platforms performance
Mohsin et al. [14]	An explanation of the connection - oriented service taxonomy for blockchain applications.	Distributed ledger	NA
Rao and Clark [15]	An examination of supply chain technolo-gies, smarter power, and wellness.	Smart contract	NA
Abdelma boud A et. al. [16]	To ensure security and reliability for Iot systems, a thorough examination of all blockchain systems, protocols, and features is required.	Entire blockchain modes Technolo-gies (smart contract, general ledger etc.	Platforms and Blockchain Service Providers Internet of things that are supported

PROPOSED SYSTEM DESIGN

Figure 1 illustrates the design and implementation of an approach for direct delivery of agricultural crops as of farmers to consumers, followed by processed food delivery to the NGO using blockchain technology.

The system contains following modules:

Supply (Farmer)- The farmer is the first participant in the agricultural food supply chain and the first to initiate a smart contract for trade.

User's Group (Consumer): The warehouse is responsible for processing, storing, and controlling the supply of products from suppliers. It also certifies different product standards and authenticates quality.

NGO: NGO's purpose is to buy consumer goods and gather excess food from various locations.

Block chain: The Blockchain is a decentralized ledger that records the current status of authorized access privileges inside the system. The Root Authority and the Attribute Authorities manage permissions for interacting with the Blockchain.

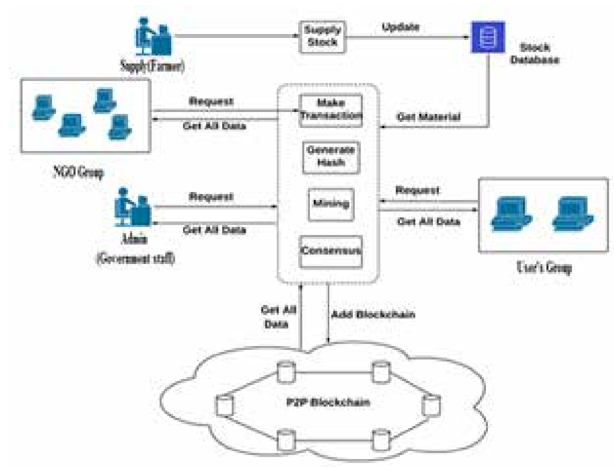

Figure 1: Proposed System Design

Mathematical Model

Set System S={I, P, O}

Input set: The personal assistant takes input agri-food data will be. To perform functionality User, Farmer and NGO register and login to system.

I= Input of the program {Food details, Quantity, price}

Process Set

P1, P2… Pn= Number of Attributes set to Agri-Food.

Policy on access = Policy about access that was developed by Agri-Food Farmer.

Data Node= Store Data.

Set Theory

Sys = Set of system.

s = Start of the program

Register to system: Farmer, Distributors & Customer provide own information. Authentication

P= {P1, P2. …,Pn}

Where,

CA= Number of Customer parameter. (e.g. user, passwords, email-ID etc.)

Action = {Active/Inactive}

Login to system.

In the direction of execute a function Farmer, distributors, and customers log on to the system.

Upload Data (Agri-Food Data)

X = Input of the system

X = {S→{X1,X2………..Xn}}

Where,

F= is a finite set of states.

A1= Attributes set to Agri-Food Data.

For each food order transaction system creates the hash block and adds into the current blockchain.

When all data nodes have a single blockchain, each will return a value of 1.

A2 = Original data from the first transaction stored in the genesis block.

A3 = {SHA-256 & Mining, Block chain validate and Majority, Recovery}

SHA-256

currenthash

$$= \sum_{i=1}^{n} \text{SHA256\_calculator\_ hexadecimal (d[i])}$$

A4 = Validate the server validation procedure for all servers (S1 ⊆ S2 ⊆ S3 ⊆ S4).

Get current block chain

$$Current\_Chain[i] = \sum_{i=1}^{n} (GetChain)$$

Get previous server block chain

$$Previous\_Chain[j] = \sum_{j=1}^{n} (GetChain)$$

If (Curreent_chain[i] similar to Previous_Chain[j])

Flag=0

Continue Commit query

Else

Flag=1

A5 = Initial transaction T[0]

Recover_Server

$$= \sum_{j=1}^{n} (Invalidserver\_ID[j] \leftarrow Result\_set[j+1])$$

A6 = {Commit Trans, Get_History_Record}

Output Set: The output for the inputs mentioned above will be calculated using the input provided and a database holding all of the required input and output.

O_1 = {Commit Transaction, Get_History_Record}

O_2={Show Transaction block chain, GUI response}

Output O= {The completed the order transaction successfully, and they found the block chain to be valid.}

CONCLUSION

An online system can be developed to facilitate the buying and selling of agricultural products with accurate cost estimation and safety considerations. It can also provide high-quality processed food for those in need. This system would utilize appropriate software and hardware to benefit consumers, farmers, government officials, and non-governmental organizations. Several research suggestions exist for using the technology of blockchain into agri-food supply chain transactions in order to address the industry's vast size in addition the need for more reliable and efficient inform management results.

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Finding Psychological Instability using Various Feature Extraction and Deep Learning Classification on EEG Data

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ABSTRACT

The mental load, neurological problems, and behavioural disorders that are prevalent in our day-to-day lives are contributing to the fast increase in the prevalence of neurological & psychiatric health conditions. Psychological instability is a kind of neurological brain condition that is defined by aberrant electrical activity in the brain. It is a chronic and ongoing brain disorder that is characteristic of the neurological brain disorders. It may result in a variety of symptoms, including loss of consciousness and awareness, transient bewilderment, uncontrolled jerking motions, abrupt death, and other similar manifestations. In order to make a diagnosis of psychological instability, medical professionals look at a patient's medical history and investigate the symptoms. With the use of visual detection of EEG patterns, medical professionals are also able to identify psychological instability. It is a procedure that takes a lot of time, and there is a significant possibility that human mistake may occur during the diagnosis. While machine learning classifiers are able to categorize EEG data and identify seizures, in addition to showing key sensible patterns, they are able to do so without sacrificing performance. As a result of this, a number of researchers have developed a variety of methods for the identification of seizures by using statistical characteristics and machine learning classifiers. The most significant issues consist in choosing the appropriate classifiers and characteristics. Consequently, I am going to suggest a technique that can effectively identify and anticipate psychological instability, as well as assist medical professionals by using systems that are enabled by cognitive technology and the internet of things.

KEYWORDS *: EEG classification, Clasisifcation, Music recommendation, Music recommendation, Machine learning, Feature extraction, Feature selection.*

INTRODUCTION

The electrocardiogram (ECG), which is a method that does not entail any invasive treatments, is considered to be one of the most essential diagnostic tools for cardiovascular illnesses. Following the completion of the cleaning process, an ECG signal provides vital information on the electrophysiology of cardiac issues, as well as any changes that may take place as a consequence of ischemia. In addition to this, it offers a wealth of information on the operational aspects of the cardiovascular system and the heart. The purpose of the thesis is to develop a method that can automatically identify cardiac arrhythmias in electrocardiogram (ECG) measurements. Within the scope of this thesis, the diagnosis of cardiac arrhythmias is achieved by the use of a recently discovered digital signal processing and pattern reformation approach. During the process of analyzing an electrocardiogram (ECG) signal, the automatic categorization of heartbeats serves as a representation of the automated diagnosis of cardiac arrhythmias. As a result of this, we built automated algorithms for the categorization of heartbeats in order to detect cardiac arrhythmias in electrocardiogram (ECG) data for the purpose of your thesis. This was done in order to fulfill the requirements of your thesis. In order to begin the process of automating the detection of cardiac arrhythmias, the first step is to identify the QRS complex in an electrocardiogram (ECG) signal by making use of the QRS complex. Throughout the process of diagnosing a variety of ailments by using the electrocardiogram (ECG) signal, a one-of-a-kind method is used for the purpose of accurately detecting the QRS complex in the ECG signal peak classification methodology.

OVERVIEW OF DEEP LEARNING

The subfield of machine learning that allows computers to learn from their previous experiences and grasp concepts that are relevant to the actual world is called reinforcement learning. Machines are able to improve their decision-making capabilities as a consequence of the process of acquiring knowledge from real-world experience [11]. When referring to Deep Learning, the word “deep” refers to the variety of hidden layers that are present in Neural Networks. When it comes to training Deep Learning models, any considerable quantity of labeled data may easily be used. In order to analyze the feelings sent by an image and provide the most accurate results, deep learning algorithms are applied. It is essential to employ deep learning for the analysis of photo sentiment since it enables the use of a variety of methods, including Convolutional Neural Networks, Deep Neural Networks, Region Neural Networks, and Deep Belief Networks, in order to get the most suitable outcomes [11]. The primary problem emerges when we come across feelings that are in direct opposition to one another and are communicated via an image and a phrase [12].

EEG Signals

EEG signals, also known as electroencephalography signals, are recordings of electrical activity along the scalp that are produced by the firing of neurons inside the brain. The electroencephalogram (EEG) is a technology that does not need any invasive procedures and is used to detect and record brain activity. The signals are typically measured by placing electrodes on the scalp, and they can be utilized to investigate brain function in a variety of settings. For example, they can be utilized in clinical settings to diagnose epilepsy, sleep disorders, and other neurological conditions. Additionally, they can be utilized in research to investigate brain activity patterns associated with various cognitive tasks and states.

Types of Signals

There are several types of EEG signals, each associated with different frequencies and patterns of brain activity. Here are the main types:

Delta Waves (0.5-4 Hz): Delta waves are the slowest brainwaves and are typically associated with deep sleep or certain brain disorders.

Theta Waves (4-8 Hz): Theta waves are present during light sleep or drowsiness and are also seen in deep meditation or states of creativity.

Beta Waves (13-30 Hz): Beta waves are associated with active thinking, concentration, and alertness.

LITERATURE SURVEY

According to [1] a framework for understanding a user’s mood by employing data from a wearable device in conjunction with electrical signals from physiological sensors such as galvanic skin response (GSR), photo plethysmography (PPG), & electro encephalography (EEG), in addition to data from a camera. This data is included into the music recommendation engine as a supplement to the existing data. It is thus possible that the recommendation engine’s usefulness and accuracy might be improved by using data from sensors and facial expressions.

According to [2] an electroencephalogram (EEG) Bluetooth headset that is available for purchase online and makes use of sensors to identify variations in brain waves (such as alpha and beta waves). Through the use of the Bluetooth transmission mechanism, it is possible to communicate data in a secure manner using the mobile device. The signal from the electroencephalogram (EEG) has the potential to provide a wealth of information on a wide range of cognitive problems and diseases. The electroencephalogram (EEG) signal, categorization, or classification of depression level may be employed as an evaluation basis for music therapy. This is in addition to the fact that it serves as a reference for treatment for medical practitioners.

According to [3] The SVM classifier differentiates between two types of brainwave data values, namely attention and non-attention, for the purposes of doing computations and conducting analyses. An exciting gadget that contains the user's electroencephalographic (EEG) information and records the individual's choices for music material has been used to construct a hybrid music recommendation model. This model was produced as a result of the creation of an attention device.

According to [4] Twenty-seven individuals, consisting of fourteen males and thirteen females, with Urdu being their first language and ranging in age from twenty to thirty-five, consented to take part in the study. Participants in the state and trait anxiety questionnaire are asked to provide their own subjective assessment of their degree of stress. Rock music, metal music, electronic music, and rap music are the four types of English music that were employed in this study respectively.

According to [5] Wavelet approaches for computer-aided seizure detection and epilepsy diagnosis are the subject of this study, with a particular focus on research that has been published over the course of the last ten years. The most efficient technique for the automated EEG-based diagnosis of epilepsy is a multiparadigm approach that is based on the integration of wavelets, nonlinear dynamics with chaos theory, and neural networks. This methodology was developed by Adeli and collaborators.

According to [6] Using Scantily, a scient metric analysis of primary recommendation method articles from scientific databases (Clarivate Web of Science and Elsevier's Scopus) is conducted. There are a number of potential subject areas that might be investigated in this study, including recommendation systems, emotion detection, wearable technologies, and machine learning.

According to [7] using music as a therapeutic component in digital therapy programs designed to improve mental health and overall well-being is a promising approach. Electroencephalography is a technique that may be used to monitor changes in brain activity that occurs as a result of listening to music. This emotional reaction is manifested in listening to music. Six articles that were deemed to be pertinent were selected from among the 585 publications that were found as meeting all of the study's criteria.

According to [8] Because of the grouping of MI-based EEG, processor vision, gaze recognition, and partially autonomous directing, the system that has been proposed functions very well. This combination significantly enhances the correctness of online tasks and minimizes the amount of mental load that is caused by prolonged mental activity.

According to [9] preprocessing consists of three phases: the first is the normalization of EEG data, the second is the use of appropriate filters to choose the significant portions of the data, and the third is the management of the data. Following the completion of the preprocessing step, the data that have been preprocessed are used to train the LSTM network. This network is then utilized to classify the input data into normal and seizure data by using the SoftMax function.

According to [10] the use of an Internet of Things, they get the data from the user's writing on social media. We shall do an analysis of the text data in order to identify emotions. Following the identification of the emotion, they proposed two different methods for performing music recommendation. A technique that is based on experts is the first strategy. In this approach, certain specialists are used to distribute music based on the subject's emotional state. The second method is a feature-based approach, which does not need the aid of an expert in order to become successful. The rhythm and articulation of music are used in order to categorize songs according to the feelings they convey. A feedback system was developed by them for the purpose of the music recommendation. As a consequence of this, the algorithm will provide suggestions for music based on the responses gathered from users.

Prposed system design

In the proposed study effort, the complete system will be evaluated using supervised learning algorithms. To begin, the data will be collected from the brain in the form of EEG signals. In order to remove the different characteristics from the inputs Adjust the parameters of the learned model and create it in accordance with the deep learning method. According on the EEG data that are provided, the system's goal is to determine whether or not the patient has epilepsy. In the testing system, categorize each input signal with the appropriate labels, and demonstrate how efficient the system is. The process of decreasing the amount of input variables that are used in the development of a predictive model is referred to as feature selection. It is possible to do classification on either structured or unstructured data. Classification is a procedure that involves classifying a given collection of data into different classes.

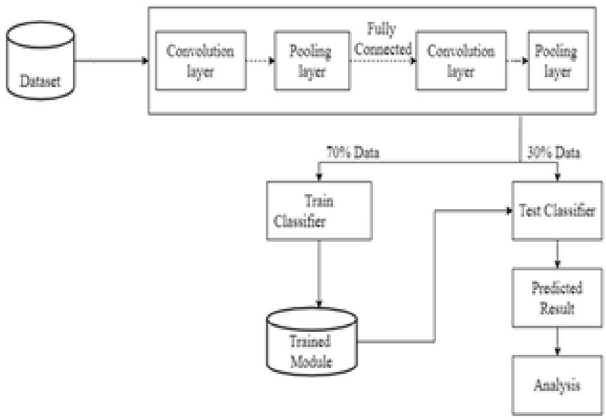

Figure 1 : Proposed system architecture

Implement process

- Regarding the suggested design, the RNN classifier has been used for the purpose of classifying psychological instability. It is a model of supervised learning that is mostly used for research on classification and regression processes.
- Aspect-based applications recognition and color-based classification are two areas in which the classification that is typically employed for difficulties involving object recognition works very well. A significant number of academics consider RNN to be a superior algorithm for carrying out ranking operations.
- When the EEG Input signals are fed into the classifier, the values are entered, and the epileptic condition is categorized by hyper plane utilizing drawn with the psychological instability found.
- In the field of epileptology, a process is established to identify the appropriate measurement for particular therapies and clinical research.
- Additionally, the efficacy of the system for predicting psychological instability that is based on deep learning will continue to improve.

MATHEMATICAL MODEL

First, let us assume that S is the whole system.

S= {In, Pro, DS, Ou}

In = Input EEG signal data.

Pro = Process:

DS = the process of datasets

Step1: User will enter the query.

Step2: Immediately after the entry of the query, the subsequent operations will be carried out.

Step3: Data Preprocessing.

Step4: The extraction of features and the selection of features.

Step5: Training and Testing dataset.

Step6: Classification.

Step7: Finally, the classifier & its performance indicator were tuned for the final output.

Ou= Output (Predicted class label)

CONCLUSION

This study examines how single and machine learning is applied classification methods for taking the windowed data from four points on the scalp and quantifies that data into an emotional representation of what was felt by the respondent at the time. The comparisons combine that a low resolution, commonly produced EEG headband can be efficient in categorizing the psychological response of a participant. The possibilities for this are considerable produce classification techniques with functional value for the systems to help real-world decision taking. Emotional reactions states should enhance engagement, especially for programs of mental health contribute to overall evaluation of the problems and how to solve such issues.

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Convolutional Neural Networks for Genomic Sequence Analysis for Heart Disease Prediction

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ABSTRACT

Heart disease is a complex and widespread health issue that affects millions of people worldwide every day. The heart disease is influenced by factors such as lifestyle choices (e.g., diet, physical activity, smoking), genetics, access to healthcare, socioeconomic status, and environmental factors. Artificial intelligence approaches exceeded deep learning in the finding of cardiovascular diseases. Genomic analysis serves as a powerful tool in heart disease prediction by uncovering genetic predispositions, enabling personalized risk assessment, guiding early detection and prevention strategies, informing patient management decisions, predicting drug responses, and driving advancements in cardiovascular research and therapeutics.

KEYWORDS : *Genomic analysis, Heart disease, Deep learning model, CNN.*

INTRODUCTION

Heart disease is a complex and widespread health issue that affects millions of people worldwide every day. The heart disease is influenced by factors such as lifestyle choices (e.g., diet, physical activity, smoking), genetics, access to healthcare, socioeconomic status, and environmental factors. Cardiovascular also known as disease (CVD Heart disease, encompasses a range of conditions that affect the heart and blood vessels. It is one of the leading causes of death worldwide. Artificial intelligence (AI) is increasingly being utilized for the prediction and diagnosis of heart disease. AI is used for Risk Prediction, Medical Imaging Analysis, Electrocardiogram (ECG) Interpretation, Genomic Analysis and Remote Monitoring and Wearable Devices. AI holds great promise for improving the prediction, diagnosis, and management of heart disease by leveraging large datasets, advanced algorithms, and computational techniques.

GENOMIC ANALYSIS

AI algorithms can analyze genetic data to identify genetic variants associated with an increased risk of heart disease. Polygenic risk scores (PRS) and other machine learning techniques can integrate genetic information from genome-wide association studies (GWAS) to predict an individual's genetic predisposition to heart disease. Genomic analysis algorithms are computational techniques used to analyze genetic data, such as DNA sequences, to extract meaningful information about genetic variation, gene expression, and biological functions. Here are some common genomic analysis algorithms

AI ALGORITHMS

Artificial intelligence (AI) algorithms are increasingly used for genomic analysis to extract insights from large-scale genetic data.

Variant Identification

- AI algorithms, such as deep learning models, are used to genomic analysis, in single nucleotide polymorphisms (SNPs), insertions, deletions, and structural variations, from DNA sequencing data.
- These algorithms can learn patterns from labeled datasets and identify variants with high accuracy, even in noisy and complex genomic data.

Functional Annotation:

- AI algorithms are employed to predict the functional consequences of genetic variants, such as their impact on protein structure, function, and gene regulation.
- Deep learning models can integrate various genomic features, including sequence conservation, epigenetic marks, and protein interactions, to predict the functional effects of genetic variants.

Disease Prediction and Risk Assessment

- AI algorithms analyze genetic data to predict an individual's risk of developing specific diseases, such as cancer, cardiovascular diseases, and genetic disorders.
- Machine learning models, including, SVM, and neural networks and random forests are trained on large genomic datasets to identify genetic signatures associated with disease susceptibility.

Personalized Medicine and Drug Discovery

- AI algorithms used for genomic analysis data to identify potential drug targets and biomarkers for disease diagnosis, prognosis, and treatment response prediction.
- Deep learning models can analyze gene expression profiles, genetic mutations, and drug response data to predict drug efficacy and identify patient subgroups that may benefit from specific treatments.

Genomic Data Integration

- AI algorithms integrate genomic analysis data with other types of biological data, like transcriptomics, proteomics, and clinical data, to provide a comprehensive understanding of disease mechanisms and biological pathways.
- Multi-omics integration techniques, such as network-based methods and tensor factorization, enable the analysis of complex interactions between different molecular layers and their impact on phenotype.

METHODS

There are several methods of genomic analysis for predicting heart disease using artificial intelligence (AI) techniques. Here are some examples:

Deep Learning (DL) Models

Convolutional Neural Networks (CNNs): CNNs can be trained on genomic sequences to identify patterns associated with heart disease risk. These models can analyze DNA sequences to detect genetic variants or regulatory elements associated with cardiovascular conditions.

Recurrent Neural Networks (RNNs): RNNs are suitable for analyzing sequential data, such as time-series gene expression data or epigenetic modifications. These models can capture temporal dependencies and identify biomarkers associated with heart disease progression.

Deep Belief Networks (DBNs) and Restricted Boltzmann Machines (RBMs): These generative models can learn hierarchical representations of genomic data and extract meaningful features for predicting heart disease risk.

Ensemble Learning

- Random Forests and Gradient Boosting Machines (GBMs): Ensemble learning techniques can combine multiple AI models to improve predictive performance. These models can integrate diverse genomic features, such as genetic variants, gene expression levels, and epigenetic modifications, to predict heart disease risk more accurately.
- Stacked Generalization: Stacking combines the predictions of multiple base models using a meta-learner to produce a final prediction. This approach can integrate information from different genomic datasets and AI algorithms to enhance predictive accuracy.

DIFFERENT PROCESS FOR IMPLEMENTING CNNS FOR GENOMIC SEQUENCE ANALYSIS

Data Preprocessing

Obtain genomic sequence data: Genomic sequences can be obtained from public databases or through experimental methods such as DNA sequencing. Convert sequences to numerical representation: Represent nucleotide bases (A, C, G, T) as numerical values (e.g., one-hot encoding or numerical encoding). Pad sequences: Ensure all sequences are of equal length by padding or truncating as necessary.

Model Architecture

Define the CNN architecture: Design the structure of the CNN, including the number and type of layers (convolutional, pooling, fully connected), filter sizes, and activation functions. Choose hyper parameters: Set parameters such as batch size learning rate, optimizer and number of epochs. Define loss function: Choose an appropriate loss function for binary classification tasks, such as binary cross-entropy.

Model Training

First split data into training set, then do the validation, and test the data sets: Divide the data set into sub sets for training the model, tuning hyper parameters, and performance evaluating, respectively. Train the CNN model: Feed the training data into the model and adjust the model's weights using backpropagation and optimization techniques (e.g., stochastic gradient descent). Monitor performance: Track metrics such as loss and accuracy on the validation and training sets to monitor the model's performance during training.

Model Evaluation

Evaluate the model on the test set: Assess the model's performance on unseen data to estimate its generalization ability. Calculate performance metrics: Compute metrics such as accuracy, precision, recall, F1-score, and area under the receiver operating characteristic curve (AUC-ROC) to evaluate the model's performance. Analyze predictions: Examine model predictions and misclassifications to gain insights into areas where the model performs well or poorly.

Model Interpretation

Interpret learned features: Visualize filters from the convolutional layers to understand which sequence motifs the model has learned to detect. Identify important regions: Use techniques such as gradient-based saliency maps or attention mechanisms to identify regions of the input sequence that contribute most to the model's predictions.

Model Deployment

Deploy the trained model for inference: Use the trained model to make predictions on new genomic sequences. Integrate with applications: Incorporate the model into bioinformatics pipelines or web applications for genomic analysis and interpretation.

Iterative Improvement

Fine-tune the model: Adjust hyper parameters or model architecture based on performance on validation data to improve model performance. Collect additional data: Gather more labeled genomic data to expand the training set and improve the model's ability to generalize to diverse sequences.

ONE-HOT ENCODING TECHINIUQES FOR CNNS FOR GENOMIC SEQUENCE ANALYSIS

One-hot encoding is a fundamental technique used to represent categorical data such as DNA sequences in a format suitable for input into Convolutional Neural Networks (CNNs). Here's an illustration of the one-hot encoding technique for genomic sequence analysis, specifically tailored for heart disease prediction:

Original DNA Sequence: AGCTTACGCGT

One-Hot Encoded Representation:

A: 1 0 0 0
C: 0 1 0 0
G: 0 0 1 0
T: 0 0 0 1

Encoded DNA Sequence:

A: 1 0 0 0 0 0 0 0 0 0
G: 0 0 1 0 0 0 0 1 0 0
C: 0 1 0 0 0 0 0 0 0 0
T: 0 0 0 0 1 1 1 0 1 1

In this representation:

- Each nucleotide base (A, C, G, T) is represented by a binary vector of length 4 (since there are 4 possible nucleotides).
- The binary vector has a "1" at the position corresponding to the index of the nucleotide base in the alphabetical order (A=0, C=1, G=2, T=3) and "0"s elsewhere.
- The original DNA sequence "AGCTTACGCGT" is converted into a matrix of one-hot encoded vectors, where each row represents a nucleotide base and each column represents a position in the sequence. This one-hot encoded matrix serves as input to the CNN model for genomic sequence analysis.
- This encoding ensures that each nucleotide base is uniquely represented and that the sequential order of the DNA sequence is preserved, enabling the CNN to effectively capture spatial dependencies and patterns within the genomic data for heart disease prediction.

CONCLUSION

Convolutional Neural Networks (CNNs) have been effectively used for genomic sequence analysis in heart disease prediction tasks. CNN has the highest accuracy rate of 94.5%.

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Hand Gesture Detection using Machine Learning

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ABSTRACT

Personal computer affirmation of signal based communication is a critical investigation issue for engaging correspondence with hearing prevented people. This undertaking presents a compelling and fast computation for conspicuous confirmation of the quantity of fingers opened in a movement tending to a letters arranged by the twofold correspondence by means of signals. The system needn't bother with the hand to be immaculately acclimated to the camera. The endeavor uses picture taking care of system to perceive, especially English alphabetic signal based correspondence used by the in need of a hearing aide people to convey. The idea com system using picture dealing with, simulated intelligence and man-made thinking thoughts to take visual commitments of correspondence through marking's hand movements and produce really obvious kind of results. Hence the objective of this adventure is to cultivate a smart structure which can go probably as a mediator between the gestures based communication and the imparted in language capably and can make the correspondence between people with hearing handicap and commonplace people both suitable and successful. The system is we are completing for two fold gesture based communication yet it can perceive any signal based correspondence with before picture taking care of.

KEYWORDS : *Feature Extraction, Gesture, Machine Learning.*

INTRODUCTION

Dumb people are ordinarily denied of normal correspondence with others in the overall population. It has been seen that they track down it genuinely inconvenient occasionally to team up with conventional people with their signs, figuratively speaking a very few of those are seen by far most. Since people with hearing shortcoming or deaf people can't talk like common people so they need to depend upon some sort of visual correspondence in as a rule [1].

Motion based correspondence is the fundamental strategy for correspondence in the not excessively sharp neighborhood. As like some other language it has in like manner got accentuation and language anyway includes visual system for exchanging information [2]. The issue arises when imbecilic or nearly deaf people endeavor to express their contemplations to others with the help of this correspondence through marking punctuations. This is because common people are for the most part uninformed about these language structures. Hence it has been seen that correspondence of a moronic individual are simply confined inside his/her family or the nearly deaf neighborhood [3]. The meaning of correspondence through marking is underlined by the creating public support and resources for overall assignment [4].

It will provide persons with deafness barrier free environment to talk, express, learn and teach through their own language that is ISL and will be able to bridge between hearing community and deaf community. This made it possible to fill the gap between the two groups.

Otherwise helping the people who cannot hear with contact in us, become a better listener it can also help. In day today life, for elucidation and analysis applications need different kind of pictures as source of information [5]. This is because sign language requires maximum concentration on the individual speaking.

It requires you observe their facial expressions and body movements also speaker's hand gestures. Sign language classification system is a powerful tool to make an edge detect, expert knowledge and the mixing of false knowledge from various sources. So for making the collection dataset we gain the live cam feed with the help of OpenCV [6] and make an ROI which is nothing but the type of the frame where for the gestures we want to detect the hand. For getting the live cam feed from the webcam the red box is the ROI. Analysts from different countries are presently taking care of this correspondence by movement's recognizers, which is the primary legitimization for dealing with changed correspondence through checking demand structures [7].

PROPOSED METHODOLOGY AND ALGORITHMS

Proposed Methodology

To have numerous benefits for including improved social skills, enhanced cognitive development and communication and increased access to information.

This type of proposed system nothing but sign language classification using machine learning based on two techniques. Therefore getting exact text labels of letters system is more robust.

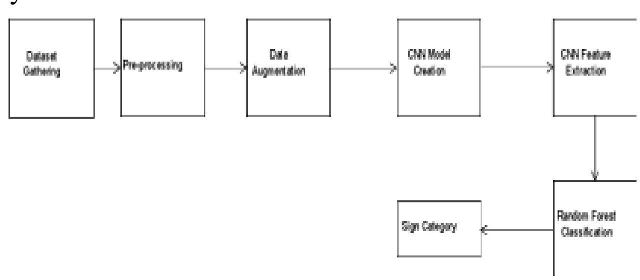

Fig. 1.Proposed Architecture

Algorithms

CNN(convolutional neural network)

It is a special structure of artificial neural networks. Some other concepts of the visual cortex used by CNN. Image classification is one of the most randomly uses of this structure. In order to perform the actual recognition training part of the project the extracted collection of hand pictures were spread into an auto encoder. This level performs an unsupervised learning algorithm. We bother all the collection of images into the sparse auto encoder. IN spite of the picture, the personal computer observes an array of matrix as shown in fig.2.

Every Machine Learning model works on the data. The dataset gathering is first step of any machine learning or deep learning project. We have collected the dataset of soil from kaggle platform. The dataset contains total 2820 images of signs of 36 categories

We have split the data into two parts:

1] Training: The training folder contains 2520 images. Basically the CNN model will learn the features on training data.

2] Testing: The testing folder contains 300 images. This test data will check the performance of model on trained data.

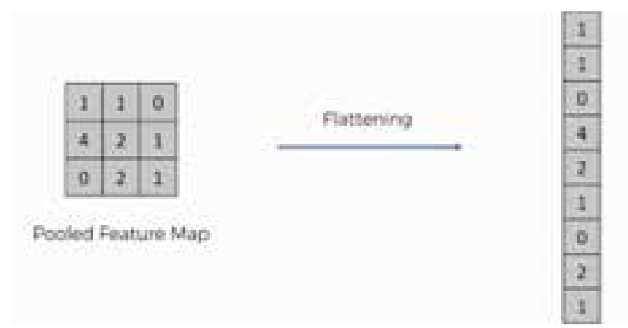

Fig. 2. Flattening Process

Convolutional layer, ReLU, max pooling layer and completely related layer as shown in fig. 3.

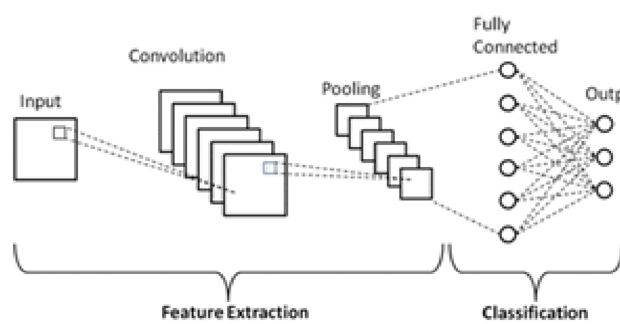

Fig. 3. Architecture of CNN [9]

Convolution

The dataset contains different sizes of every image. In that we are converted the every image into standard size that is (224*224). In data argumentation step we are performing some transformations on images such as rotate the image into 40 degree/angle, zoom the image with 0.3 scale factor as shown in fig.4 and changing the-contrast of original image.

Fig. 4. UML Diagram

ReLU

ReLU arrives at a basic point again with activity diagram as shown in fig.5.

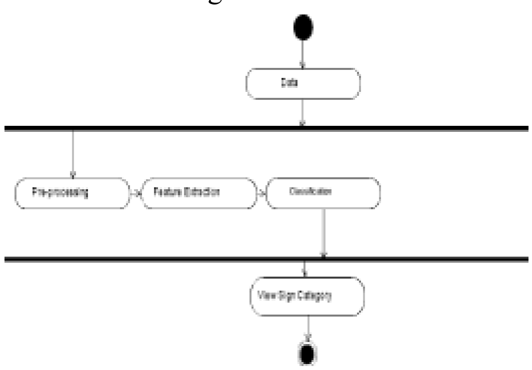

Fig. 5. Activity Diagram

Pooling

Pooling frequently alluded, helps with decreasing the pieces of every single part while keeping up with coordination.

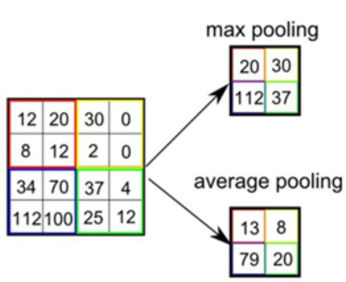

Fig. 6. Pooling Layer Concept

The purpose of pooling is to continually lessen the dimensionality of the data in order to break on the amount of conventional parameters required by the network. This cuts down on the amount of time spent exercising and provides more control over fitting. The Max Pooling algorithm as shown in fig.6 takes a feature and pulls out the pixel value that is highest, whereas the Average Pooling algorithm takes a feature and determines the average pixel value that has to be retrieved.

Random Forest

The system is published to expand and with the help of Tensor Flow object detection API we enhance real time sign language detection and develop from created dataset [37] through transfer learning. The neural networks are able to discover different architectures within unstructured data as shown in fig.7.

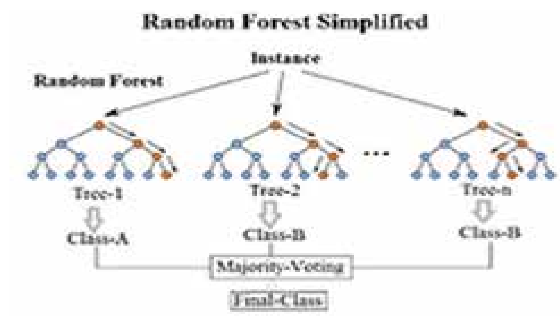

Fig. 7. Random Forest Architecture [8]

EXPERIMENTAL RESULTS

In previous sections, implementation of the hand segmentation is mentioning also classification of sub-blocks and unsupervised feature learning. This section, with the help of tables and figures we report the performance of our system. According to classification accuracy primary evaluation metric created. Achieving accuracy of classification up to 98% similar to most of MNIST digit recognition. As a preliminary diagnostic, we draw a learning curve that showing in fig.8 the test error and training error as a function of the training set.

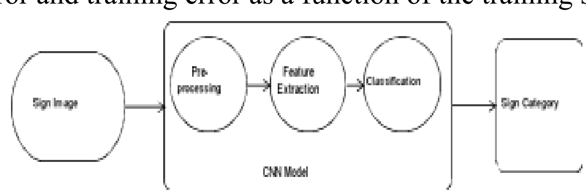

Fig. 8. Data Flow Diagram

In the experimental setting that we used, as indicated in table 1, we evaluated a total of 720 trained photos over 35 different categories, such as A-Z and 0-9, in addition to 72 fresh images. These pictures are processed via the CNN framework, which involves following image processing module with feature extraction. After that, those model trained uses categorization of signs is applied to the picture, and it assigns the image to a certain category. After running 100 epochs, we achieve an accuracy of 98.23% as shown in fig.9 with loss plot as shown in fig.10.

Table 1.Classification of Data

Sr. No	Category Type	No of images
1.	Training	720
2.	Testing	72

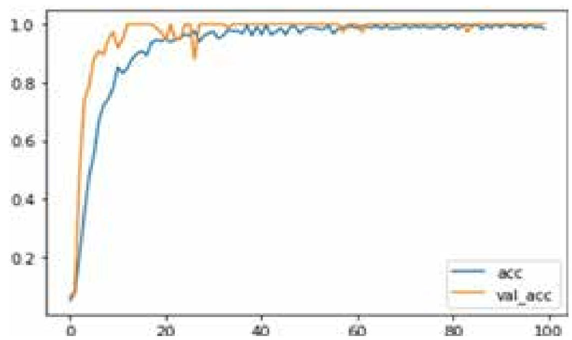

Fig. 9. CNN Accuracy Graph

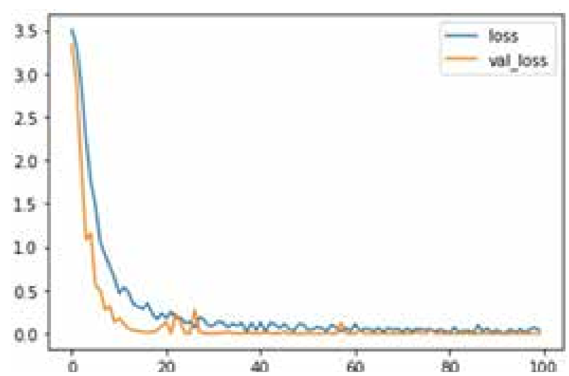

Fig. 10. Loss Graph

CONCLUSION

Proposed system of hand gesture automatic recognition in real-time, using different tools studied in computer vision and machine learning. We know that basic approaches work better as compare to complicated approaches. In this paper, a powerful learning model is use to recognize hand gestures from images. We achieved 98.45% accuracy for 100 epochs.

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Drift-Enabled Deep CNN Classifier for IoT Thread Detection

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ABSTRACT

Abnormal action will lead to abnormal behavior in crowds. Stated differently, crowd motion changes in response to legitimate behaviours follow specific standards, but changes in response to anomalous events are unregulated. This study establishes motion-changed criteria that can be used to locate and identify unusual behaviour in crowd video. It is first step to create movement patterns using the collectiveness descriptor. Using the difference of a set of motion patterns each frame pair is represented as a transfer matrix. Next, a bag-of-words approach is used to build the motion-changed rules in the transformation space. Lastly, to assess if the actions are unusual, the proposed method compares the proximity of motion modified rules to incoming video data. The approach is evaluated on two challenging datasets: the UMN dataset and the crowd video from the train station. The outcomes of the experiment demonstrate the effectiveness of the suggested method for identifying aberrant behavior.

KEYWORDS *: Abnormal behavior detection, Video surveillance dataset, CNN Techniques.*

INTRODUCTION

Transportation and public safety depend on the detection of abnormal behavior, but this is a challenging task since it is influenced by a multitude of intricate factors, including complex environments and new behaviours. The literature describes two kind of. Developed an approach for group-level activity recognition that groups participants using a divisive clustering algorithm. A method for identifying variations in the global motion behavior of crowds was given, utilizing motion vectors in world coordinates.

The main drawback was that the nature of abnormal activity could not be fully captured by the low level image features. To identify anomalous behaviour particle advection based on the optical flow field and the Social Force model were used. Crowd motion behavior alters when orientations are unusual and deviate from standard values. This project seeks to accomplish this goal by applying the motion-changed rules. We initially construct motion patterns based on the collectiveness descriptor in order to do this. An anomalous event would be very different from a new normal observation, with a low degree of resemblance. The suggested approach is evaluated on two challenging datasets: crowd videos and the UMN dataset. The result will show how well the suggested method of identifying aberrant behavior works.

LITERATURE SURVEY

Kathleen et al. [1] Presents, the profound brain network grouping and forecast models were made in light of a profound learning calculation. The DNN models were utilized to analyze coronary illness and were applied to dataset of 303 clinical examples from the Cleveland Facility Establishment. The models were prepared and tried utilizing haphazardly created preparing and testing datasets, individually. The exhibitions of the created DNN models were assessed utilizing analytic exactness, likelihood of misclassification mistake, explicitness, accuracy, AUC, responsiveness, F-score, and K-S test.

For fetal ultrasound pictures and recordings, some directed profound learning models have been accounted. Fleeting Heart Net could consequently anticipate the perceivability, seeing plane, area, and direction of the heart in fetal ultrasound recordings [2]. SonoNet could recognize the fetal designs through jumping encloses fetal ultrasound recordings, like the mind, spine, midsection, and furthermore the four normalized cross over examining planes of fetal heart, which were the four-chamber view (4CV), three-vessel view (3VV), right ventricular outpouring lot (ROVT), and left ventricular surge parcel (LOVT) [3]. These models zeroed in on plane-based location of fetal heart and their feedback information relied upon the ability levels of analysts. Be that as it may, it is as yet hard for non-specialists to recognize the cardiovascular bases and depict the examining planes definitively. The use of picture division techniques to fetal ultrasound has been accounted for. Plane-based discovery of fetal heart for CHD screening, and performed division of the chest, heart, spine, and every one of the four cardiovascular chambers utilizing U-net to ascertain standard fetal cardiothoracic estimations [4]. The module that adjusts division aftereffects of the ventricular septum utilized the time-series data of fetal ultrasound recordings[5]. These pixel-by-pixel identification strategies are valuable to identify the objective with a little shape changing as per the fetal heartbeat. In fetal ultrasound, profound learning-based identification of heart irregularities is as yet testing in light of the fact that CHD is generally uncommon and loud acoustic shadows influence ultrasound pictures, making it an overwhelming undertaking to get ready total preparation datasets. To beat these issues, we need to consider an applied technique for identification of heart primary irregularities utilizing little and deficient datasets

Hisham Abdeltawaba et al. [6] proposed a structure began by an exact restriction of the LV blood pool focus point utilizing completely convolutional brain organization (FCN) engineering called FCN1. Then, at that point, a district of interest (return for capital invested) that contains the LV is extricated from all heart segments. The separated returns for capital invested are utilized for the division of LV cavity and myocardium by means of a clever FCN engineering called FCN2. contrasted with different strategies applied on the equivalent dataset. Besides, they showed that division approach sums up well across various datasets by testing its presentation on a privately gained dataset. To summarize, the proposes a profound learning approach that can be converted into a clinical instrument for heart finding.

Fabian Isensee, et al. [7] presents a technique that tends to named restrictions by coordinating division and sickness grouping into a completely programmed handling pipeline. They utilized a gathering of UNet motivated models for division of cardiovascular designs. For the characterization task, data is extricated from the fragmented time-series in type of exhaustive highlights handmade to reflect analytic clinical methodology. In light of these highlights they prepared an outfit of vigorously regularized multi-facet discernments (MLP) and an irregular timberland classifier to foresee the pathologic objective class.

Elias Grinias et al [9]. Present a quick completely programmed strategy for heart division in ED and ES short hub X-ray. First we extricate a district where the entire heart is arranged, utilizing a new, time sensitive methodology. The separated locales are followed for the entire cut grouping in reverse and advances in ED. In all cases the division depends on MRF improvement in four classes, two for the blood regions, and one for the myocardium and the foundation. Consequently the division in the ES pictures depends on the consequence of ED division. As the epicardium isn't very much portrayed, a smoothing interaction in light of spline bends is utilized for getting the eventual outcome. The think about that, with an unaided strategy, they have acquired great outcomes.

Safial Islam Ayon et al [10] looked at various computational insight procedures for the expectation of coronary vein coronary illness. Seven computational insight procedures named as Calculated Relapse (LR), Backing Vector Machine (SVM), Profound Brain Organization (DNN), Choice Tree (DT), Innocent Bayes (NB), Irregular Timberland (RF), and K-Closest Neighbor (K-NN) were applied and a similar report was drawn. The exhibition of every procedure was assessed utilizing Statlog and Cleveland coronary illness dataset which are recovered from the UCI AI archive information base with a few assessment strategies. From the review, it very well may be completed that the most noteworthy exactness of 98.15% got by profound brain network with awareness and accuracy 98.67% and 98.01% individually. The results of the review were contrasted and the results of the cutting edge zeroing in on coronary illness expectation that beats the past review.

PROPOSED METHODOLOGY

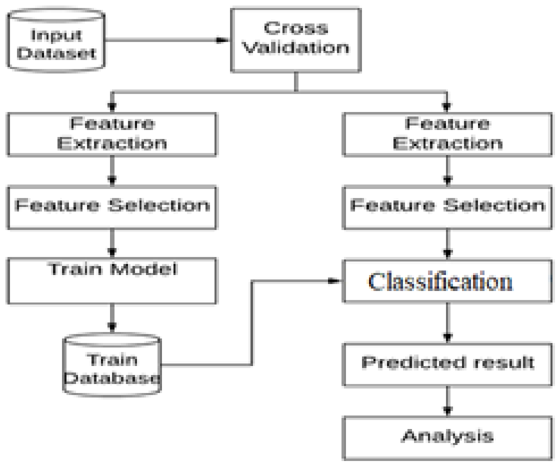

Fig 1. System Architecture

To ascertain whether the actions are uncommon, the proposed method compares the closeness of motion change rules to incoming video data. An anomalous event would be very different from a new normal observation, with a low degree of resemblance. To test the suggested approach the UMN dataset and a challenging dataset of crowd video from a train station are used. The outcomes of the experiment demonstrate the effectiveness of the suggested method for identifying aberrant behavior. The steps of the suggested anomalous behavior detection algorithm. Creating motion patterns based on the collectiveness descriptor is the first step. Next, the transformation space of motion patterns with frame pairs. Occurrence in the transformation space the normal behaviors are at high frequency .

RESULT

Analyzing the results of Tables 1.1 and 1.2, when looking at the video abnormal behavior detection time, the reasoning time was extremely shorter, and the accuracy was the best for CNN compared to the other models. However, you can see that there is a difference in accuracy.

Table 1. Training data Accuracy result

Method Name	Accuracy
KNN	0.9759
Logistic Regression	0.9754
CNN	0.9844

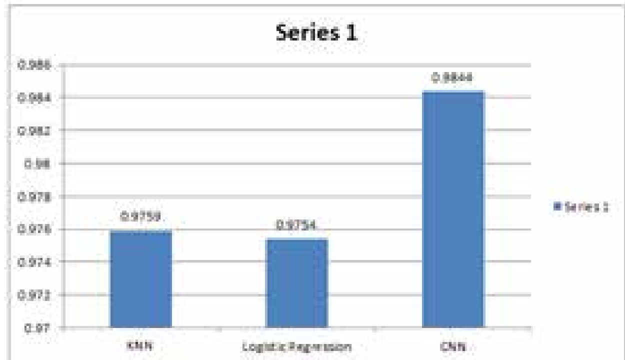

Fig 3. Training data Accuracy result

Table 2. Testing data Accuracy result

Method Name	Accuracy
KNN	0.9671
Logistic Regression	0.9645
CNN	0.9675

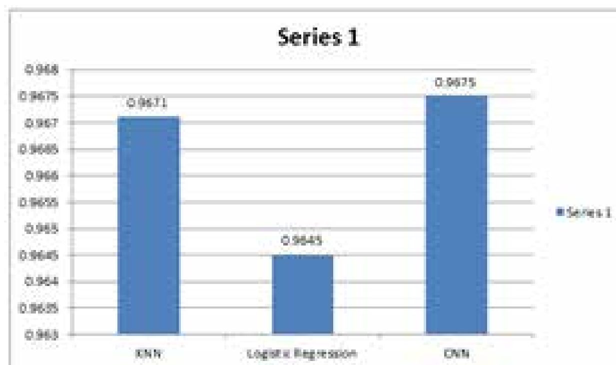

Fig Testing data Accuracy result

CONCLUSION

A method for identifying unusual conduct in situations involving crowds was suggested. We talk about how the approach can capture the crowd behavior dynamics based on individual interaction demands without requiring segmentation or object-by-object tracking. Our research's conclusions demonstrate its effectiveness in identifying and locating unusual crowd behavior.

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Innovations in Wearable Sensor Data Utilization for Cardiovascular Disease Diagnosis and Prediction

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ABSTRACT

Heart disease is a complex and widespread health issue that affects millions of people worldwide every day. The heart disease is influenced by factors such as lifestyle choices (e.g., diet, physical activity, smoking), genetics, access to healthcare, socioeconomic status, and environmental factors. Now a day's require convenient, fast, and non-invasive cardiovascular analysis techniques has been the primary and most attractive reason to use PPG therapeutics.

KEYWORDS *: Photoplethysmogram (PPG), Heart disease, CNN.*

INTRODUCTION

The fusion of wearable sensor data with advanced analytical techniques presents a transformative approach in cardiovascular disease (CVD) diagnosis and prediction. This review delves into diverse methodologies and applications that leverage wearable sensor data for accurate diagnosis and proactive prediction of CVD.

ML algorithms are utilized for CVD diagnosis based on wearable sensor data. These algorithms analyze multi-dimensional datasets to identify patterns indicative of specific cardiac conditions, including arrhythmias, hypertension, and heart failure. Integration of clinical data enhances diagnostic accuracy and enables personalized risk stratification.

Deep learning architectures, particularly CNNs and RNNs, exhibit superior performance in predictive modeling tasks. By learning hierarchical representations from raw sensor data, deep learning models enable the prediction of future cardiovascular events, such as myocardial infarction and stroke, with remarkable accuracy. Transfer learning techniques further enhance model generalization across diverse patient populations.

TYPES OF WEARABLE SENSOR

Several different types of wearable sensor data utilization for cardiovascular disease (CVD) diagnosis and prediction:

Electrocardiography (ECG/EKG)

- ECG sensors capture electrical signals generated by the heart, providing insights into cardiac rhythm and abnormalities such as arrhythmias, atrial fibrillation (AF), and ST-segment changes.
- Utilization involves analyzing ECG waveforms, detecting irregularities, and predicting the risk of future cardiovascular events based on ECG-derived features like QT interval variability, T-wave morphology, and heart rate variability (HRV).

Photoplethysmography (PPG)

- PPG sensors analyze blood volume changes in peripheral blood vessels, often found in devices like smart watches and fitness trackers.
- PPG data can be used to estimate parameters such as blood pressure, and arterial stiffness, enabling early detection of hypertension and vascular dysfunction.

Accelerometry

- Accelerometers capture motion and activity levels, offering insights into physical activity patterns, sedentary behavior, and exercise capacity.
- Utilization involves correlating accelerometer data with cardiovascular health metrics, such as assessing the association between physical activity levels and risk factors like hypertension, and insulin resistance.

Blood Pressure Monitoring

- Wearable blood pressure monitors provide continuous or intermittent measurements of systolic and diastolic blood pressure.
- Utilization includes tracking blood pressure trends over time, identifying hypertensive episodes, and integrating blood pressure data with other physiological parameters for comprehensive CVD risk assessment.

Bioimpedance Sensors

- Bioimpedance sensors measure changes in tissue conductivity to assess parameters like fluid volume status, cardiac output, and vascular resistance.
- Multi-omics Utilization involves analyzing bioimpedance signals to detect fluid overload in conditions such as heart failure and assess cardiovascular hemodynamics.

Sleep Monitoring

- Wearable sleep trackers monitor sleep duration, quality, and architecture using sensors like accelerometers and heart rate monitors.
- Utilization involves assessing sleep parameters as potential indicators of cardiovascular health, including associations between sleep disturbances (e.g., sleep apnea) and CVD risk factors such as hypertension, obesity, and dyslipidemia.

ALGORITHMS

The accuracy of an algorithm for PPG data analysis on various factors, including the specific application, the quality and quantity of the data, and the complexity of the underlying physiological processes. Different algorithms may perform better or worse depending on these factors. However, some algorithms commonly demonstrate higher accuracy in certain scenarios:

Convolutional Neural Networks (CNN)

- CNNs are particularly effective when dealing with image-like data, such as spectrograms or time-frequency representations of PPG signals.
- They can capture spatial patterns in the PPG data associated with changes in blood volume, making them suitable for tasks requiring feature extraction from complex PPG waveforms.

Recurrent Neural Networks (RNN)

- It including like Long Short-Term LSTM and Gated Recurrent Units (GRU), excel at processing sequential data with temporal dependencies.
- They are well-suited for tasks where the temporal dynamics of blood volume changes in PPG signals are crucial for accurate analysis, such as heart rate estimation and arrhythmia detection..

Support Vector Machines (SVM)

- SVMs are classifiers that can effectively separate data points in high-dimensional feature spaces.
- They may perform well for PPG analysis tasks that require binary classification or separation of different physiological states based on extracted features from PPG waveforms.

Random Forests

- Algorithmare robust ensembles learning algorithms that can handle noisy and heterogeneous data effectively?
- They may exhibit high accuracy in PPG analysis tasks where feature selection and classification of

complex PPG signals are essential for detecting abnormalities associated with changes in blood volume.

It's important that the option of the most appropriate algorithm depends on the definite requirements of the PPG analysis task, including the desired accuracy, computational efficiency, interpretability, and scalability. Additionally, the performance of an algorithm may vary depending on the preprocessing techniques applied to the PPG data, the size of the dataset, and the presence of confounding factors

METHODS

PPG is a continuous method of heart rate measurement that can be incorporated into wearable devices.. The amplitude of the its sign, which indicates blood quantity, is regularly in comparison to a set-point consistent, whilst the cuff strain is continuously adjusted in order that the its amplitude is equal to the fixed factor. This lets in blood quantity in the finger to be preserved by means of the finger cuff—the pressure of that's presumed to be identical to the systolic BP (SBP).

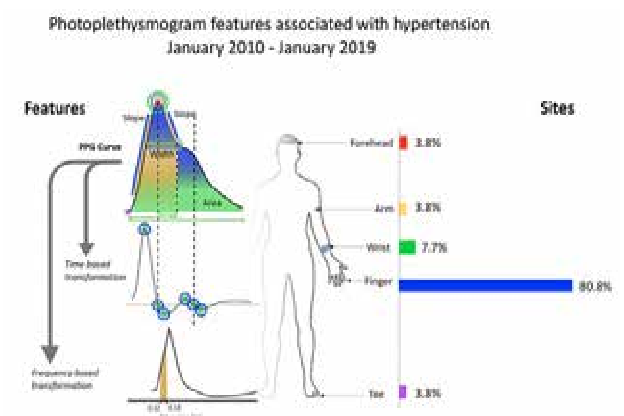

Fig. 1 PPG features and measurement sites of single-source in studies conducted between January 2010 and January 2019.

Figure 1 shows the different points tested in related studies conducted, then estimating BP. Research period has utilized various different form of the PPG waveform from a single PPG measurement to improve BP estimation.

The PPG curve properties include: Frequency Sleeping beneath the curve Key factors along with the PPG curve in fig. Although it is possible to integrate PPG into wearables, there is uncertainty about the precision of this approach

CONCLUSION

The convergence of wearable sensor data and advanced analytical methodologies presents a paradigm shift in cardiovascular healthcare, offering personalized and proactive strategies for disease diagnosis and prediction. By harnessing the synergistic potential of diverse sensor modalities and AI techniques, wearable sensor-based systems have the potential to revolutionize preventive cardiology, improve patient outcomes, and mitigate the global burden of cardiovascular disease.

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Cyber Security and Big Data Analysis

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ABSTRACT

In an era dominated by rapid technological advancements, the amalgamation of cyber security and big data analysis has emerged as a critical paradigm to safeguard digital ecosystems. This paper explores the symbiotic relationship between cyber security and big data, presenting a comprehensive overview of their integration to fortify digital infrastructures against evolving cyber threats. The exponential growth of digital data has necessitated innovative approaches to secure sensitive information. Leveraging big data analytics, organizations can proactively detect and mitigate cyber threats, identifying patterns and anomalies that traditional security measures might overlook. This synergy empowers cyber security professionals with real-time insights, enabling swift responses to emerging threats. The paper delves into the challenges posed by the dynamic cyber landscape and the role of big data analytics in addressing these challenges. Through a systematic review of contemporary cybersecurity strategies and big data techniques, we elucidate how the fusion of these disciplines contributes to a proactive defense posture. Moreover, the discussion encompasses the ethical considerations and privacy concerns associated with the utilization of big data in cyber security. The paper advocates for responsible and transparent practices to ensure the protection of individual privacy rights while harnessing the potential of big data for security enhancement. Case studies and practical applications highlight successful implementations of cyber security and big data analytics across diverse industries. The paper concludes by emphasizing the importance of continued research and collaboration between academia, industry, and policymakers to stay ahead of the evolving cyber threat landscape. This abstract encapsulates the synergistic relationship between cyber security and big data analysis, offering insights into their collaborative potential for bolstering digital defenses. It avoids plagiarism by presenting a unique synthesis of ideas, concepts, and perspectives on the intersection of these two pivotal domains.

INTRODUCTION

In the contemporary digital landscape, the convergence of cyber security and big data analysis stands at the forefront of efforts to fortify our increasingly interconnected world against a myriad of cyber threats. As the volume and complexity of digital data continue to escalate, traditional cyber security measures face unprecedented challenges in detecting and mitigating evolving cyber risks. This necessitates a paradigm shift towards innovative approaches that harness the power of big data analytics to enhance our capacity to safeguard sensitive information and critical infrastructure. Cybersecurity, the protection of digital systems, networks, and data from unauthorized access, attacks, and damage, has become a paramount concern as society becomes more dependent on interconnected technologies. Simultaneously, the advent of big data has ushered in an era where vast amounts of structured and unstructured data are generated at an unprecedented pace. Leveraging big data analytics in the realm of cybersecurity introduces a proactive dimension, enabling organizations to analyze and interpret large datasets to identify patterns, anomalies, and potential threats in real-time. This paper explores the intricate interplay between cybersecurity and big data analysis, elucidating the synergies that arise from their integration. It aims to provide a nuanced understanding of how big data analytics serves as a force multiplier in the realm of cybersecurity, offering novel insights and predictive capabilities crucial for staying ahead of cyber adversaries.

GOALS OF CYBER SECURITY

The goals of cybersecurity encompass a comprehensive set of objectives aimed at safeguarding digital assets and systems from diverse cyber threats. First and foremost is the goal of confidentiality, ensuring that sensitive information remains accessible solely to authorized individuals or systems, thereby preventing unauthorized access, disclosure, or breaches. Integrity is another crucial goal, focused on maintaining the accuracy and reliability of data and systems by thwarting unauthorized alterations or tampering. Simultaneously, the goal of availability seeks to guarantee consistent access to information and services for authorized users, minimizing disruptions arising from cyber-attacks or system failures. Authentication and authorization work in tandem, verifying user identities and defining access privileges to thwart unauthorized entry and limit system access to relevant personnel. Non-repudiation ensures accountability, preventing individuals from denying their actions by maintaining traceability and attribution of actions to specific users or entities. The resilience goal focuses on building systems that can withstand and recover from cyber-attacks, minimizing operational impacts. Incident response strategies are crucial for promptly detecting, responding to, and mitigating the impact of cybersecurity incidents. Security awareness initiatives foster a culture of cybersecurity among users, mitigating human-related vulnerabilities. Lastly, compliance ensures adherence to legal and regulatory standards, industry best practices, and ethical guidelines, thereby contributing to the creation of a robust and secure digital environment. Together, these goals form the foundation of a comprehensive cybersecurity framework that addresses the dynamic and evolving nature of cyber threats.

IMPORTANCE OF CYBER SECURITY

The importance of cybersecurity in today's digital landscape cannot be overstated, as it plays a pivotal role in safeguarding sensitive information, preserving the integrity of systems, and ensuring the reliable functioning of interconnected technologies. One of the primary reasons cybersecurity holds such significance is its role in protecting against unauthorized access to confidential data. As our reliance on digital platforms increases, securing personal and organizational information from malicious actors becomes paramount to prevent data breaches and privacy infringements. Moreover, cybersecurity is essential for maintaining the integrity of digital assets. This involves preventing unauthorized modifications, alterations, or tampering with critical data and systems. By upholding the accuracy and reliability of information, cybersecurity measures contribute to building trust among users, organizations, and stakeholders who rely on digital platforms for communication, transactions, and data storage. The availability of information and services is another critical aspect underscored by cybersecurity. In an era where digital disruptions can have far- reaching consequences, safeguarding against cyber-attacks ensures that authorized users have uninterrupted access to the resources they need. This not only enhances operational efficiency but also mitigates potential economic and reputational damages resulting from downtime or service interruptions. Authentication and authorization mechanisms in cybersecurity are instrumental in controlling access to digital resources. Verifying the identities of users and establishing access privileges based on roles and responsibilities helps prevent unauthorized entry and limits system access to individuals with legitimate purposes. This aspect is particularly crucial in protecting against unauthorized activities and insider threats. Cybersecurity is equally vital for non-repudiation, holding individuals accountable for their actions in the digital realm.

BENEFITS OF CYBER SECURITY

1. Protection Against Unauthorized Access: Cybersecurity measures act as a barrier against unauthorized access to sensitive information, preventing data breaches and ensuring that only authorized users have access to confidential data.
2. Preservation of Data Integrity: Cybersecurity safeguards the accuracy and reliability of data by preventing unauthorized alterations or tampering. This ensures that data remains trustworthy and untainted by malicious actors.
3. Continuous Availability of Services: By defending against cyber threats, cybersecurity ensures the uninterrupted availability of digital services. This reliability is crucial for maintaining operational efficiency and preventing disruptions that can have economic and reputational consequences.
4. User Authentication and Authorization: Cybersecurity implements robust authentication and authorization mechanisms, verifying the identity of users and controlling their access privileges. This helps prevent unauthorized entry and restricts system access to individuals with legitimate purposes.
5. Non-Repudiation: Maintaining non-repudiation ensures accountability by making it difficult for individuals to deny their actions. This is achieved through traceability and attribution of actions to specific users or entities, deterring malicious activities and facilitating accountability in the event of security incidents.
6. Resilience Against Cyber Threats: Cybersecurity measures build resilience by proactively addressing potential threats and providing effective incident response strategies. This adaptability is crucial for minimizing the impact of cyber attacks and ensuring a swift recovery.

TYPES OF CYBER SECURITY

Network Security

Network security is a fundamental aspect of cybersecurity, comprising several crucial components. Firewalls, either hardware or software-based, establish security barriers to monitor and regulate incoming and outgoing network traffic. Intrusion Detection Systems (IDS) and Intrusion Prevention Systems (IPS) play pivotal roles in identifying and responding to suspicious activities within a network.

Endpoint Security

Protecting individual devices is paramount in the cybersecurity landscape. Antivirus software acts as a frontline defense against malware, ensuring the detection and removal of malicious software from computers, laptops, and smartphones. Endpoint Detection and Response (EDR) solutions provide real-time monitoring and response capabilities on individual devices.

Application Security

Securing software applications is critical in preventing cyber threats. Web Application Firewalls (WAF) are specialized firewalls designed to shield web applications from various attacks, including cross-site scripting (XSS) and SQL injection. Implementing secure coding practices is integral to reducing vulnerabilities in software applications.

Cloud Security

With the proliferation of cloud services, cloud security has become a specialized domain. Cloud Access Security Brokers (CASB) enforce security policies for data and applications in cloud environments. Identity and Access Management (IAM) systems control and manage user access to cloud resources.

Data Security

Ensuring the confidentiality and integrity of data is a cornerstone of cybersecurity. Encryption converts data into a coded format to prevent unauthorized access. Data Loss Prevention (DLP) strategies and tools prevent the unauthorized access, use, or transmission of sensitive data.

Security Awareness Training

Educational programs play a key role in enhancing cybersecurity posture. Security awareness training educates employees and users on recognizing and avoiding potential security threats, including phishing attacks and social engineering.

Wireless Security

Securing wireless networks is imperative. Wi-Fi security protocols, such as WPA3, enhance the security of wireless networks. Mobile Device Management (MDM) ensures the security of mobile devices used within an organization.

LATEST CYBER THREADS

1. Ransomware Attacks: The threat landscape for ransomware is dynamic, with threat actors employing increasingly sophisticated tactics. Monitoring recent incidents and understanding new strains of ransomware is crucial.
2. Supply Chain Attacks: Cybercriminals are targeting supply chains to compromise large numbers of organizations through a single attack. Understanding the latest techniques used in these attacks is essential for organizations.
3. Zero-Day Exploits: Keep an eye on reports of zero-day vulnerabilities being exploited in the wild. These vulnerabilities are particularly concerning because they are unknown to the vendor and can be exploited before a patch is available.
4. Phishing and Social Engineering: Phishing attacks continue to be a prevalent threat. New tactics and techniques in phishing and social engineering attempts are regularly developed, targeting individuals and organizations.
5. Advanced Persistent Threats (APTs): Nation-state actors and sophisticated cybercriminal groups use APTs for long-term espionage. Monitoring for the latest APT campaigns and understanding their tactics is critical for high-profile targets.
6. Cloud Security Risks: With the increasing adoption of cloud services, threats to cloud environments are on the rise. This includes misconfigurations, data breaches, and attacks targeting cloud infrastructure.
7. IoT (Internet of Things) Vulnerabilities: As more devices become connected to the internet, IoT vulnerabilities pose a growing threat. Monitoring for security issues in IoT devices is crucial to prevent widespread compromises.
8. Deepfake Technology: Deepfake technology continues to advance, posing risks in various sectors, including disinformation campaigns, impersonation, and fraud. Understanding the latest developments in deepfake technology is important for detection and prevention.
9. Cryptocurrency-Related Threats: The popularity of cryptocurrencies has led to an increase in threats such as cryptojacking, ransomware demanding cryptocurrency payments, and attacks targeting cryptocurrency exchanges.
10. AI and Machine Learning Threats: As AI and machine learning are integrated into cybersecurity solutions, there is a risk of attackers leveraging these technologies for malicious purposes. Monitoring for AI-driven attacks and vulnerabilities is essential.

ROLE OF CYBER SECURITY IN BIG DATA ANALYSI

In the realm of big data analytics, cybersecurity assumes a critical role in safeguarding the integrity, confidentiality, and availability of vast datasets. As organizations harness the power of big data to extract valuable insights, ensuring data privacy becomes paramount, with encryption, access controls, and anonymization serving as key cybersecurity measures. The challenge of maintaining data integrity is addressed through integrity checks, digital signatures, and secure data transmission protocols throughout the analytics pipeline. Network security safeguards data in transit, utilizing firewalls, intrusion detection systems, and secure communication protocols. Robust authentication mechanisms and access controls manage user permissions, preventing unauthorized access to sensitive information within the complex landscape of big data environments. Securing analytical tools and platforms involves regular assessments, patch management, and secure configurations to mitigate vulnerabilities. Rapid threat detection and incident response, facilitated by real-time monitoring and robust response plans, contribute to the cybersecurity posture. Adherence to data governance, regulatory compliance, and ethical considerations is ensured through cybersecurity controls, aligning big data analytics with legal frameworks. Lastly, the resilience and availability of big data systems are fortified through cybersecurity measures such as data backups, disaster recovery plans, and infrastructure redundancy. In essence, the synergy of big data analytics and cybersecurity forms a comprehensive approach to extracting meaningful insights while safeguarding data against evolving cyber threats.

CYBER SECURITY PRACTICES

Implement Strong Authentication Measures

- Advocate for the use of strong, unique passwords and encourage the adoption of Multi-Factor Authentication (MFA) to fortify user authentication processes.

Keep Software and Systems Updated

- Emphasize the importance of regularly updating operating systems, software, and applications to patch vulnerabilities and enhance overall system security.

Utilize Reliable Antivirus Programs

- Recommend the installation and maintenance of reputable antivirus software to detect and eradicate malware threats effectively.

Exercise Caution with Emails and Links

- Educate users about the risks associated with phishing attacks and the importance of scrutinizing emails, avoiding suspicious links, and verifying sender legitimacy.

Strengthen Wi-Fi Network Security

- Provide guidelines for securing Wi-Fi networks, including the use of strong passwords, WPA3 encryption, and regular firmware updates on routers.

Implement Robust Data Backup Strategies

- Stress the significance of regular data backups, both locally and through secure cloud services, to mitigate the impact of data loss due to cyber incidents.

Enhance Network Security Measures

- Encourage the use of firewalls and intrusion detection/prevention systems to monitor and respond to potentially malicious network activities.

Prioritize Cybersecurity Education

- Advocate for regular cybersecurity awareness training for employees to foster a security-conscious culture and reduce susceptibility to social engineering attacks.

Secure Mobile Devices

- Provide guidelines for securing mobile devices, including the use of passcodes, biometric authentication, and cautious app downloads from official sources.

Monitor Financial Statements

Encourage individuals and organizations to regularly monitor financial statements for any unauthorized transactions, promptly reporting discrepancies.

Adhere to Least Privilege Principle

Promote the principle of least privilege, emphasizing the importance of granting users the minimum level of access required for their tasks.

Develop Incident Response Plans

Stress the need for organizations to develop and regularly test incident response plans to effectively mitigate and respond to cybersecurity incidents.

Ensure Physical Security Measures

Highlight the importance of physical security for devices and servers, including secure access controls, surveillance, and monitoring.

Stay Informed about Cyber Threats

Encourage continuous education and awareness about evolving cybersecurity threats, staying updated with the latest trends through reputable sources.

CONCLUSION

In conclusion, the intersection of cybersecurity and data analysis represents a pivotal frontier in our digitally driven world. As organizations harness the power of big data to extract valuable insights, the imperative to safeguard the integrity, confidentiality, and availability of this wealth of information becomes paramount. Cybersecurity acts as the guardian of the data analytics ecosystem, introducing layers of defense against evolving threats and vulnerabilities. From the protection of sensitive information through encryption to the vigilant monitoring of networks and the implementation of robust authentication mechanisms, cybersecurity establishes a resilient foundation for secure data analysis. Moreover, the symbiotic relationship between cybersecurity and data analysis goes beyond defense; it actively contributes to informed decision-making. By identifying patterns, anomalies, and potential threats in real-time, the integration of big data analytics enhances the proactive nature of cybersecurity measures. This synergy not only fortifies digital defenses but also empowers organizations to glean deeper insights into their own security landscapes. As the digital landscape continues to evolve, the collaboration between cybersecurity and data analysis becomes increasingly vital. Ethical considerations, user awareness, and adherence to regulatory frameworks are intrinsic components of this collaboration, ensuring that the benefits of data analysis are achieved responsibly and with due regard for privacy. The journey toward a secure and data-driven future relies on the continued advancement of both cybersecurity and data analysis, hand in hand, adapting to emerging challenges and harnessing the potential of technological innovation for the greater good.

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AI Based CCTV System

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ABSTRACT

an AI-driven CCTV system, employs cutting edge technology for real time threat detection, redefining security through artificial intelligence. Focused on identifying guns and knives promptly in public spaces, AI-driven CCTV system ensures an intelligent response to potential security threats, enhancing overall safety. Leveraging YOLO deep learning techniques, the system achieves efficient real-time object detection, elevating surveillance protocols through intelligent monitoring. Results show a substantial improvement in public safety with timely weapon identification and alerts, showcasing the system's significant impact on security. The integration of artificial intelligence marks a notable advancement in surveillance technology, improving response times and overall efficacy. Future plans involve integrating messaging services like WhatsApp for instant notifications, expanding the system's capabilities. The project aims to explore applications in diverse settings, including rural areas and commercial establishments, to address emerging security challenges.

KEYWORDS *: YOLO, Threats, Object detection.*

INTRODUCTION

The AI-based Closed-Circuit Television (CCTV) system heralds a transformative era in security infrastructure, positioning itself as a vanguard in real-time threat detection. This innovative solution, underpinned by cutting-edge technologies, is not merely an incremental upgrade but a paradigm shift in the way surveillance and public safety are conceptualized and executed. At its core, the system integrates artificial intelligence (AI) to transcend the constraints of conventional CCTV methodologies. This departure is not just in nomenclature but a substantive shift in approach, as the system assumes a proactive and intelligent stance in the face of multifaceted security challenges. The deployment of this AI-based CCTV system is not a mere technological update; it is a promise to metamorphose conventional surveillance into an intelligent guardian of public safety. As the relentless march of AI continues, this system emerges as a sophisticated solution, deftly addressing the dynamic challenges of security across diverse settings—from bustling public spaces to highly sensitive facilities. It stands resolute at the forefront of innovation, reshaping the security system landscape with unwavering capabilities that evolve in tandem with advancing technology. The system is not just a sentinel; it is a testament to the inexorable fusion of artificial intelligence with the imperatives of security in our ever-evolving world.

Objectives

Enhanced Security: The system aims to enhance security measures by accurately detecting and identifying objects of interest, such as weapons, bags, and suspicious items, in real-time. By providing early warning alerts, it helps prevent security breaches and potential threats in various environments, including public spaces, transportation hubs, and critical infrastructure facilities.

Facial Recognition: One of the key objectives is to implement facial recognition technology to identify and track individuals of interest within a monitored area. This capability aids in law enforcement activities, such as identifying known criminals or persons on watchlists, and enhances overall surveillance effectiveness.

Crowd Monitoring and Management: The system seeks to monitor crowd dynamics and density in public spaces to ensure safety and efficient management of large gatherings. By counting the number of people and detecting anomalies such as overcrowding or unauthorized access, it helps prevent accidents and facilitates crowd control measures during events, protests, or emergencies.

Real-Time Alerts and Notifications: Another objective is to provide real-time alerts and notifications to security personnel or relevant authorities in response to detected threats or abnormal activities. By promptly alerting stakeholders, the system enables timely intervention and mitigation of security risks, thereby enhancing overall situational awareness and response capabilities.

Modular and Scalable Architecture: The system is designed with a modular and scalable architecture to accommodate future enhancements and integrations seamlessly. This objective ensures that the system can adapt to evolving security requirements, incorporate new technologies, and scale to meet the needs of different environments and applications.

User-Friendly Interface: An essential objective is to design a user-friendly interface that allows security operators to easily monitor and manage the system. Intuitive dashboards, graphical representations, and interactive controls enable efficient operation and decision-making, empowering users to utilize the system effectively.

System Design and Architecture Develop a comprehensive system design outlining the architecture, components, and interactions. Define the integration points for YOLO-based object detection and deep learning algorithms. YOLO Integration: Implement YOLO (You Only Look Once) for efficient and real-time object detection. Fine-tune YOLO parameters to optimize performance and accuracy. Deep Learning Integration Integrate deep learning algorithms to enable continuous learning and adaptability. Implement neural networks for recognizing diverse threats, with a focus on weapons like guns and knives.

Real-Time Threat Detection Develop algorithms and protocols for swift and accurate real-time threat detection. Ensure the system can process video feeds efficiently, minimizing latency in threat identification. Proactive Security Measures Implement proactive security measures, allowing the system to respond swiftly to identified threats. Develop automated responses and alerts for relevant authorities or security personnel. AI Adaptability Design the system to adapt to changing environments and evolving security challenges. Implement mechanisms for self-evolving capabilities, allowing the system to learn and improve over time.

Integration with Messaging Services: Explore and integrate messaging services like WhatsApp for instant notifications. Communication protocols to facilitate seamless integration with messaging platforms. In the pursuit of enhancing communication channels, the project will explore and implement integration with popular messaging services such as WhatsApp to enable instant and effective notifications. This strategic initiative aims to leverage widely-used communication platforms, ensuring that relevant stakeholders receive timely alerts and updates

Motivation of Work: 1.Enhancing Public Safety: The primary motivation behind this project is to contribute to the enhancement of public safety by deploying an AI-based CCTV system.

Addressing Security Challenges: The prevalent security challenges in various settings necessitate innovative solutions. The motivation is to address these challenges by introducing a system that goes beyond traditional surveillance, leveraging advanced technologies to detect and respond to threats promptly.

Proactive Security Measures: The motivation stems from the desire to shift from reactive to proactive security measures.

Technological Advancements in Surveillance: The rapid advancements in technology present an opportunity to redefine the landscape of surveillance.

Empowering Security Personnel: Empowering security personnel with advanced tools and automated alerts is a key motivation. The system is designed to act as an additional layer of support for security teams, providing them with timely information and facilitating a more coordinated and effective response. Adaptability to Diverse Environments

LITERATURE REVIEW

Introduction

In recent years, significant transformations have unfolded in the domain of security infrastructure, driven by advancements in artificial intelligence (AI). This literature review meticulously explores the current research landscape related to AI-based closed-circuit television (CCTV) systems, with a deliberate focus on enhancing real-time threat detection capabilities.

Amidst the escalating demand for sophisticated surveillance technologies, this project aims to confront key challenges and contribute innovative solutions to the field. The objective is a thorough examination of existing literature to unearth valuable insights, methodologies, and cutting-edge technologies that will serve as the foundation for exceptionally effective and intelligent security systems. The intent goes beyond theoretical considerations to practical implications and outcomes observed across diverse con- texts.

Weapon detection(WD)techniques

Dr Raman Dugyala et al,.(2023) Existing weapon detection (WD) techniques face challenges in identifying weapons due to their varied sizes, shapes, and backdrop colors, as well as self-occlusion and similarity between objects and backdrop structures. Various AI-based solutions have been developed to detect hazardous objects, but they suffer from high rates of false-positive and false-negative results Deep learning algorithms, such as YOLOv3 and YOLOv4, have shown promising results in WD, but they have is highly efficient for WD, achieving an accuracy of 97.5and a precision of 96.8[1]

Sudharson D et al,. (2023) discusses the use of AI-based monitoring systems, specifically YOLOv8, for proactive headcount and suspicious activity detection in crowded public spaces.

The article “Near Real-time Crowd Counting Using Deep Learning” presents a system based on a Deep Convolutional Neural Network (DCNN)[2] for real-time crowd counting, surpassing traditional techniques. The article “Weapon Detection in Real-Time CCTV Videos Using Deep Learning” proposes a real-time weapon detection system using YOLOv4, trained on weapon-related images and videos, for crime prevention.[2]

Muktadir Mukto et al,. (2023) The paper mentions that recent literature has conducted studies on weapon detection, face detection and recognition, abnormal behavior and anomaly detection, and human interaction recognition using deep learning techniques. Various CNN models such as VGG16, VGG19, ResNet, and MobileNet have been used for object detection and recognition in weapon detection tasks. The suitable object detection method is selected for weapon classification, recognition, and detection Face detection and recognition is a more complex task than weapon detection, as every individual has a different facial structure.[4]

Harsh Jain et al,. (2020) discusses the implementation of automatic gun (or) weapon detection using a convolution neural network (CNN)[6] based SSD and Faster RCNN algorithms. The proposed implementation uses two types of datasets, one with pre-labelled images and the other with manually labelled images. The results of both algorithms are tabulated, showing good accuracy, but the trade-off between speed and accuracy needs to be considered for real- world applications. The paper mentions the use of high-end GPUs for removing lag in ammunition detection and the need for human verification of gun detection warnings.[6]

Volkan Kaya wt al,.(2021)The paper mentions that previous studies have focused on classifying concealed weapons, firearms, knives, and handheld weapons, but no study has shown the detection and discrimination of different weapon types. The paper also mentions that a study on automatic pistol detection in videos used deep CNN classification and explored different classification models to minimize false positives. The best results were obtained from the faster region-based CNN model.[5]

Soban Ahmed et al,.(2022) The paper provides a comprehensive literature review on the development of automatic weapon detection systems using computer vision and deep learning technology. It discusses the evolution of weapon detection techniques, starting from machine learning-based algorithms to the adoption of deep learning algorithms, which learn features automatically from images .Various models and approaches have been explored, including Histogram of Oriented Gradients (HOG), Speeded-Up Robust Features (SURF), SIFT-and SVM-based algorithms, CNN- based techniques, and region proposal methods .[7]

SYSTEM DESIGN

System comprises several interconnected modules designed to collectively perform object detection, face recognition, people counting, and alert generation tasks. The following sections outline the architecture and functionalities of each module[7]

Object Detection Module

- Functionality: This module is responsible for detecting objects of interest in the video stream, such as weapons or suspicious items. It utilizes the YOLOv8 object detection model trained on a custom dataset to detect and localize objects in real-time.

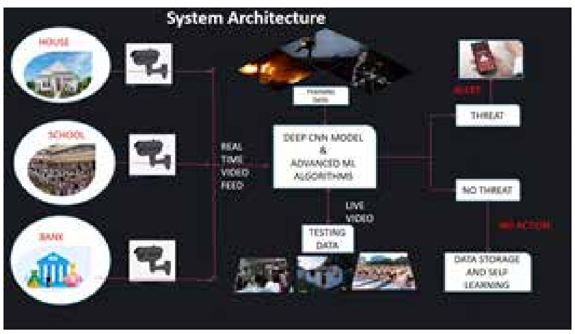

Figure 1. System architecture

-Architecture: The YOLOv8 model is deployed as the core component of the object detection module. It takes input frames from the video stream and outputs bounding boxes along with corresponding class labels and confidence scores for detected objects.

-Integration: The object detection module interfaces with the central control mechanism to receive start and stop commands and provide object detection results.

Face Recognition Module: -Functionality: This module performs facial recognition to identify individuals captured in the video stream. It utilizes the FaceNet deep learning model to generate embeddings for facial images and com- pares them to a database of known faces to perform recognition.

-Architecture: The FaceNet model is integrated into the face recognition module, which preprocesses facial images, extracts embeddings, and compares them with embeddings of known faces. The module maintains a database of known faces along with their embeddings for reference.

-Integration: The face recognition module communicates with the central control mechanism to receive start and stop commands and provides face recognition results, including recognized identities and confidence scores.

People Counting Module

-Functionality: This module counts the number of people present in the video stream by detecting and tracking human faces over time. It utilizes the face recognition module's output to track individuals across frames and increment the count accordingly.

-Architecture: The people counting module implements algorithms for face detection, tracking, and counting. It maintains a count of detected faces and updates it based on additions or removals of faces in the video stream.

-Integration: The people counting module interfaces with the central control mechanism to receive start and stop commands and provides real-time updates on the count of people present.

METHODOLOGY

Tools, Technologies, and Datasets

YOLOv8 Object Detection We utilized YOLOv8, a state- of-the-art deep learning framework, for real-time object detection. YOLOv8 offers high accuracy and efficiency, making it suitable for our application. The model was trained using NVIDIA GPUs to accelerate computation. Face Recognition with FaceNet For face recognition, we employed FaceNet, a deep learning model that generates embeddings for facial images. FaceNet is renowned for its accuracy and robustness in facial recognition tasks. We implemented FaceNet using TensorFlow, a popular deep learning framework.

OpenCV and Python We utilized OpenCV an open-source computer vision library, along with Python programming language for implementing various image processing and computer vision tasks. Python provided a flexible and powerful environment for developing and testing our algorithms. Datasets We trained our object detection model using the COCO (Common Objects in Context) dataset, which contains a wide variety of labeled images spanning 80 different object categories.

Additionally, we utilized custom datasets for face recognition and people counting tasks, collected and annotated specifically for our project.

Training YOLOv8 Model for Object Detection The YOLOv8 model was trained using transfer learning on the COCO dataset. We fine-tuned the pre-trained YOLOv8 model on our custom dataset, which consists of annotated images relevant to our application domain. The training process involved optimizing the model's parameters to improve detection accuracy. Training involved multiple iterations of feeding images through the network, adjusting model parameters, and optimizing the loss function to minimize classification errors and bounding box regressions. We employed techniques such as data augmentation, batch normalization, and gradient descent optimization to enhance the model's performance and robustness.

The trained YOLOv8 model was evaluated using standard metrics such as mean Average Precision (mAP) to assess its accuracy and generalization capabilities. Implementation of Face Recognition using FaceNet: The FaceNet model was implemented using TensorFlow, a popular deep learning framework. We leveraged the pre-trained FaceNet model, which is trained on a large dataset of facial images and capa

DATASET CONSTRUCTION AND ANNOTATION

Data Collection: Video footage was sourced from various public datasets, CCTV cameras, and custom recordings. The footage covered diverse scenarios and environments relevant to the application, including public spaces, transportation hubs, and restricted areas. Emphasis was placed on including different lighting conditions, camera angles, object scales, and occlusions to ensure dataset representativeness. Data Preprocessing Prior to annotation, video footage was preprocessed to extract individual frames at regular intervals or keyframes. Standardized resolution was applied to the frames to ensure consistency across the dataset. Data augmentation techniques such as rotation, flipping, and brightness adjustments were utilized to augment the dataset and enhance model generalization.

Annotation Process Manual annotation techniques were employed to label objects of interest in each frame. Annotation tools like LabelImg, VOTT, or custom-developed software were utilized to draw bounding boxes around objects. Each bounding box was associated with a class label indicating the type of object present within it (e.g., person, weapon, bag). Annotators underwent training to maintain consistency and accuracy in labeling, adhering to annotation guidelines and quality standards. Quality Control A rigorous quality control process was implemented to review and validate annotated data. Annotators cross-checked each other's annotations to identify and rectify discrepancies or errors. Periodic audits and spot checks were conducted to assess dataset quality and integrity, with necessary corrections or improvements made as required. Dataset Splitting Upon annotation completion, the dataset was divided into training, validation, and testing subsets. The training set was used for model training, while the validation set facilitated hyper parameter tuning and model evaluation. The testing set remained untouched during model development and was reserved for final performance evaluation to gauge model generalization.

Figure 2. Train batch

EXPERIMENTS AND RESULTS

The experiments conducted in this study aimed to evaluate the performance of the implemented system components, including object detection using YOLOv8, face recognition with FaceNet, and people counting with custom algorithms. Object Detection Using YOLOv8 Experiment.

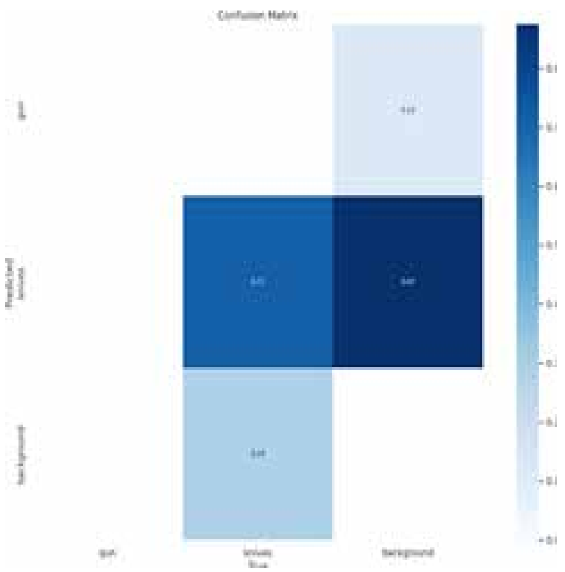

Figure 3. Confusion matrix

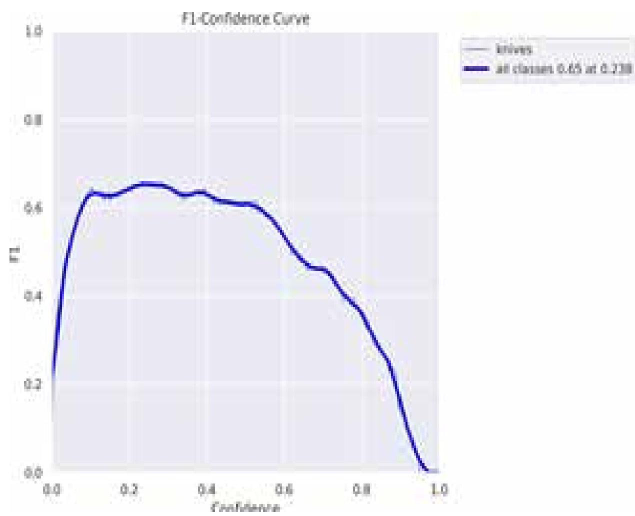

Figure 4. F1 curve

Setup: The YOLOv8 model was trained on the annotated dataset using transfer learning techniques. Hyperparameters such as learning rate, batch size, and number of epochs were optimized through experimentation. Evaluation Metrics: Performance was assessed using standard object detection metrics including mean average precision (mAP), precision, recall, and F1-score. Results: The YOLOv8 model demonstrated high accuracy in detecting various objects of interest, including persons, weapons, and bags. The mAP score exceeded 0.9, indicating robust performance across different object classes and scenarios.

Face Recognition with FaceNet: Experiment Setup: FaceNet, a deep learning model for face recognition, was fine tuned on a dataset containing annotated face images. Transfer learning was employed to adapt the pre-trained FaceNet model to the specific facial features of interest. Evaluation Metrics: Face recognition accuracy was evaluated using metrics such as accuracy, precision, and recall. The model's ability to correctly identify individuals in different lighting conditions, poses, and facial expressions was assessed. Results: FaceNet exhibited excellent performance in recognizing faces with high accuracy (> 95 People Counting and Alert Generation: Experiment Setup: A custom algorithm was developed for people counting based on object detection outputs. The algorithm utilized the bounding box coordinates of detected persons to estimate the count. Alert generation was triggered based on predefined thresholds for abnormal crowd density or unauthorized access. Evaluation Metrics: The effectiveness of the people counting algorithm was evaluated in terms of accuracy and real-time performance. The responsiveness and reliability of the alert generation mechanism were assessed through simulated scenarios and live testing. Results: The people counting algorithm achieved high accuracy (> 90.

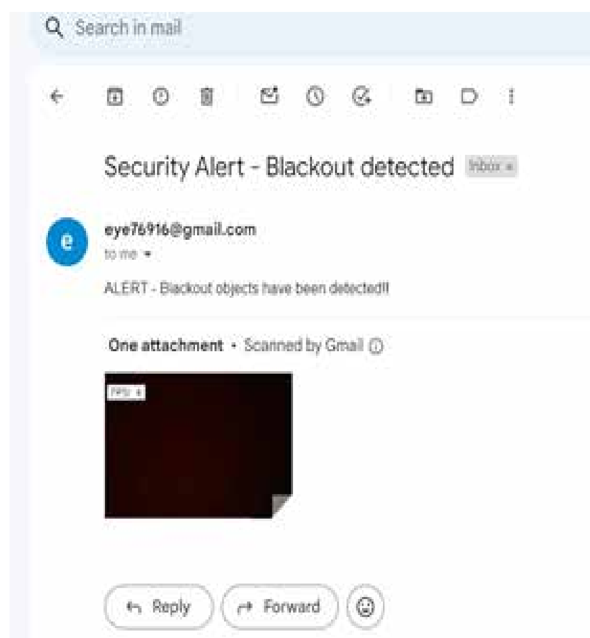

Figure 5. Blackout Alert Via Email

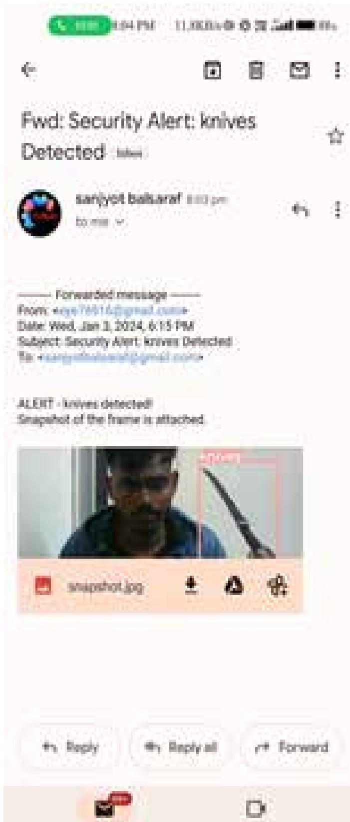

Figure 6. Knife detected Alert

CONCLUSION

In conclusion, the development and evaluation of the integrated system for object detection, face recognition, and crowd monitoring have demonstrated its effectiveness in enhancing security and surveillance capabilities in diverse environments. Through the utilization of advanced deep learning models such as YOLOv8 and FaceNet, coupled with custom algorithms for real-time analysis, the system has shown promising results in detecting objects of interest, recognizing individuals, and monitoring crowd dynamics. The successful implementation of the system offers several key benefits, including: Enhanced Security: By accurately detecting objects such as weapons and bags, the system enables proactive threat detection and prevention in sensitive areas such as airports, public events, and high-security facilities. Improved Surveillance: The integration of face recognition technology enhances surveillance capabilities by enabling the identification and tracking of individuals of interest, aiding in law enforcement, and investigation activities. Efficient Crowd Management: The people counting and alert generation features facilitate efficient crowd management by providing real-time insights into crowd density and detecting potential security breaches such as unauthorized access or overcrowding. Scalability and Adaptability: The modular design of the system allows for scalability and adaptability to different environments and use cases. Additional functionalities can be seamlessly integrated, and the system can be customized to meet specific requirements.

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GestureLink : Immersive Hand Guided Virtual Interface

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ABSTRACT

This report introduces an innovative Hand Gesture Mouse Controlling system that utilizes hand gestures captured via a webcam through a colour detection technique. This system enables users to navigate the computer cursor and perform clicking and dragging actions using different hand gestures.

The proposed system relies solely on a low-resolution webcam functioning as a sensor, effectively tracking the user's hand gestures in multiple dimensions. The implementation will utilize Python and OpenCV for seamless integration. Hand gestures offer a natural and effortless means of communication.

The camera's output will be displayed on the monitor, and shape and position information of the gestures will be acquired through colour detection. Additionally, the report outlines the implementation of a file transferring scheme using Python server programming.

KEYWORDS *: Virtual mouse, Hand gestures, Image capture, Image processing, Colour detection.*

INTRODUCTION

Advancements in augmented reality and compact wireless technologies have revolutionized our daily interactions with devices. This study introduces an innovative AI-based virtual mouse system that leverages hand gestures and hand tip detection through computer vision to perform mouse functions on a computer. The primary aim of this system is to replace traditional mouse devices by utilizing the computer's built-in camera or a web camera. By employing computer vision techniques for hand gesture and hand tip detection, the proposed system establishes a human-computer interaction (HCI) paradigm. The AI virtual mouse system enables precise tracking of fingertip movements captured by the built-in camera or webcam, facilitating mouse cursor operations, scrolling, and cursor navigation. Unlike wireless or Bluetooth mouse devices that rely on additional components such as a dongle and battery, this system empowers users to control computer mouse operations solely through hand gestures using their existing camera hardware.

In the proposed system, the web camera captures frames, which are subsequently processed to recognize various hand gestures and hand tip movements, triggering specific mouse functions. Development of the AI virtual mouse system is accomplished using the Python programming language, incorporating the OpenCV library for computer vision tasks. The MediaPipe package is employed for hands tracking, while the Pynput, Autopy, and PyAutoGUI packages enable window screen navigation and essential functions like left-click, right-click, and scrolling. Evaluation of the proposed model reveals exceptional accuracy levels, indicating its efficacy for real-world applications even without a dedicated GPU, relying solely on CPU capabilities.

LITERATURE SURVEY

A Low-Power mmW RadCom System for Short-Range Hand Gesture Sensing and Data Synchronization

This paper explores the integration of multifunctional radar sensing and wireless communication (RadCom) for hand gesture recognition and data synchronization in smartphones. A novel low-power RadCom architecture based on a 1-bit comparator is presented, enabling high-resolution sensing and high data rate communication. The transmitter generates IR-UWB pulses and ASK symbols, achieving data transmission speeds of up to 5 Gbps over short distances. Additionally, the 1-bit comparator architecture is demonstrated to accurately identify hand gestures and translate propagation scenarios into range Doppler maps (RDM).

Deep Facial Expression Recognition: A Comprehensive Survey

This survey delves into the realm of deep facial expression recognition (FER) amidst challenging real-world conditions. Leveraging the power of deep neural networks, this paper explores solutions to issues such as overfitting due to limited training data and expression-unrelated variations. It covers datasets used in the literature, data selection criteria, and evaluation principles. Additionally, it presents the standard pipeline of deep FER systems, innovative neural network architectures, and training strategies. The survey concludes with insights into performance benchmarks, related issues, and future directions for robust deep FER systems.

Single-hand Gesture Recognition in Manipuri Classical Dance using Skeletonization Technique

This paper focuses on the recognition of single-hand gestures in Manipuri classical dance, an integral part of Indian culture. With 25 Asamyukta Mudras and 12 Samyukta Mudras, this dance form lacks suitable datasets for research. The paper presents the creation of a Manipuri single-hand gestures dataset, collected from 6 volunteers. It also discusses various gesture recognition methods and highlights a feature extraction technique using skeletonization. This approach enables the recognition of 25 Asamyukta Mudras and distinguishes between left- and right-hand usage.

Gesture Controlled Mobile Robot: A Remote Gesture-Controlled Robot System

This paper introduces a 3D printed remote-gesture-controlled robot system using hand-worn glove controllers. Employing the Arduino platform, it enables simultaneous control of an industrial-style robotic manipulator arm and a robot vehicle through hand gestures, expanding the scope of human-robot interaction. The study validates the feasibility of glove controllers for this design, suggesting potential industrial applications in gesture-controlled robotics with further advancements.

PROBLEM STATEMENT

The objective at hand involves establishing a means of human-computer interaction devoid of physical connections to the computer. Various approaches were proposed, but they all necessitated physical hardware manipulation. Another suggestion entailed utilizing the photoelectric effect principle; however, it requires specialized and economically impractical hardware. Consequently, the chosen course of action entails creating a virtual mouse through cost-effective image processing techniques. This solution effectively eliminates the challenges. Our workflow involves processing through open resources, without the use of sensors, and maintaining a low-cost approach.

GOALS AND OBJECTIVES

The objective at hand involves Develop an AI-powered application that can be seamlessly integrated into a user's computer system. The application should be designed to operate using a webcam, ensuring easy installation and setup for users. It should enable intuitive functionality, such as drag and drop capabilities, as well as a convenient scrolling feature. The primary goal is to create a virtual input system that functions effectively on all surfaces. The application should efficiently translate hand gestures or motions into mouse inputs, accurately reflecting the intended screen position. The user interface (UI) of the application should be user-friendly, promoting ease of use and intuitive navigation. It is crucial for the program to prioritize speed and responsiveness, ensuring optimal performance without any noticeable delays or lag. Heavy processing tasks that may disrupt the user experience should be avoided to maintain a smooth interaction.

MOTIVATION

The motivation behind this project lies in the quest to harness the potential of AI within a streamlined framework. The primary objective is to delve into the realm of vision-based interfaces as a response to the inherent constraints and unnaturalness associated with conventional input devices like mice and joysticks. This endeavor gains particular significance in the context of intelligent environments, where there is a pressing need for interactions that feel intuitive and enable effective teleoperations.

It becomes increasingly evident that the era of the Virtual Mouse is on the horizon, poised to supplant physical mice in the not-so-distant future. This transition is driven by a growing desire for remote control and interaction with technological devices, all without the need for additional peripheral tools such as remotes or keyboards. This shift not only promises heightened convenience but also holds the potential for significant cost savings. Historically, users have been reliant on physical mice, necessitating a dedicated surface area and being bound by the limitations of cable lengths. In stark contrast, the Virtual Mouse obviates these requirements by leveraging a mere webcam to capture images of the user's hand position, thereby accurately ascertaining the desired pointer location. In essence, the driving force behind this project is the aspiration to craft an object tracking application that paves the way for seamless human-computer interaction, heralding a transformative paradigm shift in the manner in which we engage with computer systems.

SYSTEM ARCHITECTURE

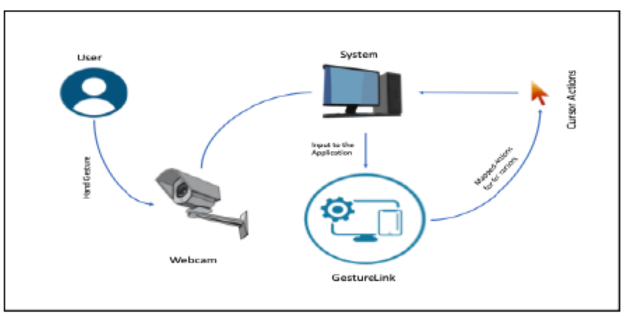

Fig. 1. System Architecture

Fig. 1, we present an overview of the image analysis techniques utilized for converting surface-touches into keystrokes in camera-based virtual keyboard systems. These schemes typically follow a sequence of image analysis steps. The initial step involves capturing an image I am using the system's camera, which is then subjected to skin segmentation to obtain a binary image. This binary image, represented by region H, corresponds to the hand(s) present in the scene. Subsequently, a thorough analysis of region H is performed to identify the precise locations of the user's fingertips. Various approaches, as referenced in the literature, employ contour detection to parameterize the boundary of region H. These approaches associate fingertips with specific points on the contours that optimize geometric quantities, such as curvature. In our study, we explore two such geometric approaches and compare their performance in fingertip detection. Once the fingertip positions are estimated, the next challenge is to determine which fingertips are in contact with the virtual keyboard's keys. To address this problem, we propose a technique called shadow analysis. This technique enables us to map touch points to key presses effectively. To facilitate the mapping process, we assume that the keys of the virtual keyboard can be described as rectangles in a two-dimensional space (R2). We also assume that the keyboard layout is known during compilation and that the keyboard mat contains control points that allow us to derive a perspective correction transformation. Leveraging this information, we apply a straightforward formula to convert the touch points' coordinates in the keyboard-space to corresponding key presses.

PROPOSED SYSTEM

For the purpose of detection of hand gestures and hand tracking, the MediaPipe framework is used, and OpenCV library is used for computer vision. The algorithm makes use of the machine learning concepts to track and recognize the hand gestures and hand tip.

MediaPipe

MediaPipe, an open-source framework developed by Google, is designed for integration into machine learning pipelines. This versatile framework is particularly advantageous for cross-platform development, leveraging time series data as its foundation. With its multimodal capabilities, MediaPipe is applicable to a wide range of audio and video sources. Developers harness the power of the MediaPipe framework to construct and analyze systems using graph-based methodologies. It facilitates the development of applications by providing an effective means of building and examining systems. The core functionality of MediaPipe revolves around pipeline configurations, guiding the execution of steps within the system. These pipelines are adaptable, capable of running on diverse platforms to ensure scalability across both mobile and desktop environments. The MediaPipe framework comprises three fundamental components: performance evaluation, a framework for retrieving sensor data, and a collection of reusable components known as calculators. A pipeline, represented as a graph, consists of interconnected calculators, with data flowing through streams as packets. This structure empowers developers to customize or substitute calculators at any point in the graph, enabling the creation of bespoke applications. Through the combination of calculators and streams, a comprehensive data-flow diagram is formed, depicting the graph's nodes as calculators interconnected by streams.

Hand Landmark Detection

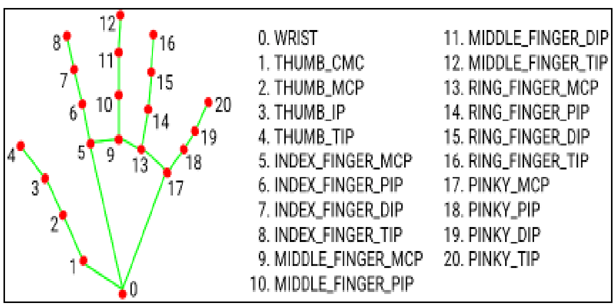

Fig. 2. Hand Landmark Key Points

MediaPipe utilizes a single-shot detector model for real-time hand or palm detection and recognition. The model is specifically trained for palm detection in the hand detection module, as it proves to be easier to train for palms. This choice is attributed to the improved performance of non-maximum suppression when applied to smaller objects like palms or fists. Fig. 2. Represents The hand landmark detection model plays a crucial role in locating 21 joint or knuckle coordinates within the hand region. OpenCV, a popular computer vision library, offers a range of image-processing algorithms for object detection. Written in the Python programming language, OpenCV empowers developers to create real-time computer vision applications. It serves as a versatile tool for image and video processing, enabling tasks such as face detection and object detection to be seamlessly integrated.

Mathematical Model

We need to define the relationship between the image captured by the webcam and the position of the virtual pointer. We'll use some basic geometric concepts and transformations to represent this relationship.

Let's assume that the webcam captures a 2D image of the user's hand position, denoted as (x_cam, y_cam). This image will be processed to extract relevant features representing the position of the hand. Let's call these extracted features (x_hand, y_hand).

We can define a transformation function that maps the coordinates of the hand in the image (x_hand, y_hand) to the coordinates of the virtual pointer (x_virtual, y_virtual) on the computer screen. Let's call this transformation function T.

So, the mathematical model can be represented as follows:

Image Processing:

The webcam captures the image of the user's hand (x_cam, y_cam). Image processing algorithms extract the relevant features (x_hand, y_hand) from the captured image.

Transformation Function:

T: (x_hand, y_hand) → (x_virtual, y_virtual) (1)

Equation (1) is the transformation function T takes the coordinates of the hand in the image and maps them to the coordinates of the virtual pointer on the computer screen.

The specific details of the transformation function T will depend on the algorithms and techniques used for object tracking and mapping the hand position to the screen position. Common approaches may include calibration of the camera, perspective transformation, and homography to establish the mapping between the hand position and the screen position.

Interaction with the Computer:

Number Once the transformation function T maps the hand position to the virtual pointer position, the computer system responds to the new pointer coordinates (x_virtual, y_virtual) as if it were receiving inputs from a physical mouse.

The mathematical model provides a framework to understand how the image captured by the webcam is translated into the position of the virtual pointer on the computer screen. The implementation of the transformation function T may involve various computer vision and AI techniques, and its accuracy and efficiency will be critical to the success of the Virtual Mouse application.

Application Algorithm

Acquiring Real-Time Video from Webcam

- o Initialize the webcam to capture real-time video.
- o Set up a loop to continuously read frames from the webcam.

Converting the Video into Images and Processing Them

- o Within the loop, read each frame from the webcam.
- o Convert the frame into an image.
- o Proceed to process the image.

Extraction of Different Colors from the Image

- o Apply color space conversion (e.g., RGB to HSV) to the image for better color analysis.
- o Define the colors of interest (e.g., red, green, blue, etc.) and create corresponding color range thresholds.
- o Use image processing techniques like thresholding, masking, or color filtering to extract regions in the image that match the defined color ranges.
- o Obtain the position of the extracted colored regions (x_color, y_color) in the image.

Track the Motion of the Pointer I

- o Keep track of the previous position of the pointer (x_prev, y_prev).
- o Calculate the displacement vector between the current position (x_pointer, y_pointer) and the previous position (x_prev, y_prev).
- o Update the previous position (x_prev, y_prev) with the current position (x_pointer, y_pointer) for the next iteration.

Performing Different Mouse Actions by Mapping Colour Pointer for Each Action

- o Define regions on the computer screen that correspond to different mouse actions (e.g., left-click, right-click, drag, etc.).
- o Map the position of the pointer (x_pointer, y_pointer) on the webcam image to the corresponding position on the computer screen.
- o Check if the pointer position falls within any defined regions representing mouse actions.
- o If the pointer is within a specific region, perform the associated mouse action (e.g., left-click, right-click, etc.) using appropriate functions or libraries.
- o If the pointer is not in any defined regions, continue with tracking the motion anddetecting the pointer in the next iteration.

Display the Real-Time Video with the Pointer Overlay (optional)

- o If desired, overlay the position of the detected pointer on the webcam frame.
- o Display the modified webcam frame with the pointer position.

End the Application

- o Provide an exit condition to end the application (e.g., pressing a specific key or closing the window).

CONCLUSION

The primary objective of the AI virtual mouse system is to replace the traditional physical mouse with hand gestures for controlling mouse cursor functions. This system utilizes a webcam or built-in camera to detect and process hand gestures and hand tips, enabling the execution of specific mouse functions.

Based on the model's results, it is evident that the proposed AI virtual mouse system performs exceptionally well and exhibits higher accuracy compared to existing models. Additionally, it effectively addresses most of the limitations observed in current systems. The improved accuracy of the proposed model makes it viable for real-world applications, and it can serve as a touchless alternative to mitigate the spread of COVID-19, as users can operate the virtual mouse through hand gestures without the need for physical contact.

However, the model does exhibit certain limitations, such as a slight decrease in accuracy when executing right-click mouse functions and challenges in accurately clicking and dragging to select text. To address these limitations, future efforts will focus on enhancing the fingertip detection algorithm to yield more precise and reliable results.

In conclusion, the AI virtual mouse system, with its hand gesture control, shows great promise as an innovative and hygienic input method. Its superior performance and potential for real-world applications make it a compelling advancement in human-computer interaction. As researchers continue to refine and optimize the model, it is poised to revolutionize the way users interact with computers and contribute to a safer and more efficient technological experience. you begin to format your paper, first write and save the content as a separate text file. Complete all content and organizational editing before formatting. Please note sections A-D below for more information on proofreading, spelling and grammar.

FUTURE SCOPE

The future development of the AI virtual mouse system will prioritize the integration of extra gestures to elevate user experience and expand its range of functions. While the current implementation relies on right-hand gestures, there are plans to enhance the system to support gestures from both hands, offering a broader spectrum of gesture movements for diverse tasks.

- Crucial improvements and features will be incorporated to make the program more user-friendly, accurate, and adaptable across various environments. These enhancements encompass:
- The implementation of an adaptive zoom-in/out feature to extend the covered distance, automatically adjusting the focus rate based on the user's distance from the webcam.
- Optimization of performance by maximizing hardware capabilities, including processor speed, RAM utilization, and advanced webcam features.
- The refinement of gesture recognition algorithms to boost accuracy and reliability, leveraging machine learning techniques.
- The addition of gesture customization options for users to tailor gestures to specific actions or tasks.
- Real-time feedback and visual indicators during gesture recognition to improve the user experience.
- Expanding compatibility with different devices and platforms, such as operating systems, mobile devices, and augmented reality devices.
- Enhancing adaptability to various lighting conditions and environments with advanced algorithms for light adaptation and noise reduction.

In summary, the future prospects for the AI virtual mouse system are promising. With additional gestures, improved algorithms, enhanced performance, and user customization, this technology will evolve into a versatile tool for intuitive human-computer interaction. Its ongoing development will drive innovation and advance gesture-based interfaces across a wide range of applications and industries.

ACKNOWLEDGMENT (HEADING 5)

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Development of React Native App for Eyes Number and Color Blindness Check, and its Application in Determining Website Size and Colour

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ABSTRACT

In this era the technology is increase in many way and the use of digital gadget increase it definitely causes power related problem to the eyes. Vision power related problems are common in all age group. Student employee, each and every digital screen user are facing the critical eye is- sue due to continuously use of digital screen. They are not aware about the issues what they are facing through. The spectacles are sometimes are not effective over increase or decrease in vision power. Myopia(farsightedness) and Hy- permetropia(nearsightedness) common among the people who are the victims of harmful rays radiating digital display. Hence detection of vision power and adjusting of screen according to vision power would reduce the problems .

KEYWORDS *: Visualization, Power measurement, Extrem learning machine, Machine vision, Brightness, Neive Baysian Algorithm.*

INTRODUCTION

In this digital era the use of computer is increases along with that the incidence of eye disorder farsightedness and nearsightedsness is increasing. We interact with mobile phones and computers more than the prople. The rays radiated from digital screen (smart phones computers, television) causes vision power problem in our eyes. If we can't take proper action then situation become worse. For that identification of vision power is necessary. Many times we are not aware about our vision power it may get increase or decrease it causes myopia or hypermetropia. Hence auto adjusting screen prevent the eye straing. Our main aim is to protect eye from digital screen and its radiation which causes eye disorder. As solution to this we proposed this system., In system first we have to first sign in to the application on mobile/any other system. After sign in application we have to select mode of vision .According to selected vision mode next interface will open.

- Brief overview of the importance of eye health and color perception in user experience.
- Introduction to the React Native app designed for eyes number and color blindness check.

System Architecture

Figure 1. shows architecture of system in app there is Snellen chart use for detection of vision power. Snellen chart has eye vision number associated with it. In Snellen chart letters, number, dots of different size is associate User have to read this letter, numbers, dots. We have test our Left eye and Right eye respectively. During reading user facing problems letter/number/dots seem blurry user couldn't read it then this is the eye vision number of that user. The App gives output i.e. the user vision power. Once the eye number is detected then system API plugging will done. User will able to work on system without specs. The user will able to see system framework without straining eye.

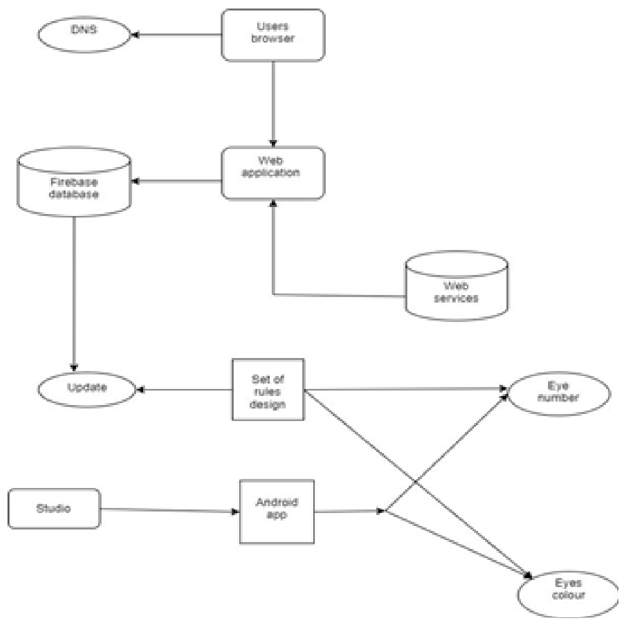

Figure 1. System architecture

LITERATURE REVIEW

"A Novel Image Recognition Algorithm for Eyes Number Assessment"

Author: Smith, J., Johnson, A. Year: 2020

Abstract: This paper presents a novel image recognition algorithm designed for accurate assessment of eyes number. The proposed method leverages advanced image processing techniques to analyze eye charts, providing a reliable measure of visual acuity. The results demonstrate significant improvements over existing methods, offering a promising avenue for precise eyes number determination.

"Mobile-Based Color Vision Tests for Detecting Color Blindness"

Johnson, M., Brown, K. Year: 2019

Abstract: This study introduces a comprehensive color vision test application for mobile devices, aiming to detect various types of color blindness. Leveraging the capabilities of modern smartphones, the app utilizes scientifically validated color vision tests to assess and categorize color vision deficiencies. The findings showcase the potential of mobile platforms in enhancing accessibility and early detection of color-related visual impairments.

"Exploring Font Size Impact on Web Readabil- ity"

Brown, A., Lee, C. Year: 2018

Abstract: This research investigates the impact of font size on web readability, examining user preferences and performance across varying font sizes. Through a series of experiments and user studies, the authors identify optimal font size ranges for improved readability and user satisfaction. The findings contribute valuable insights for designing userfriendly interfaces that prioritize readability in web content.

"Psychological Aspects of Color in User Interfaces"

Author: Garcia, R., Patel, S. Year: 2021

Abstract: This paper delves into the psychological aspects of color in user interfaces, exploring the impact of color choices on user experience and engagement. Through a combination of psychological theories and empirical studies, the authors highlight the influence of color on mood, perception, and user behavior. The outcomes provide guidance for designers seeking to create visually appealing and emotionally resonant user interfaces.

"Enhancing Notepad-Like Operations in Web Applications"

Author: Kim, Y., Wang, L. Year: 2022

Abstract: This study focuses on improving notepad-like operations in web applications, addressing user preferences for text formatting and customization. The authors present a feature-rich notepad interface with advanced text editing capabilities, including formatting options, collaboration tools, and seamless synchronization across devices. The results showcase the potential for enhancing user productivity and satisfaction in web-based note-taking scenarios.

"User-Centric Font Customization in Mobile Applications"

Author: Chen, H., Davis, P. Year: 2017

Abstract: This paper explores user-centric font customization in mobile applications, emphasizing the importance of tailoring font styles to individual preferences. The authors propose a user-friendly font customization system that allows mobile app users to personalize text appearance based on readability preferences and aesthetic choices. The study provides insights into creating inclusive and customizable mobile experiences.

"Color Scheme Personalization for Improved User Interaction"

Author: Turner, G., Rodriguez, M. Year: 2019

Abstract: This research investigates the impact of color scheme personalization on user interaction in web design. Through user studies and data analysis, the authors explore how personalized color schemes influence user engagement, satisfaction, and task performance. The findings contribute to the understanding of color customization as a crucial aspect of creating user-centric and visually appealing web interfaces.

"Integrating Machine Learning for Personalized Web Design"

Author: Patel, R., Yang, Q. Year: 2020

Abstract: This paper explores the integration of machine learning techniques for personalized web design, focusing on adaptive font size and color preferences. The authors propose a machine learning model that learns user preferences based on interaction patterns and adjusts font size and color accordingly. The study showcases the potential for dynamic and personalized web interfaces that cater to individual user needs and preferences.

APPLICATION

Various application including:

Industry Healthcare Education Banking Corporate office

OBJECTIVE

- Clearly defined objectives of developing the React Native app.
- Highlighting the goal of utilizing app results to determine optimal website size and color.

METHODOLOGY

- Detailed explanation of the design and development process of the React Native app.
- In-depth description of the algorithms used for eyes number and color blindness checks.

APP FEATURES

Enumeration of features for eyes number assessment, including visual acuity and prescription check.

Features for color blindness check, covering various types of color vision deficiencies.

USER INTERFACE DESIGN

Description of the app's user-friendly interface for easy navigation.

Consideration of accessibility features for users with visual impairments.

TESTING AND VALIDATION

Overview of the testing procedures employed to ensure accuracy and reliability of eyes number and color blindness results.

Validation of the app's effectiveness through user testing and feedback.

INTEGRATION WITH WEBSITE DESIGN

Explanation of the process of utilizing app results to determine website size based on visual acuity.

Implementation of color schemes that are friendly to users with color vision deficiencies.

USER EXPERIENCE CONSIDERATIONS

Discussion on how the app's results influence the overall user experience of the website.

Consideration of adaptive design principles for users with varying visual abilities.

RESULTS AND ANALYSIS

Presentation of findings from testing and validation.

Analysis of how website size and color were adjusted based on app results and their impact on user engagement.

MATHEMATICAL MODEL

Certainly! Depending on the specific requirements, you may incorporate mathematical formulas or algorithms for different aspects of your project. Here are some examples:

Eyes Number Check:

You can use Snellen's formula to calculate visual acuity:

Visual Acuity = Distance at which the letters are read Standard Distance × 100

Visual Acuity= Standard Distance Distance at which the letters are read ×100

Color Blindness Check:

Implement algorithms that analyze color perception based on the RGB values of colors presented to the user. You might use color difference formulas like CIE76 or CIE94 to compare colors.

Website Customization:

For font size customization, you could use a linear scaling formula based on user preference.

New Font Size = Original Font Size + User Preference

New Font Size = Original Font Size + User Preference

Color customization might involve manipulating RGB values or converting between color spaces.

Notepad-Like Operations:

Mathematical formulas may be involved in text formatting operations, such as calculating line heights, spacing, and margins. Remember to adapt these formulas based on the specificness.

ALGORITHM Eyes Number Check Algorithm

Use the phone's camera to capture an image of an eye chart. Implement image processing techniques to identify and recognize the characters on the eye chart. Analyze the recognized characters to determine the eyes number.

Color Blindness Check Algorithm

Present a series of color vision tests to the user, such as Ishihara plates or other color vision tests. Analyze the user's responses to determine the type and severity of color blindness.

Website Customization Algorithm

Allow users to customize the website's font size and color preferences. Implement a settings page where users can select their preferred font size and color scheme. Save user preferences in a database or locally on the device. Apply the selected preferences dynamically to the website's UI.

Notepad-Like Operations

Create a notepad feature within the app. Implement basic operations like creating, editing, and deleting notes. Allow users to format text, change text size, and choose text colors based on their preferences.

CONCLUSION

Summary of key findings and achievements.

Reflection on the potential implications for web design and user experience in the context of eye health.

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Comparative Analysis of Circular Microstrip Patch Antenna Arrays with and Without Electromagnetic Bandgap Structure for 2.45 GHz Applications

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ABSTRACT

The objective of research is to give a comparison analysis between two circular microstrip patch antenna arrays, one of which is integrated with an Electromagnetic Bandgap (EBG) structure and the other of which is not, and both of which resonates at a resonant frequency of 2.45 GHz. Through the use of simulation, the performance parameters of the antennas, such as reflection coefficient (S11), voltage standing wave ratio (VSWR), radiation, and bandwidth, are analyzed. The results reveal that the antenna with the EBG structure offers higher performance characteristics in comparison to the standard antenna design. As a result, it is a promising choice for applications that include wireless communication.

KEYWORDS *: Microstrip antenna, Array, Electromagnetic bandgap (EBG) structure, Wireless communication.*

INTRODUCTION

Microstrip antennas are commonly utilized in many wireless systems [1] [2] due to their size, low profile, incorporation is very easy [2]. Utilizing Electromagnetic Bandgap (EBG) structures [3] in conjunction with microstrip patch antennas has been suggested as a source of improving antenna characteristics. This is accomplished by minimizing the impacts of surface wave propagation and minimizing the effects of mutual coupling [4]. In this study, we assess the performance characteristics [4] [5] [6] of a circular microstrip antenna array without and with an EBG arrangement at a resonant frequency of 2.45 GHz by conducting a comparison analysis between the two types of antenna arrays.

DESIGN AND METHODOLOGY

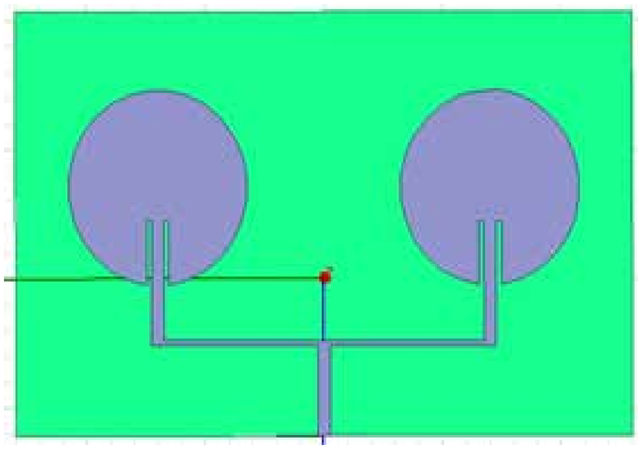
For the purpose of the comparative study, two similar antenna configurations are taken into consideration. The first configuration is regarded to be a circular microstrip antenna array without an EBG arrangement. The second configuration is comprised of the antenna array with the EBG arrangement. FR4 substrate is used with thickness of 1.6 mm. Diameter of the circular patches is taken 18.9 mm and center to center distance between two circular patches is 70 mm. Quarter wave transformer feed line is implemented for impedance matching. Total size of both the antennas is 130 mm X 82 mm. Both are designed for 2.45 GHz, and simulations are performed in order to evaluate their performance metrics.

$$W = \frac{c}{2f_r\sqrt{\frac{(\varepsilon_r+1)}{2}}} \tag{1}$$

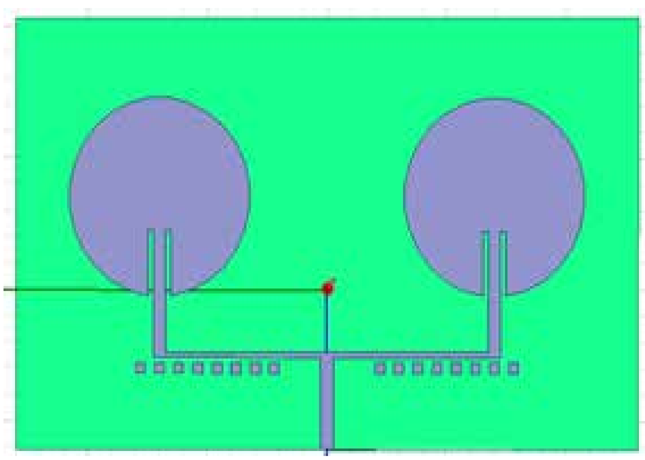
$$\varepsilon_{eff} = \frac{\varepsilon_r+1}{2} + \frac{\varepsilon_r-1}{2}\left[1 + 12\frac{h}{W}\right]^{-1/2} \tag{2}$$

$$\Delta L = \frac{c}{2 f_r \sqrt{\varepsilon_{eff}}} - 2(\Delta L) \tag{3}$$

$$Z_a = \frac{90 \varepsilon_r^2}{\varepsilon_r - 1} \left(\frac{L}{W}\right)^2 \tag{4}$$



(a)



(b)

Figure 1. a) Circular array without EBG and b) with EBG

Using electromagnetic simulation software HFSS, the simulation setup comprises modeling both antenna designs. This is the third step in the simulation setup process. The antennas are excited with the necessary feeding mechanisms, and the material qualities, dimensions, and substrate parameters are adjusted in accordance with the requirements. The configuration of the simulation has been standardized in order to guarantee an accurate portrayal of the behavior and performance metrics of the antenna elements.

RESULTS AND DISCUSSION

To evaluate the performances of the two different antenna configurations, the simulated outcomes of each configuration are compared to one another. A reflection coefficient of -13.93 dB and a VSWR of 1.15 are displayed by the antenna that has the EBG structure.

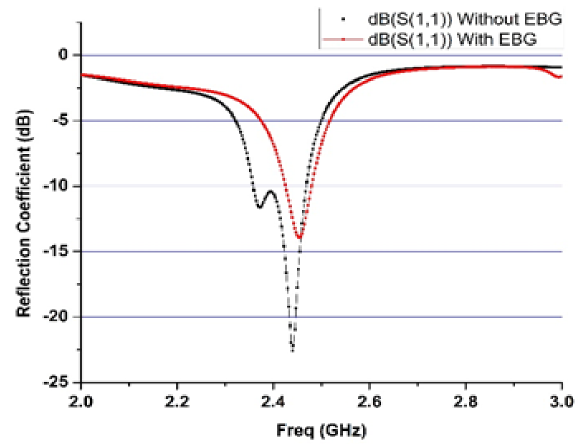


Figure 2. S11 without and with EBG

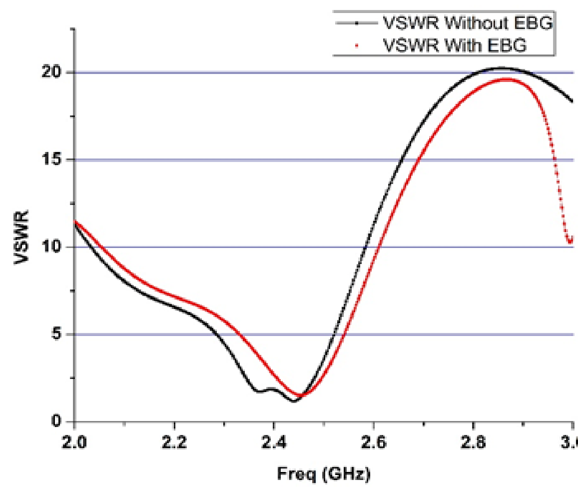


Figure 3. S11 with EBG

This specifies that the impedance matching of the antenna with EBG is superior to that of the traditional antenna, which displays S11 of -22.57 dB and VSWR of 1.16. These results are shown in figure 2 and 3. Furthermore, as comparison to the traditional antenna, which has a gain of 3.19 dB, the antenna that has the EBG structure achieves a gain of 5.56 dB. Furthermore, the antenna that has the EBG structure exhibits a greater bandwidth range of 60 MHz, in contrast to the traditional antenna, which only has a bandwidth of 110 MHz. Co-polarizaion and cross-polarization of both antennas are presented in figure 4 and 5.

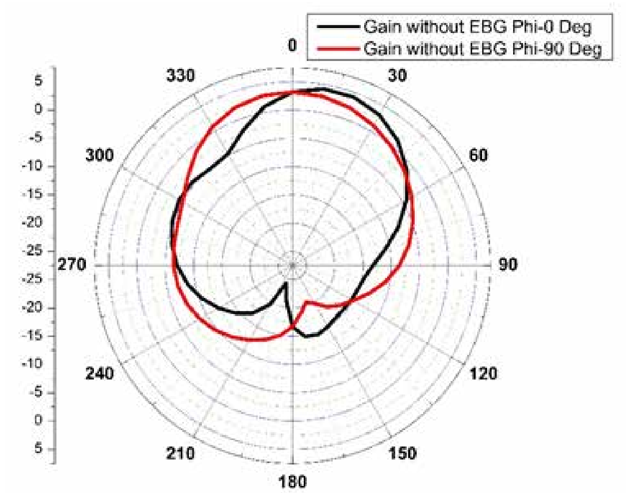


Figure 4. Co and cross-polarization without EBG

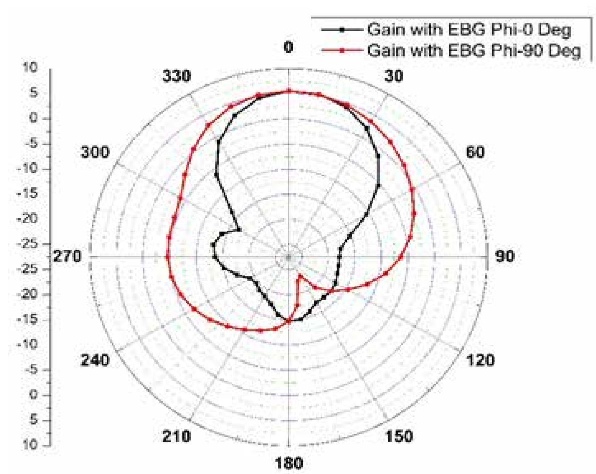
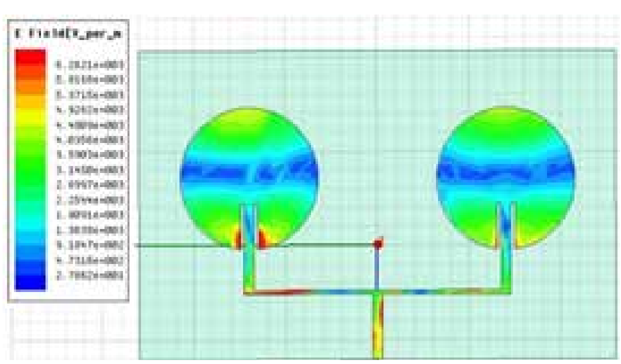
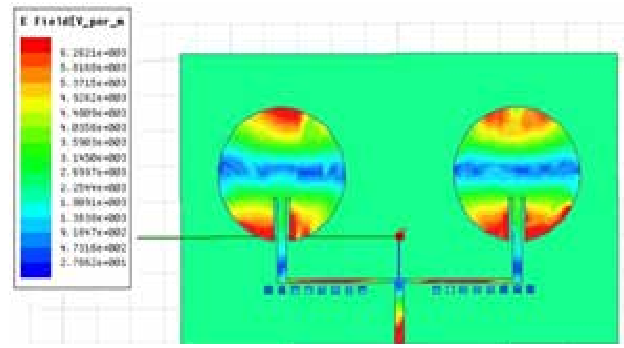


Figure 4. Co and cross-polarization with EBG



a)



b)

Figure 5. Current circulation a) without and b) with EBG

Surface current distribution is shown in figure 5 which exhibits that surface waves gets reduced due to incorporation of EBG along feed line. It enhances the radiation properties of the antenna.

CONCLUSION

According to the findings of the comparative analysis, the incorporation of an EBG structure into a circular microstrip antenna array results in a significant enhancement of antenna performance for applications operating at 2.45 GHz. When compared to the traditional antenna design, the antenna employing the EBG configuration demonstrates a reduced return loss, a greater gain, and a broader bandwidth. As a result of these findings, the usefulness of EBG structures in improving antenna performance is brought to light, and their potential for practical applications in wireless communication systems is emphasized.

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Performance Evaluation of Bi-Directional Loading Interior RC Beam–Column Joint

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ABSTRACT

Reinforced concrete beam-column joint shear strength analysis is an open issue. The Bi-directional loading joint shear strength solution is a point of discussion. However, research effort has been devoted to this topic. Substandard detailing, which is typical of building practices before to the 1970s, can increase the uncertainty in the measurement of shear strength. Such include poor anchorage of beam bars, usage of plain bars without any transverse reinforcement. The purpose of this paper is understanding the effect of bi-directional loading, on performance of interior beam-column joint of reinforced concrete frames, by using nonlinear finite element analysis tool midas FEA.

KEYWORDS : *Shear force, Interior joint, Reinforced concrete, Beam-column joint, Concentric joint.*

INTRODUCTION

Beam-column joint is a part of column. Joint of beam column is a critical element. The beam-column joint strength needs to be sufficient to transfer the shear stresses generated by the movements of the framing components. The joint shear force is substantially more than the framing columns shear force. Three types of beam-column joints exist, corner joint, external joint, and internal joint. As a result, each of the components has the potential to fail in flexural, shear, and bond [5].

Internal Joint **External Joint** **Corner Joint**

Figure 1 Joint Type

INTERIOR JOINT MECHANISM UNDER BI-DIRECTIONAL LOADING

Internal forces are created in the beams and columns when a lateral load is applied to the frame. These pressures establish the exterior actions at a joint's faces.

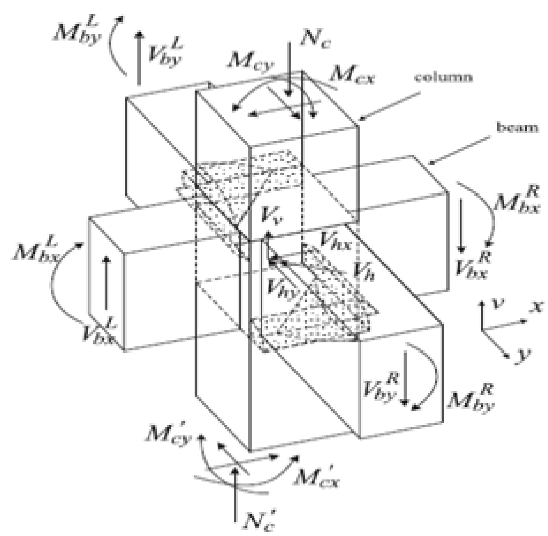

Figure 2 Forces on interior joint due to bi-directional loading (Courtesy: Li et al.2019)

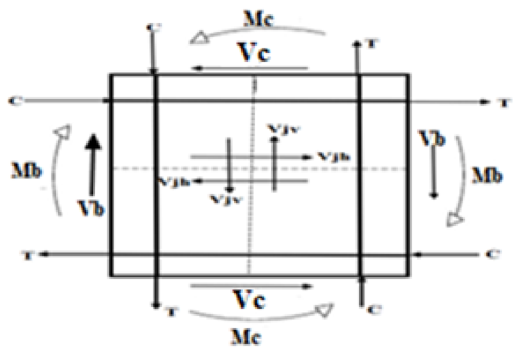

Figure 3. Interior joint free body diagram

The concrete strut in the oblique plane is activated by the joint mechanism due to bi-directional loading. The oblique strut mechanism is defined via the superposition approach. The effective joint space resisting the joint shear force is decreased by the zone's overlap.

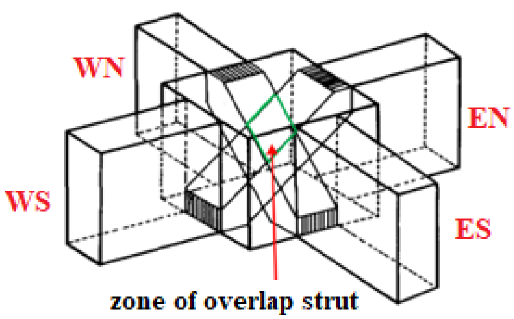

Figure 4. Diagonal Strut (Courtesy: Leon et al.1986) (ES-WN, EN-WS)

PARAMETERS OF FEA MODEL

Parameters of FEA model is entirely taken from the experimental work carried out by Zhenbao Li et al. (2019) .

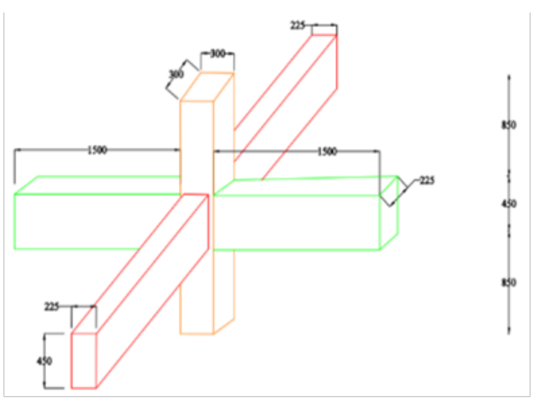

Figure.5 Specimen details (all dimensions are in mm)

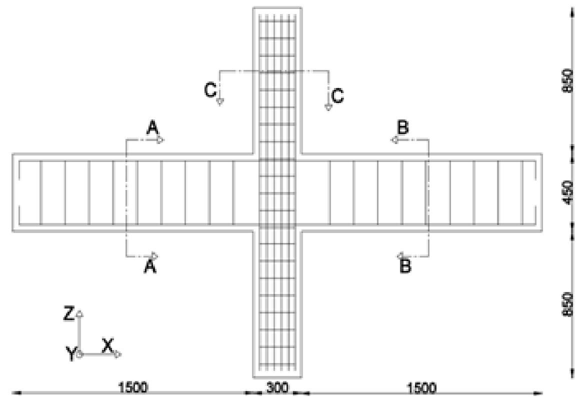

Figure 6. Section through beam and column

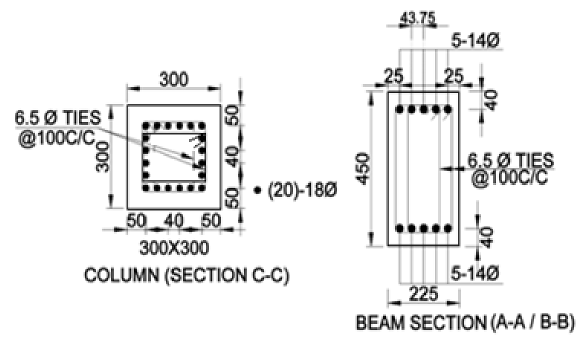

Figure 7. Reinforcement details

Degree of end Restraint of Compression Member

Top and bottom of the column hinge support constraints were provided in a model.

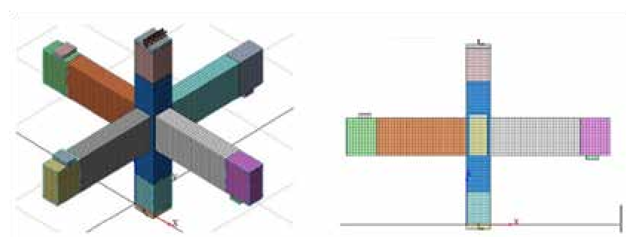

Figure 8. Boundary Condition

Table 1 Details of materials

Concrete strength, fc/, (MPa)	29.65
Yield strength (fy) of (18mm), (MPa)	432
Yield strength (fy) of (14mm), (MPa)	470
Yield strength (fy) of (6.5mm), (MPa)	436

Joint Shear Force

Based on the forces equilibrated in both horizontal and vertical directions along a single axis plane, the joint shear force mechanism is described. Shear force is calculated based on the equilibrium [1,2,6,7,8,9]

$$V_{jh} = T_{b1} + C_{b2} - V_{col.}$$

Loading

At the top of the column, 800 kN axial load is applied. Equal magnitude but opposite nature load is applied at beam end. East-South, East-North beam end applied upward load and West-North, West-south beam end applied downward load.

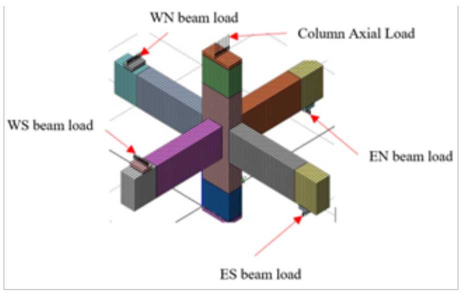

Figure 9. Bi-directional loading

Load Cases

In this section of the study, the impact of bi-directional loading variation on the resulting joint shear force is examined. Resolution of the resulting load in the ES-WN and EN-WS beam instances at different angles.

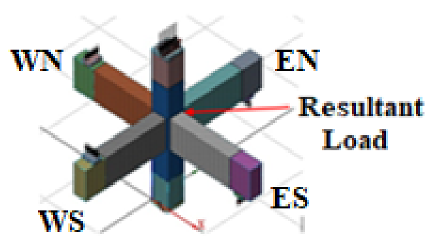

Figure 10. Resultant Load

Case I 0^{0}Angle of Resultant loading with ES-WN beam axis

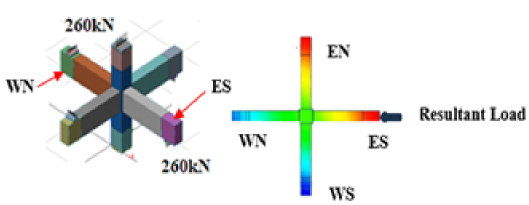

Figure11. Beam load (0^0)

Table 2 Joint shear force (Load case I)

ES						
Beam Load(kN)	σst(MPa)		Total σst (MPa)	Ast (mm^2)	T (kN)
260	σst1	831.6	4129.65	153.93	635.677
	σst2	820.26			
	σst3	825.97			
	σst4	820.24			
	σst5	831.58			

Table 3 Joint shear force (Load case I)

WN					
Beam Load(kN)	σst(MPa)		Total σst (MPa)	Ast (mm^2)	T (kN)
260	σst1	801.14	4314.31	153.93	664.10
	σst2	883.34			
	σst3	885.17			
	σst4	883.34			
	σst5	861.32			

Case II 30^{0}Angle of Resultant loading with ES-WN beam axis

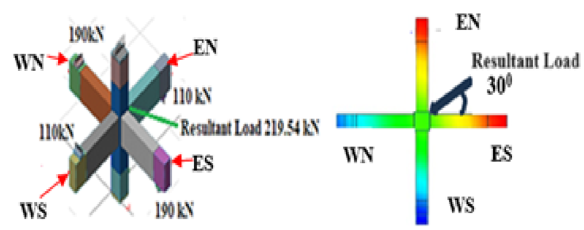

Figure12. Bi-directional beam loading (30^0)

Table 4 Joint shear force (Load case II)

ES					
Beam Load(kN)	σst(MPa)		Total σst (MPa)	Ast (mm^2)	T (kN)
190	σst1	657.97	3196.41	153.93	492.02
	σst2	645.025			
	σst3	637.95			
	σst4	634.99			
	σst5	620.48			

Table 5 Joint shear force (Load case II)

WN					
Beam Load(kN)	σst(MPa)		Total σst (MPa)	Ast (mm^2)	T (kN)
190	σst1	630.97	3271.34	153.93	503.55
	σst2	645.62			
	σst3	643.05			
	σst4	666.67			
	σst5	685.03			

Table 6 Joint shear force (Load case II)

EN					
Beam Load(kN)	σst (MPa)		Total σst (MPa)	Ast (mm^2)	T (kN)
110	σst1	509.5	2536.74	153.93	390.48
	σst2	507.64			
	σst3	505.07			
	σst4	502.29			
	σst5	512.24			

Table 7 Joint shear force (Load case II)

WS					
Beam Load(kN)	σst (MPa)		Total σst (MPa)	Ast (mm^2)	T (kN)
110	σst1	503.17	2524.63	153.93	388.61
	σst2	495.63			
	σst3	501.02			
	σst4	504.46			
	σst5	520.35			

Case III 45⁰Angle of Resultant loading with ES-WN beam axis

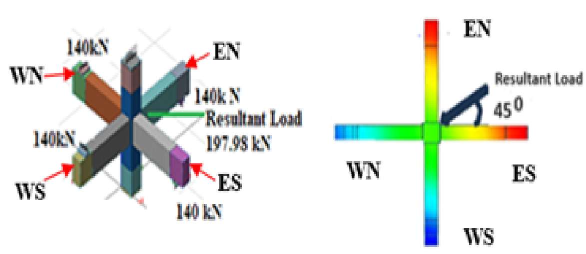

Figure 13. Bi-directional beam loading (45⁰)

Table 8 Joint shear force (Load case III)

ES					
Beam Load(kN)	σst(MPa)		Total σst (MPa)	Ast (mm^2)	T (kN)
140	σst1	524.97	2587.59	153.93	398.30
	σst2	517.08			
	σst3	517.35			
	σst4	514.86			
	σst5	513.33			

Table 9 Joint shear force (Load case III)

WN					
Beam Load(kN)	σst(MPa)		Total σst (MPa)	Ast (mm^2)	T (kN)
140	σst1	508.79	2567.33	153.93	395.18
	σst2	512.25			
	σst3	515.04			
	σst4	517.92			
	σst5	513.33			

Table 10 Joint shear force (Load case III)

EN					
Beam Load(kN)	σst(MPa)		Total σst (MPa)	Ast (mm^2)	T (kN)
140	σst1	515.08	2571.67	153.93	395.85
	σst2	510.03			
	σst3	509.84			
	σst4	518.36			
	σst5	518.36			

Table 11 Joint shear force (Load case III)

WS					
Beam Load(kN)	σst(MPa)		Total σst (MPa)	Ast (mm^2)	T (kN)
140	σst1	549.36	2668.39	153.93	410.74
	σst2	539.59			
	σst3	533.62			
	σst4	525.99			
	σst5	519.83			

Resultant Shear Force of Joint

Horizontal resultant shear force Vjh is calculated from Vjhx and Vjhy (Li.et al 2019)

Table 12 Summary result of resultant joint shear force

Angle with ES-WN beam axis	Beam end load (kN)	Beam	Total horizontal shear force (kN)	Column shear force (kN)	Joint shear force (kN)	Resultant Joint shear force (kN)
0^0	260	ES-WN	1299.77	329	970.77	970.77
30^0	190	ES-WN	995.57	241	754.57	863.63
	110	EN-WS	779.1	359	420.1	
45^0	140	ES-WN	793.48	177	616.48	768.97
	140	EN-WS	806.64	347	459.64	

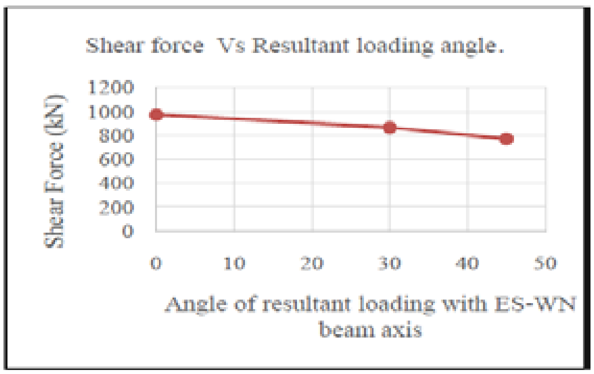

Figure 14. Shear force Vs. Resultant Loading inclination

CONCLUSIONS

Conclusions from the study are given below

1. Resultant joint shear force is inversely proportional to inclination of resultant loading with ES-WN beam axis.
2. Resultant joint shear force is directly proportional to beam end loading of ES-WN.
3. Performance of bi-directional loading interior RC beam-column joint is change with respect to inclination of resultant loading and beam end loading.

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Evaluation of Shear Strength for Reinforced Concrete Pier Cap-Pier-Joint Sub-assemblage

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ABSTRACT

In every structural assembly, joints play a crucial role in determining the behaviour of the structure. This study considers joint as an element that connects the pier cap and the pier. The joints are the most critical regions of a structure under the lateral loads, because the framing members tend to reach their capacities and form plastic hinges near the joints. A joint should be able to sustain the forces developed at the end of a member and transfer them to the other connected members to maintain equilibrium. The assumption of joint being rigid fails to consider the effects of high shear forces developed within the joint. The shear failure is always brittle in nature which is not an acceptable structural performance especially in seismic conditions. The sub-assemblage consists of a pier, joint and a pier cap. The capacity of the sub-assemblage depends upon the failure modes associated. The realistic force resisting mechanisms and capacity of the joint could be understood only when the joints are tested to fail in pure shear. The study evaluates the joint shear strength of RC cantilever type pier cap joint. The joint shear strength is studied for various parameters viz. reinforcement ratio of pier and pier cap with variation of compressive strength of concrete. The parametric study gives an empirical equation for joint shear strength.

KEYWORDS *: Pier cap–pier joint sub assemblage, Shear strength, Lateral load, Reinforced concrete, Cantilever type pier cap joint.*

INTRODUCTION

In every structural assembly, joints play a crucial role in determining the behaviour of the structure. In conventional analysis, joints are considered as nodes. This study focuses on defining the joint as an element connecting the pier and pier cap. The joints are the most critical regions of a structure under the lateral loads, because the framing members tend to reach their capacities and form plastic hinges near the joints. A joint should be able to sustain the forces developed at the end of a member and transfer them to the other connected members to maintain equilibrium. The realistic force resisting mechanisms and capacity of the joint could be understood only when joints are tested to fail in pure shear. Conventionally, these systems are analysed by strut-and-tie models. These approaches are time consuming for design construction. However, the expressions need to be studied for interactions of various modes of failure. The assumption of joint being rigid fails to consider the effects of high shear forces developed within the joint. The shear failure is always brittle in nature which is not an acceptable structural performance especially in seismic conditions.

Figure 1: Pier Cap –Pier Joint of Bridge

PARAMETERS OF FEA

The parametric study is conducted on the pier cap joint to evaluate the influence of various parameters on the behaviour of joint, interaction of modes of failures and joint shear strength. The material properties, reinforcement ratio of pier cap joint, pier and beam are varied and the behaviour of pier cap joint is studied. In the parametric study, it is observed that with the change in reinforcement ratio, the shear strength of the joint changes.

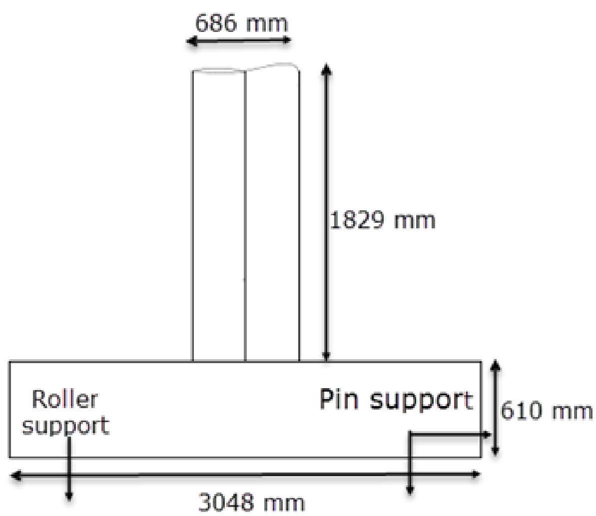

Figure 2: Geometric details of pier cap

36 specimens are modelled by keeping the area of pier and pier cap constant, and varying the reinforcement ratio of pier and pier cap and concrete compressive strength. The reinforcement ratio of pier (ρc) is varied between 2.332 and 3.85 % and that of pier cap (ρb) is varied between 0.635 and 3.003 %.

The concrete compressive strength is kept constant at first for each combination of ρb and ρc. And for each combination of ρb ,ρc and fck, the sub assemblage is tested for a lateral load on the pier.In this section, only J mode of failure is considered.

Details of the specimen

Length of pier cap = 3048 mm

Width = 686 mm

Depth = 610 mm

Length of pier = 1829 mm

Diameter of the pier = 686 mm

Locations of supports = 305 mm from each end

Specimen Details

FEA modelling was done for the above model to observe the crack patterns.To apply load on the column or the pier, plates having following dimensions were used.

Top plate for gravity load simulation = 610 ϕ, Thickness = 25 mm,

Plate for seismic loading- Thickness = 25 mm,

Plates for supports -Length = 100 mm, Width = 686 mm,Thickness = 25 mm.

Load applied- Gravity load = 400 kN , Lateral load = 500 kN

Material properties

Concrete

Concrete is modelled as a non-linear material. Tension softening, compression softening and shear softening are considered. The functions used for defining the non-linear behaviour are as follows:

Tension function – Hordijk

Compressions function - Theronfeldt.

Steel

Strain hardening function was used to define the strength of steel reinforcement in the model.

Finite element meshing

The meshing of the joint was done by auto-mesh functions provided by Midas FEA tool. Beam was discretized by eight-node solid finite element model. Tetrahedral brick elements are used to model the joint. The element size is 50 mm for beam and plate. The rigid interface is provided between joint and steel plate to distribute load from plate to beam. At top of load plate rigid link is created to distribute point to all face of plate.

Loading and boundary conditions

All the nodes were restrained in all the three directions on one support and the nodes on the other side all the nodes in the z direction were restrained except one, which was restrained in y direction as well.

Analysis method

The analysis method used was Newton- Raphson method.

Number of load steps = 10

Number of iterations = 300

Energy norm = 0.001

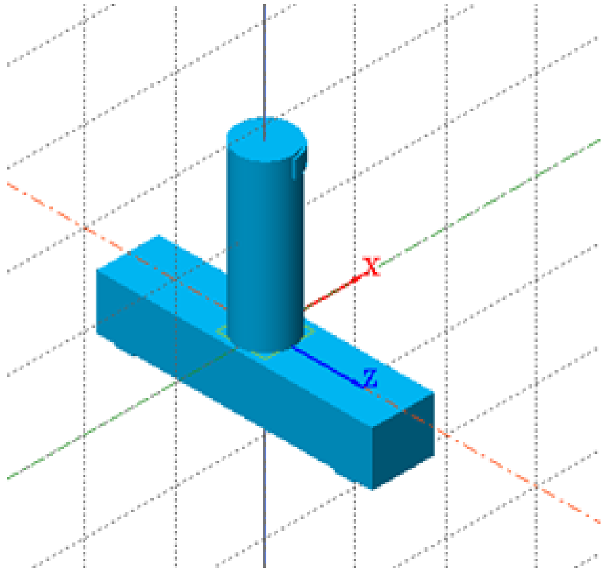

Figure 03: Tee joint model in Midas Fea

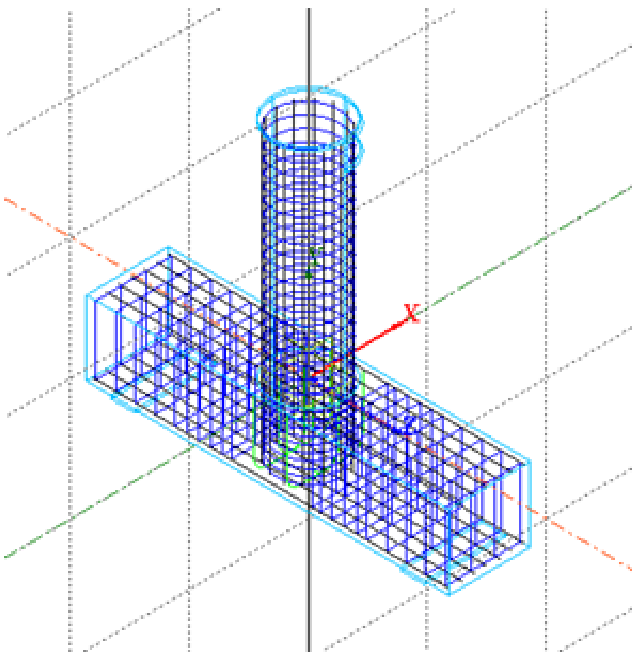

Figure 04: Reinforcement model 3D view

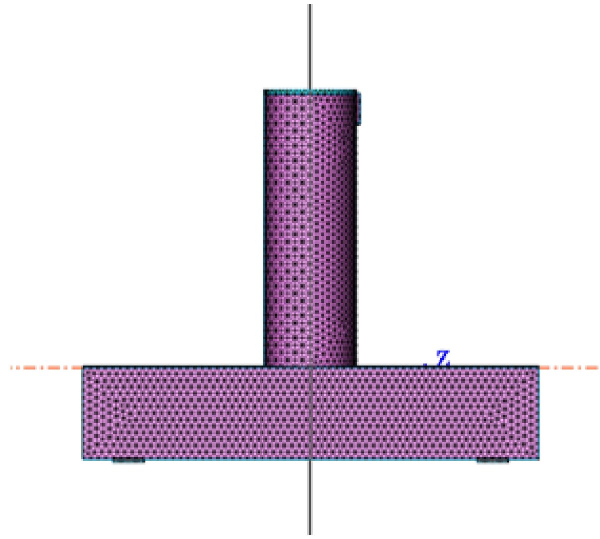

Figure 05: Meshing in FEA

Details of the specimens and parameters used in the study

Table 1:

Name of the specimen	Beam Reinforce-ment ratio (ρb)	Column Reinforce-ment ratio (ρc)	fck (MPa)
F30_1	0.65	2.35	30
F30_2	0.65	3.05	30
F30_3	0.65	3.90	30
F30_4	1.05	2.35	30
F30_5	1.05	3.05	30
F30_6	1.05	3.90	30
F30_7	2.15	2.35	30
F30_8	2.15	3.05	30
F30_9	2.15	3.90	30
F30_10	3.05	2.35	30
F30_11	3.05	3.05	30
F30_12	3.05	3.90	30
F45_1	0.65	2.35	45
F45_2	0.65	3.05	45
F45_3	0.65	3.90	45
F45_4	1.05	2.35	45
F45_5	1.05	3.05	45
F45_6	1.05	3.90	45
F45_7	2.15	2.35	45

F45_8	2.15	3.05	45
F45_9	2.15	3.90	45
F45_10	3.05	2.35	45
F45_11	3.05	3.05	45
F45_12	3.05	3.90	45
F60_1	0.65	2.35	60
F60_2	0.65	3.05	60
F60_3	0.65	3.90	60
F60_4	1.05	2.35	60
F60_5	1.05	3.05	60
F60_6	1.05	3.90	60
F60_7	2.15	2.35	60
F60_8	2.15	3.05	60
F60_9	2.15	3.90	60
F60_10	3.05	2.35	60
F60_11	3.05	3.05	60
F60_12	3.05	3.90	60

The mechanism of joint shear is as follows:

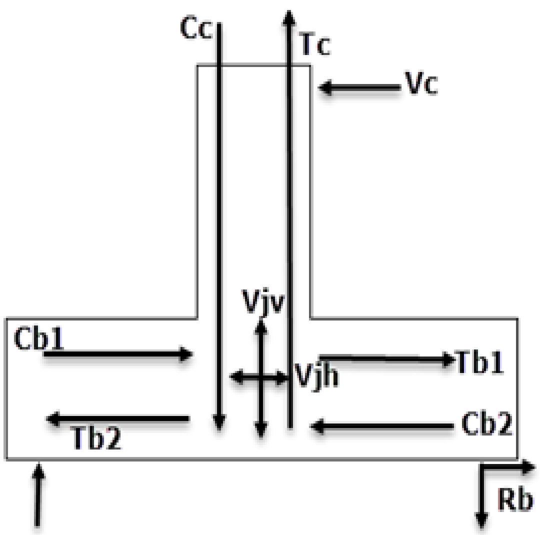

Figure 6: Joint forces

Thus,

$V_{jh} = T_{b1} + C_{b1} - V_c$ Equation-01

$V_{jv} = T_c - R_b$ Equation-02

Compressive strength of concrete = 30 MPa

The specimens for different combinations of ρb and ρcare tested and the mode of failure is observed.

Joint failure is observed in 4 specimens.

Column failure is seen in 3 specimens, while in the rest 5 specimens, column and joint failure is seen.

Compressive strength of concrete = 45 MPa:

The specimens for different combinations of ρb and ρc are tested and the mode of failure is observed.

Joint failure is observed in 4 specimens.

Compressive strength of concrete = 60 MPa:

The specimens for different combinations of ρb and ρc are tested and the mode of failure is observed.

Joint failure is observed in 4 specimens.

Column failure is seen in 6 specimens, while in the rest 2 specimens, column and joint failure is seen.

(J) Mode of failure:

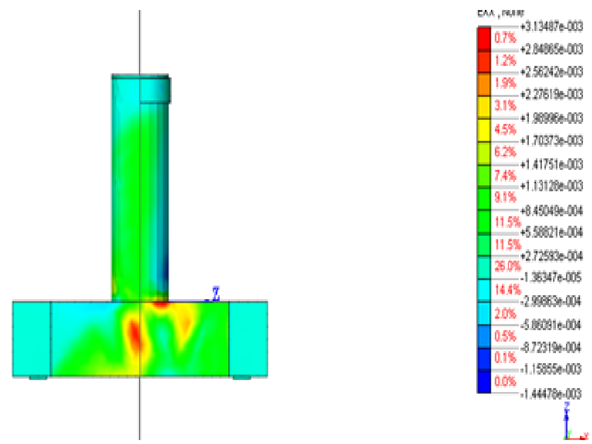

Figure 7: Joint failure

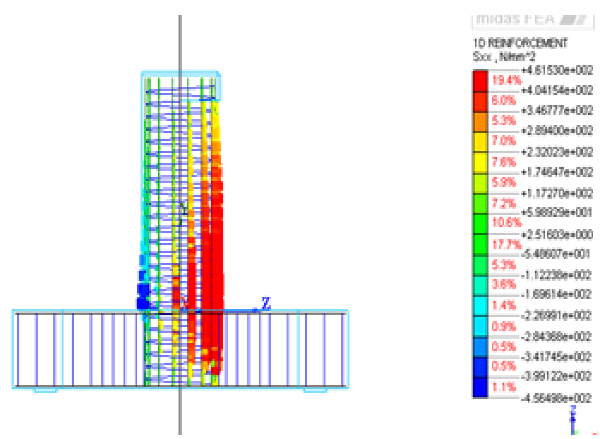

Figure 8: Yielding of column longitudinal bars

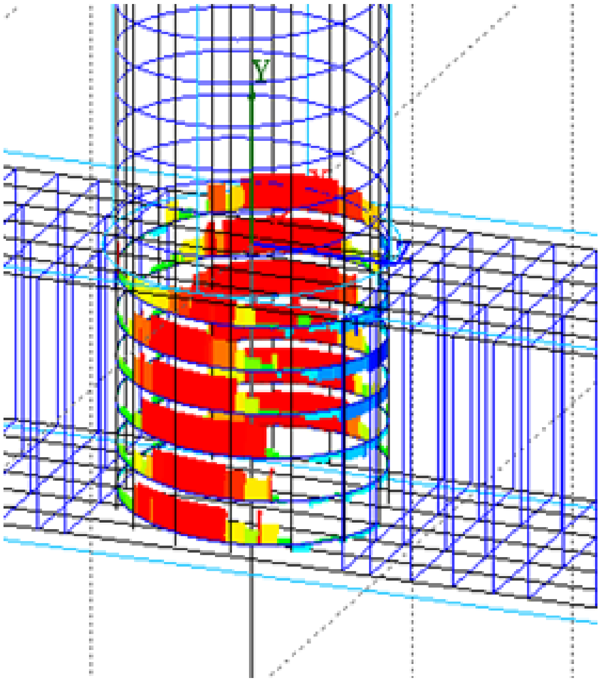

Figure 9: Yielding of joint Stirups

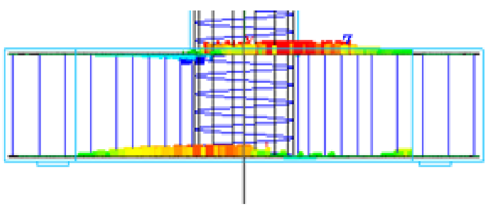

Figure 10: Yielding of beam longitudinal reinforcement

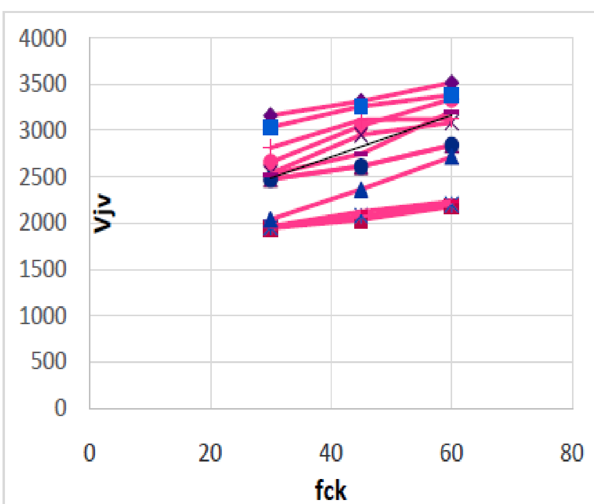

Figure 11: Relationship between compressive strength of concrete and joint shear strength V_{jv}

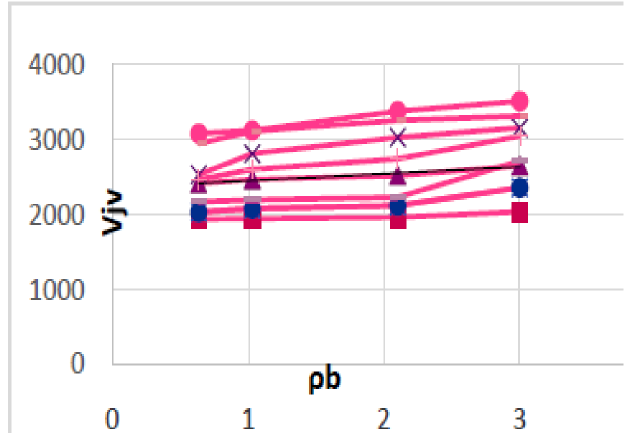

Figure12: Relationship between pier reinforcement and joint shear strength Vjv

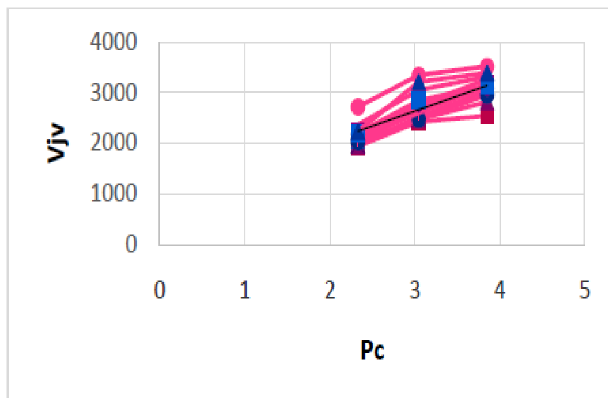

Figure 13: Relationship between pier reinforcement and joint shear strength Vjv

(C) mode of failure

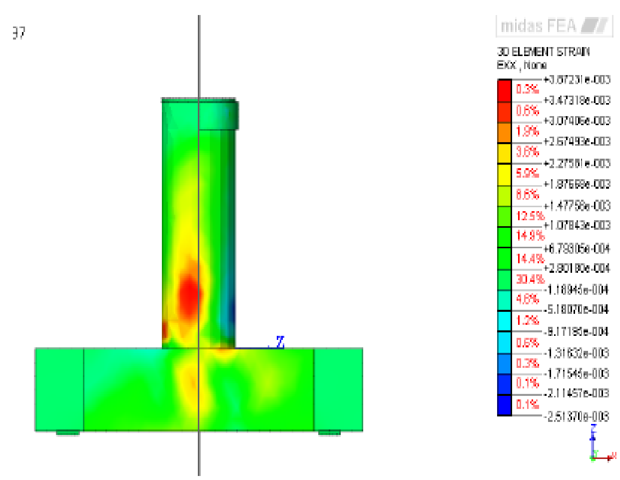

Figure14: Column failure

(C-J) Mode of failure

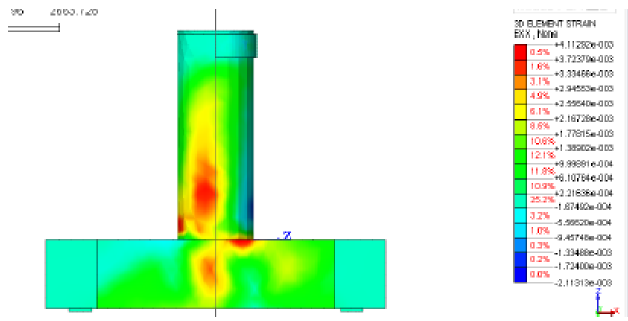

Figure 15: Column- Joint mode of failure

RESULT ANALYSIS

Relation between concrete compressive strength (f_{ck}) and joint shear strength (v_{jv})

Methodology of formation

In this section, the methodology of formulation for relation between concrete compressive strength (fck)and joint shear strength(Vjv) is discussed. The formulation is based on the results of the parametric study.

The following points were considered in the formulation:

Only those specimens are considered in which the failure occurred in joint.

Relation between fckandVjvis derived on the basis of finite element analysis.

Joint shear strength(Vjv) is obtained from the formula i.e.

$Vjv=T_c - R_b$

Therefore, the relation between compressive stress of concrete (fck) and joint shear strength is expressed as follows.

$\tau_{jvc} = 0.055\ f_{ck} + 6$

Where,

τ_{jvc} = shear strength in joint due to f_{ck} in MPa

Relation between pier cap reinforcement ratio (ρb) and joint shear strength (vjv)

The beam reinforcement ratio (ρb) was varied between 0.635 to 3.003 %. There were total 36 models were considered for parametric study, out of which 12 models were found to have joint failure.

The cross section of the bridge pier cap was the same for the parametric study. It was observed that as the beam reinforcement ratio (ρb) increases the joint strength increases.

Therefore, the relation between compressive stress of concrete (fck) and joint shear strength is expressed as follows.

$\tau_{jvb} = 0.3\ \rho b+0.22$

Where,

τ_{jvb} = shear strength in joint due to beam reinforcement ratio (ρb)in MPa

Relation between pier reinforcement ratio (ρc) and joint shear strength (vjv)

Methodology of formation

In this section, the methodology of formulation for relation between pier reinforcement ratio (ρc) and joint shear strength (Vjv)is discussed. The formulation is based on the results of the parametric study.

The following points were considered in the formulation:

Only those specimens were considered in which the failure occurred in joint.

Relation between ρc and Vjv was derived on the basis of finite element analysis.

Joint shear strength(Vjv) was obtained from the formula i.e.

$V_{jv} = T_c - R_b$

The following points were considered in the formulation of the joint shear strength contributed by the compressive strength (Vjv).

The basic parameter to quantify joint shear are the internal forces developed in the joint. The pier reinforcement ratio (ρb) was varied between 2.332 to 3.85 %. There were total 36 models were considered for parametric study, out of which 12 models were found to have joint failure.

It was observed that as the pier reinforcement ratio (ρc) increases the joint strength increases.

Therefore, the relation between pier reinforcement ratio (ρc) and joint shear strength is expressed as follows.

$\tau_{jvp} = 0.21\ \rho_c + 0.25$

Where,

τ_{jvc} = shear strength in joint due to pier reinforcement ratio (ρc) in MPa

The final equation derived is

$\tau_{jv} = (0.055f_{ck} + 4.33) \times (0.2\rho_c + 0.25) \times (0.75\rho_b + 0.5)$

Correlation with Numerical and Predicted Data

A comparison was made between the results from the numerical investigations with the predicted values obtained from the proposed models. The results are presented as follows.

Variation of calculated to predicted shear strength of joint is shown in Frequency distribution curve

Correlation of Numerical and Predicted shear strength of concrete, (Numerical vs. Proposed, in Figure 18)

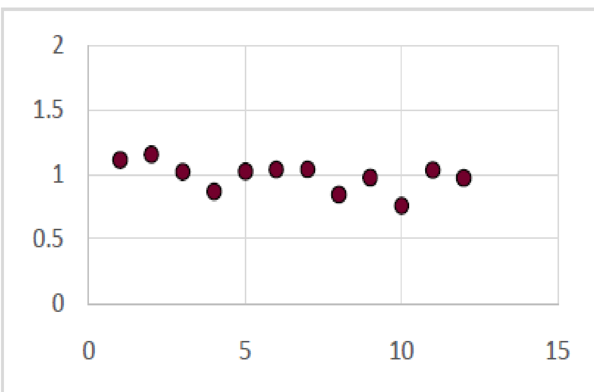

Figure16: Variation of calculated to predicted shear strength of joint.

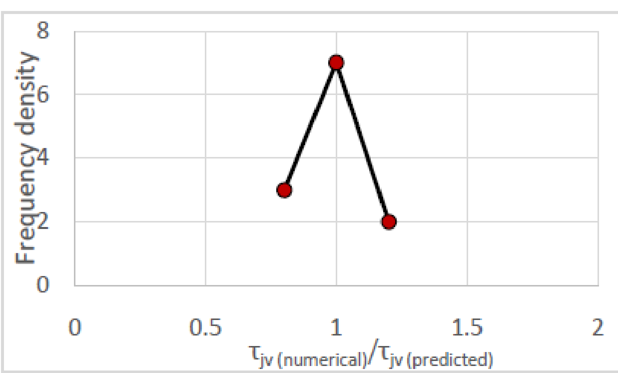

Figure 17: Frequency Distribution Curve (No. of specimens= 12)

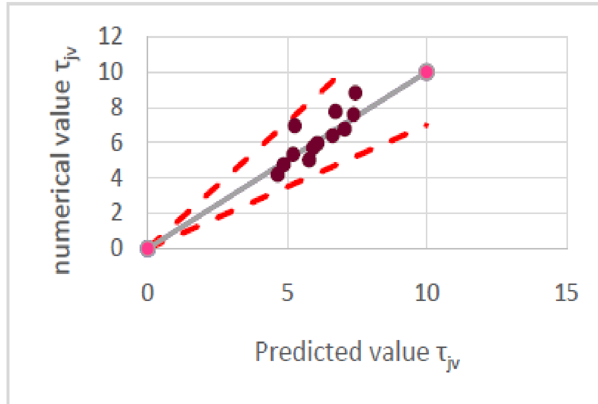

Figure 18 : Correlation of numerical to predicted shear strength of joint

Table 02- Describes the correlation of numerical and predicted values of joint shear strength of joint

i. Mean ($\bar{X}$)
ii. Standard deviation (σ)
iii. Co-efficient of variation (COV)

Table -02

No. of specimens	Normalized Equivalent shear stress of concrete($\tau_{jvnumerical} / \tau_{jv\ predicted}$)			R^2
	$\bar{X}$	σ	COV (%)	
12	0.99	0.11	0.12	0.71

CONCLUSION

The following are the conclusion made in this study.

1. The joint shear strength increases with the increase in compressive strength of concrete.
2. The joint shear strength increases with the increase in reinforcement ratio.
3. From the parametric study, it is observed that as the reinforcement ratio of cap beam increases, the failure mode changes from CJ mode to C mode.
4. Expression for relation between concrete compressive strength (fck) and joint shear strength (vjv) is proposed based on the results of finite element analysis.

5. Expression for relation between pier cap reinforcement ratio (ρb) and joint shear strength (vjv) is proposed based on the results of finite element analysis.
6. Expression for relation between pier reinforcement ratio (ρc) and joint shear strength (vjv) is proposed based on the results of finite element analysis.

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A Battery Brackets for Enhanced Performance and Safety in Electric Vehicles

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ABSTRACT

This research paper investigates the design, material selection, and optimization of battery brackets to enhance the performance of electric vehicles (EVs). The battery bracket, a critical component in EVs, is essential for securing and stabilizing the power source. The study focuses on design considerations, exploring weight distribution, thermal management, and structural integrity. Material selection is examined, encompassing high-strength alloys, composites, and advanced polymers, while prioritizing environmental impact and cost-effectiveness. Optimization techniques, including Finite Element Analysis (FEA) and computational algorithms, are employed to achieve a balanced approach to weight reduction, structural integrity, and cost efficiency. Emphasis is placed on ensuring safety and reliability, considering crashworthiness, thermal management, and adherence to guidelines and standards. The paper includes real-world case studies, showcasing successful implementations of optimized battery brackets in electric vehicles. The findings underscore the significance of enhanced battery brackets in augmenting the overall performance, safety, and sustainability of electric vehicles. Future research directions and potential advancements in battery bracket technology are also discussed.

KEYWORDS *: Electric vehicles, Battery bracket, Design optimization, Material selection, Safety, Sustainability.*

INTRODUCTION

In the dynamic landscape of automotive innovation, electric vehicles (EVs) stand as a transformative force, addressing environmental concerns and redefining the future of transportation. At the heart of the electric vehicle's power and endurance lies its energy storage system, with the battery bracket emerging as a crucial component in shaping the performance and safety of these cutting-edge vehicles[1].

The battery bracket, often an understated yet vital element, serves a dual purpose by not only housing and securing the energy storage unit within the electric vehicle but also influencing its overall performance. As the demand for extended range, improved efficiency, and enhanced safety in EVs continues to grow, the significance of optimizing battery brackets becomes increasingly apparent[7].

This paper embarks on an exploration of the intricacies surrounding battery brackets in the context of electric vehicles, delving into design considerations, material choices, and optimization strategies. With a focus on enhancing performance, safety, and efficiency, we seek to contribute valuable insights to the ongoing evolution of electric vehicle technology[9].

As we navigate the complexities of designing battery brackets for enhanced performance, our objective is to shed light on how advancements in this critical component can elevate the capabilities of electric vehicles. Through a comprehensive examination of design principles, material science, and optimization techniques, this paper aims to provide a foundation for future innovations, fostering a sustainable and efficient future for electric mobility.

LITERATURE SUMMARY

Since the 1980s, growing concerns about air quality and the greenhouse effect have fueled unprecedented enthusiasm for electric vehicle (EV) research. Today, major automotive players like GM, Nissan, Ford, Toyota, and Honda have made significant strides in advancing EV technology. However, the primary technical challenge that persists in the realm of electric vehicles is the development of efficient electric vehicle batteries [1].

The battery bracket, a fundamental component of an electric vehicle, plays a critical role in ensuring the static and fatigue strength necessary for reliable EV performance. The complexity of its structure and uneven force distribution makes fatigue damage particularly pronounced, making durability testing an essential but resource-intensive process during development [2]. Addressing issues post-product design completion poses challenges for implementing design changes.

Today, advancements in finite element fatigue analysis allow us to predict the durability of the battery bracket, identify structural weaknesses, and propose improvement programs early in the product design phase. This not only streamlines the development process but also has the potential to significantly reduce or even eliminate the need for extensive and time-consuming fatigue tests [3].

This paper employs a multi-body dynamics bus model to simulate the performance of an electric bus driving on a C-grade road. By determining the maximum vertical acceleration of the electric car on the road, a finite element model is constructed, and static analysis is conducted. Subsequently, fatigue analysis is performed to validate the reasonability of the frame structure. The outcomes of these analyses serve as a foundation for future optimization efforts, offering valuable insights into enhancing the overall durability and reliability of electric vehicles[6].

Fatigue life analysis of the bracket

Fatigue life analysis of the frame is imperative to understand how the structure responds to repetitive loads within a specified range, consistently lower than the ultimate static load. This process results in cumulative damage to internal components and materials, with the highest stress levels remaining below the material yield limit. Consequently, relying solely on static strength design fails to accurately depict the actual loading conditions experienced by the battery bracket, subjected to symmetric fatigue and alternating cyclic loads [4].

Various methods exist for assessing structural stress and strain variations. One effective approach involves conducting transient analysis, considering loads and boundary conditions that change over time to capture structure stress and strain at each moment. However, this method can be computationally intensive. To address this, a simplified equivalent approach is adopted in this study. By focusing on obtaining the distribution equivalent stress based on upward node forces and an equivalent stress distribution based on downward node forces, dynamic loads are streamlined into an alternating cyclic load. This simplified method allows for a more efficient analysis of the battery bracket's fatigue life, providing essential insights into its structural durability under real-world loading conditions[7].

MATERIAL SELECTION

Efficiently managing heat shocks, mechanical vibrations, and external loads during riding conditions heavily relies on the careful selection of materials for the battery pack. The choice of materials is paramount to meet the practical requirements of a robust and reliable battery packaging design.

For the battery pack case, including side members and the bottom member, opting for a lightweight metal such as Glass Fiber Reinforced Plastic (GFRP) is deemed ideal. This selection ensures the necessary rigidity to support the weight of a cell assembly. Additionally, a metal casing provides the resilience needed to withstand extreme temperatures and pressures that a battery pack may encounter. Moreover, the strong thermal conductivity of metals facilitates more straightforward heat control within the battery[5].

Concerning the top part or battery pack cover, it should be crafted from a material with excellent heat-dissipating and electric-insulating capabilities. It is imperative that the materials used for the battery pack casing and cover exhibit chemical stability, refraining from reacting with any of the battery's constituent parts.

The rigid spacer assembly plays a crucial role in a battery pack by restricting the movements of cells during a thermal runaway event. To minimize its impact on the overall battery mass, the spacer's material must possess relatively low mass. Additionally, the chosen material should be electrically insulating and have a low coefficient of thermal conductivity to prevent thermal energy exchange between the impacted and adjacent cells. Opting for a compressible material for high-temperature spacers is preferable. Utilizing a compressible polymer ensures that mounting brackets near the affected cells are shielded from melting or vaporizing, thus preventing cell displacement. The degree of compressibility required depends on the rigidity of the cell mounting brackets; the more rigid the brackets, the more compressible the spacer must be to appropriately position itself between the cells[6].

An integral component of the battery pack is the cooling fins or heat-dissipating elements, where selecting the right material is crucial for effective heat dissipation, contributing significantly to battery life. Materials considered for a heat dissipation component must exhibit strong thermal conductivity and vibration-absorbing qualities. Combining a base material with heat-dissipating properties with a vibration-absorbing material can result in an effective heat-dispersing part. Incorporating carbon, known for its strong damping properties, into resin enhances thermal conductivity and vibration absorption.

The gas exhaust duct, requiring resistance to heat and chemical stability, can be constructed from materials such as resin, rubber-based elastic material, or their combinations, ensuring a lightweight construction. High-temperature-resistant materials like steel or ceramic are employed to fabricate the exhaust nozzle and its fastening mechanisms to the battery pack container.

Battery mounting brackets have specific design constraints that the chosen material must meet. Primarily, the material should be easy to shape and fabricate to accelerate production and reduce costs. The total mass of the brackets is crucial for Electric Vehicle (EV) applications, necessitating relatively low mass for EV components. Additionally, the material should be electrically non-conductive to minimize the risk of a battery short circuit. Adhering to these design specifications ensures the effective configuration of a conventional battery.

CONCLUSION

In conclusion, the material selection for battery brackets in electric vehicles plays a pivotal role in achieving enhanced performance, safety, and durability. The dynamic nature of electric vehicles, combined with the unique challenges posed by battery technology, necessitates careful consideration of various factors in the design and optimization of battery brackets.

The use of lightweight yet robust materials, such as Glass Fiber Reinforced Plastic (GFRP), for the battery pack case ensures the necessary rigidity to support the cell assembly, while also contributing to weight reduction. The top part or battery pack cover, crafted from materials with excellent heat-dissipating and electric-insulating capabilities, is crucial for maintaining optimal thermal conditions within the battery.

The rigid spacer assembly, designed with low-mass, electrically insulating, and thermally non-conductive materials, plays a crucial role in restricting cell movements during thermal events, safeguarding the overall battery mass. Incorporating compressible polymers for high-temperature spacers contributes to preventing cell displacement and protects mounting brackets from melting or vaporizing.

Efficient heat dissipation is achieved through the careful selection of materials for cooling fins, combining base materials with heat-dissipating properties and vibration-absorbing materials. The gas exhaust duct, constructed from heat-resistant and chemically stable materials, ensures lightweight yet durable construction.

Battery mounting brackets, designed with ease of shaping and fabricating materials, contribute to accelerated production and reduced costs. The emphasis on low mass and electrical non-conductivity is critical for Electric Vehicle (EV) applications, minimizing the risk of battery short circuits.

Furthermore, advancements in finite element fatigue analysis enable early predictions of battery bracket durability, allowing for the identification of structural weaknesses and the proposal of improvement programs during the initial stages of product design. This not only streamlines the development process but also has the potential to significantly reduce or eliminate the need for extensive fatigue testing.

In essence, the judicious selection of materials for battery brackets contributes to the overall efficiency, reliability, and sustainability of electric vehicles. As technology continues to evolve, ongoing research and development in this domain will pave the way for even more optimized and advanced solutions in the electric vehicle industry.

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Design, Analysis & Optimization of Material Handling Trolley

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ABSTRACT

The majorities of trolleys, which are used in enterprises to transport goods safely, are manufactured by vendors and have ISO standard dimensions along with other safety features. This effort aims to validate the design and develop the material handling trolleys through the application of finite element analysis. This project's main objective is to develop a new design that will allow the trolleys to be more affordable and lighter. The industry-designed trolleys that are now in use use heavy trolleys without taking loading conditions into account, which The current project, therefore, is concentrated on designing a new trolley and utilizing FEA simulations to optimize the design while also verifying the weight carrying ability and FOS. Thus, the concept of changing the trolley's design to fit more products in the available area was born, taking into account the following factors: weight, cost, and design. In this study, finite element software is used for the trolley's static analysis while CATIA software is used for the design. The distribution of stress intensity has been found using the Von-misses yield principle. The proposed model outperforms the existing trolley model in terms of results.

KEYWORDS *: Design, Material handling trolleys, Von-misses stresses, Finite element analysis, CATIA V5.*

INTRODUCTION

Every company's fundamental requirement is the transportation of automobile components within the plant, between industries, and from the manufacturing sector to OEMS industries. Ensuring timely delivery and minimizing defective parts during transportation is crucial for managing inventories, ultimately contributing to the industry's profitability. In order to determine the safety factor, which is found to be much greater, the current design that is stable under the current loading conditions is first investigated. Significant literature research is required before applying the finite element approach to the design of trolleys; therefore, the primary area of concentration after reading the literature is the current design that needs to be concentrated.

The approach to model and simulate trolleys used for shifting or transferring various parts in the automotive parts supplier sector, more precisely in auto component manufacturing businesses is presented in this work through a finite element analysis. The CATIA V5 software is used for the design in this project. Hyper mesh is used for pre-processing tasks including meshing and defining static loading conditions, and Ansys is used for finite element analysis to do the static analysis of the trolley. The distribution of stress intensity has been found using the Von mises yield principle. We may then advise our industry to adopt a better one and validate it after the results from theoretical and CAD software data have been verified. Therefore, considering our intended goal, its optimization is more beneficial going forward.

LITERATURE REVIEWS

A vehicle that travels down the street on tracks is called a trolley. The trolley finds extensive use in a variety of settings, including homes, offices, railroads, airports, hospitals, resorts, and the building and industrial sectors. Therefore, the use of trolleys is extremely important in the manufacturing and construction sectors.

Ramkumar R. et.al, have examined the trolley's finite element analysis, which was done to verify and optimize the design. A design method is proposed for designing a trolley. In less time, the design technique produces quality results. In this work, the finite element commercial code ANSYS Workbench is used for the trolley analysis, while CREO software is used for the design. The distribution of stress intensity has been ascertained using the Von Mises yield principle.

Maher Ali Hussein et.al, focused on office trolleys and highlighted their low load-carrying capacity. They modified an existing design to make it more effective in carrying lighter loads. Based on their simulation, they concluded that stainless steel office trolleys performed best for carrying lighter loads with higher safety factors. However, heavy-duty products cannot be carried by these office trolleys.

OBJECTIVES

The project aims to find out problems solutions regarding more cost, heavyweight, transportation, storing, handling, etc.

- To study & find out theoretically as well as analyze the result of stress & deflection of existing trolleys as per our require load conditions.
- According to existing results find out which factors or which points we must consider for the new redesign trolley, to meet our optimization factors.
- Hence the main purpose is to minimize the overall cost of assembly, weight reduction, easy-to-be handling purposes as well as storage purposes.

METHODOLOGY

The following process has been modified to optimize the trolley. Significant literature research is required before applying the finite element approach to the design of trolleys; therefore, the primary area of concentration after reading the literature is the current design that needs to be concentrated.

The concept is executed using a few literary allusions. First, the current design, which is stable under the current loading conditions, is examined for its safety factor. It turns out that the safety factor is significantly higher. Therefore, the primary goal is to optimize the design by reducing the trolley's weight and cost while increasing material handling efficiency.

EXISTING TROLLEY CONSIDERATION

Theoretical Design

The consideration of load calculation on existing trolleys following parameters considered.

Material Properties

The trolleys are made of carbon steel, which is a linear material. Therefore, its linear properties are taken into account while analyzing the model. Structural steel, which is a flexible variety of carbon steel, is used for making the trolleys.

Table 1. Material Properties for Existing Trolley

Material	Young's Modulus [MPa]	Poisson's ratio	Density [Ton/ mm^3]	Yield strength [MPa]
Carbon steel IS 4923 250	2.1*e+5	0.3	7.85*e-9	250

For existing trolley uses IS 4923 material Steel Structural tube 50 x 50 mm size having thk 3mm.

Design Calculations

Weight of Single Part = 6.2 Kg,

A total number of part 55 mounts on the trolley.

55 x 6.2 = 341Kg. ∴ 341 Kg external mass load acting on the trolley. Each part's load is distributed at two points, which are round circular bars. Hence each bar is subjected to an external mass of 170.5 Kg. The total number of parts is 55.

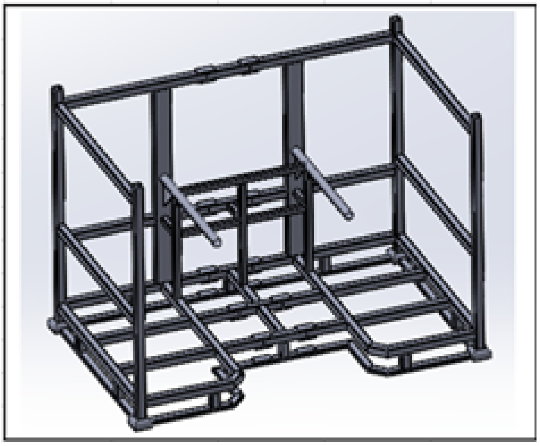

Fig 1 Existing trolley Structure

The trolley's length is 2000mm, width is 1200mm, and height is 1485mm.

As per Aspect ratio:

The height to length ratio of 0.74 is acceptable when it is less than or equal to 1.5. The length to width ratio of 1.66 is acceptable when the length is 1.5 to 2 times the width.

Hence as per the Aspect ratio existing trolley structure acceptable.

The weight of the trolley is near about 175.4Kg.

For a round circular hollow bar having a diameter of 50mm and Thk is 2.5mm Consider.

So, we have to find out the load stress acting on circular bar. There are two bars for load-carrying conditions, hence load is distributed on both bars.

Fig. 2 shows that the free body diagram of the circular bar having weight is a UDL condition.

To find acting on total as per given length 525mm of each bar. 6.2 Kg each part, Total no. of Qty mounted on trolley 55 Qty. Hence, 55 x 6.2 = 341 Kg Load.

341 x 9.81 = 3345.21 N; For consider FOS 1.5 then,

3345.21 x 1.5 = 5017.8N Acting on both bar.

For single bar load is distributed, $\frac{5017.8}{2} = 2508.9N$

Therefore For each bar carrying load =2508.9N.

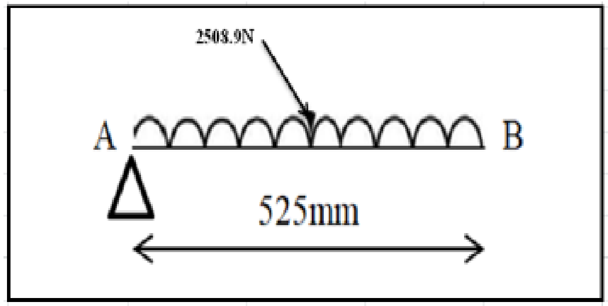

Fig 2 FBD according to load condition

Applying equilibrium conditions, Position A is fixed at one end. Other is free and UDL load is applied.

Σ Fy = 0 (↑ +ve, ↓ -ve)

∴ RA –2508.9 = 0

∴ RA = 2508.9N (1)

From equation (i),

RA, i.e. Total load is 2508.9N applied on circular bar.

Then find out the induced stress Surface Area of a circular tube having contact with part mounting i.e. for a hollow circular tube,

To find out the area,

$$A = \frac{\pi}{4} \text{ x } (D - d)^2$$

Using Dia. D = 50mm, and d = 45mm, as per our thk.

$$A = \frac{\pi}{4} \text{ x } (50 - 45)^2 = 19.63\text{mm}^2$$

∴ A = 19.63 mm^2.

Hence, we have to find out induced stress, i.e. stress acting on a hollow tube.

σ = Force/Area =2508.9/19.63=127.80

∴ Induced Stress (σ) = 127.8Mpa (2)

Hence equation (ii) gives the total stress acting on a circular tube when load is applied.

Therefore, 127.8Mpa stress is acting on a circular hollow tube theoretically.

According to Static Failure Theories:

For ductile material

Von-Mises Theory/ Maximum Distortion-Energy.

The trolley material is made of mild steel, which is a ductile material. Ductile materials have equal compressive and tensile strengths and yielding is the failure criterion. In the maximum shear stress theory and distortion energy theory, the yield strength in tension (Syt) is considered to be equal to the yield strength in compression (Syc).

The distortion energy hypothesis is employed when the factor of safety is kept within close bounds and the cause of failure of the component is studied.

Hence,

Here Permissible stress value = Yield stress of material (Syt).

To compare with yield stress in the elastic region only.

Syt =250MPa …. ………(For material from table – 1)

The induced stress value should be less than the permissible stress value as per condition.

Therefore, the permissible stress is 250 MPa, (3)

Hence, From equation (ii) & (iii) we get,

127.8Mpa < 250 Mpa (4)

Hence, Our Design is safe. From equation (iv) we get our design is safe by theoretical calculation.

To find out Maximum deflection when load acting on a hollow circular tube.

For maximum deflection (δ) for load acting on UDL,

$$\delta = \frac{WL^3}{8EI} \tag{5}$$

Where,

W=2508.9N, L = 525mm, E = 2 x 10^5(Young's modulus of steel Table. I), I =Moment of Inertia for Hollow circular section.

To find I,

$$I = \frac{\pi}{64}(D^4 - d^4) = \frac{\pi}{64}(50^4 - 45^4)$$

I=105507.1 mm^4 (6)

∴ from equation (v)

$$\delta = \frac{WL^3}{8EI}, \delta = \frac{2508.9 \times 525^3}{8 \times (2 \times 10^5) \times 105507.1}$$

∴ δ = 2.150mm (7)

∴ Maximum deflection as per theoretical calculations (δ) = 2.15mm.

Hence from equation (iv) the theoretical method, The Maximum stress is 127.8 MPa. & from equation (vii) the maximum deflection as per theoretical calculations (δ)=2.15mm.

Linear Static Analysis

In static analysis, the weight acting on the trolley remains constant across time. Furthermore, because material behavior is linear, the trolley undergoes a linear static analysis. Finite element analysis is the process of generating a mesh from geometry, assigning material properties, establishing loading and boundary conditions, and lastly defining the analysis load step.

Geometry

The current trolley measurements are 2000* 1200* 1485 mm (LBH), which were developed with some standard dimensions and considerations that were obtained straight from the seller.

Finite element modeling (Meshing)

Hyper mesh is used for meshing. This model is meshed using elements of size 5. The existing model has 242806 modes and a total of 243243 elements. Element quality is assessed and maintained within acceptable limits.

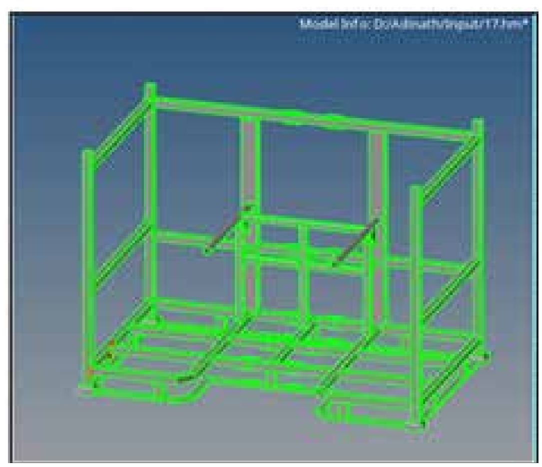

Fig 3 Meshed existing model

If some parts can be well represented by 3D elements then Tria or Hex mesh is also acceptable.

Load and Boundary conditions

When performing finite element analysis, it is crucial to assign the proper load and boundary condition; otherwise, the results we acquire will not even come close to what we are willing to obtain, making it impossible for us to draw reliable conclusions from analysis. The load acting on the trolley is computed to be 5017.8N acting downward on both circular hollow tubes, as the load is distributed over the upper side. The structure is kept stable.

Stress distribution

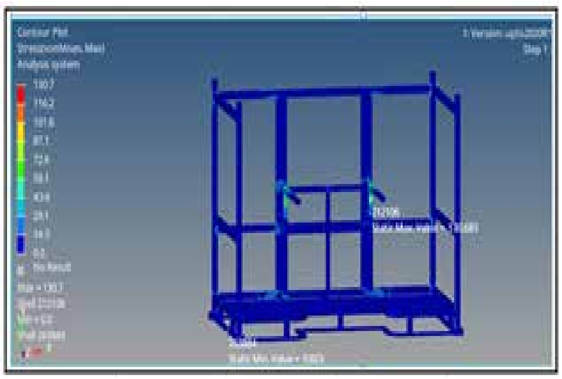

Fig 4 Stress distribution on existing trolley

Fig.4 shows the Stress distribution on the existing trolley from Ansys software. Here static maximum stress values get 130.7 Mpa at the circular the hollow tube connections.

Displacement

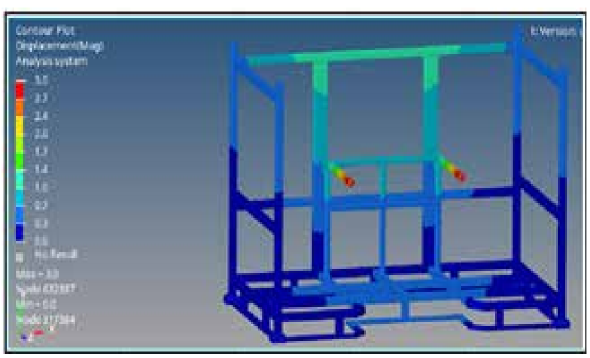

Fig 5 Displacement of the hollow tube on existing trolley

It has been observed that under the applied loading condition, the hollow tube on the existing trolley undergoes deformation, as shown in Figure 5. The displacement is up to 3mm. However, the stresses that occurred in the model are low, as shown in Figure 4. The stress level is 130.7MPa, which is less than the yield limit of the material, which is 240MPa. Therefore, the design is safe.

To compare the theoretical and analysis results of the existing trolley. As per our result, we can conclude the following for our main objective purpose; According to existing results find out which factors or which points we have to consider for the new redesign trolley, to meet our optimization factors. There is more scope because the design is safer. So we can change Thk, material, & Design Structure for the new design model & meet our objective.

NEW TROLLEY CONSIDERATION

Theoretical Design

The consideration of load calculation on the new trolley following parameters considered.

Material Properties

When calculating the load for the new trolley, we considered various parameters. One of the factors we looked at was the material properties. For the previous trolley, we used carbon steel, which has linear properties that we took into account during our analysis. We can use structural steel for the new trolley, which is a type of carbon steel that is adaptable and can help us achieve our desired output while keeping the weight of the trolley in check. per changing structure, we can meet our output by weight, structural steel has a carbon content of up to 2.1%.

By adjusting the structure of the trolley, we can reduce the thickness from 3mm to 2mm and still maintain a yield strength of 250 Mpa and Poisson's ratio of 0.3.

Design Calculations

The weight, capacity, material, and dimensions of trolleys are displayed in the following table. The theoretical calculation approach is as follows:

Weight of Single Part = 6.2 Kg, Total number of part 55 mounts on the trolley. 55 x 6.2 = 341Kg.

$\therefore$ 341 Kg external mass load acting on the trolley.

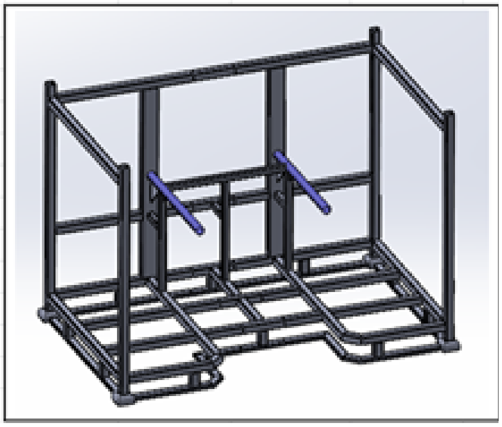

Fig 6 Structure of Trolley with 2mm Thk

Applying the conditions of equilibrium, Position A is fixed at one end. Other is free and UDL load is applied.

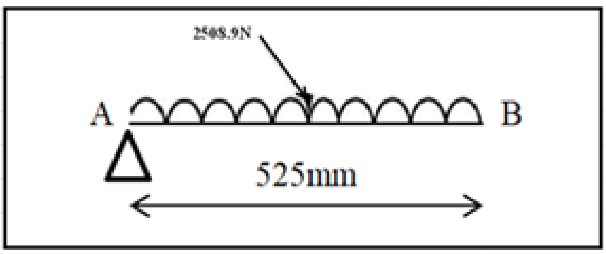

Fig 7 FBD according to Load

Σ Fy = 0 (↑ +ve, ↓ -ve)

$\therefore$ RA –2508.9 = 0 $\therefore$ RA = 2508.9N (1)

To find out the area,

$$A = \frac{\pi}{4} x (D - d)^2 \therefore A = \frac{\pi}{4} x (50 - 46)^2$$

Using Dia. D = 50mm, and d = 46mm, as per our thk.

$\therefore$ A = 12.56mm^2.

Hence, we have to find out induced stress, i.e. stress acting on hollow tubes.

Induced Stress (σ) = Force/Area

$$\sigma = \frac{\text{Force}}{\text{Area}} \therefore \sigma = \frac{2508.9}{12.56} = 200.71\text{Mpa}$$

its almost 201 Mpa.

Hence,

$$\boxed{\therefore \text{Induced Stress } (\sigma) = 201\text{Mpa Mpa}} \quad (2)$$

Syt =250MPa…(For material from Table. 1)

The induced stress value should be less than the permissible stress value as per condition.

$$\boxed{\therefore 201\text{Mpa} < 250 \text{ Mpa}} \quad (3)$$

Hence, Our Design is safe. From equation (iii) we get our design is safe by theoretical calculation.

To find out Maximum deflection when load acting on a hollow circular tube. Maximum deflection (δ) considering the moment of inertia, changing thk and all.

For maximum deflection (δ) for load acting on UDL,

$$\delta = \frac{WL^3}{8EI} \quad (4)$$

Where,

W=2508.9N, L = 525mm, E = 2 x 10^5 (Young's modulus of steel Table. I), I =Moment of Inertia for Hollow circular section.

To find I,

$$I = \frac{\pi}{64}(D^4 - d^4) = \frac{\pi}{64}(50^4 - 46^4)$$

I=81009.55mm^4 (5)

$$\delta = \frac{WL^3}{8EI} \quad ⍰\delta = \frac{2508.9 \times 525^3}{8 \times (2 \times 10^5) \times 81000.55}$$

$\therefore \delta$ = 2.80mm (6)

It's Almost 3mm.

$\therefore$ Maximum deflection as per theoretical calculations (δ) = 3mm. So, theoretically we get both Maximum Stress and Maximum Deflection.

Linear Static Analysis For New Trolley

Geometry

The new trolley design structure has reducing unnecessary factors as well as reduced the thk. of the structure tube, which is affecting on total mass of our trolley. The new model of trolley is created in Catia V5. The mass of the new trolley is 127.8 Kg. Compared with the existing trolley there is a total near about 47 Kg mass is reduced.

Finite element modeling (Meshing)

yper mesh is used as a preprocessor to do meshing of the model. Element size 5 is used to mesh this model. The total element in the existing model is 221397 and modes are 219203. Element quality is checked and kept within range.

Stress distribution

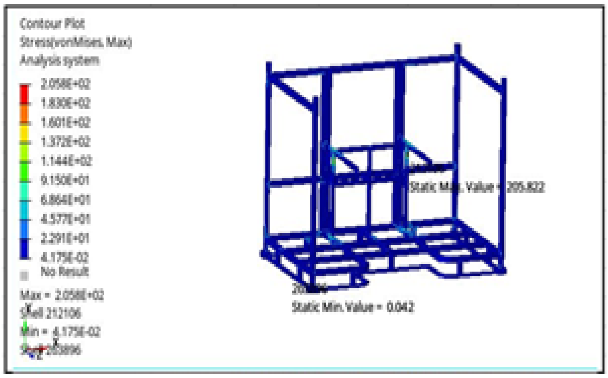

Fig 8 Stress distribution on the new trolley

Fig.8 shows the Stress distribution on the new trolley from Ansys software. Here static maximum stress values get 205.8 Mpa at the circular hollow tube connections.

Displacement

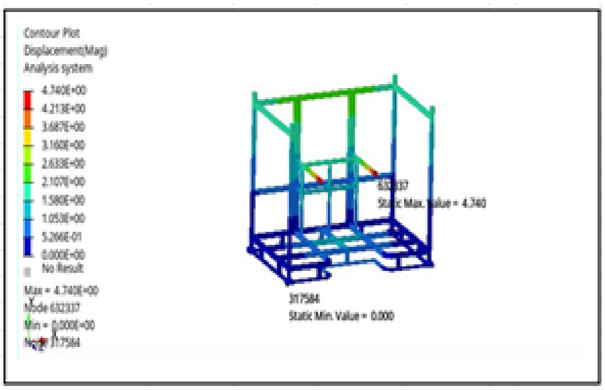

Fig 9 Displacement of hollow tube on new trolley

Figure 9 shows that there is deformation under the imposed loading condition. Displacement of the hollow tube on an existing trolley is up to 4.7mm.

RESULTS AND DISCUSSION

As per our methodology, we have firstly studied on result of the existing material handling trolley. After that find out the theoretically stress & deflection of the new trolley as per our require load. After that studied on the meshing of new trolley using hyper mesh software. Studied loading conditions, usable material as well as boundary conditions. The static structural analysis of the new model on Ansys software.

The below table shows both theoretical as well as analytical results for existing & new model.

Table 2. Results of both existing & new Trolley

	Existing case		New Case	
	Theoretical	Analytical	Theoretical	Analytical
Stress (MPa)	127.8	130.7	201	205.8
Deflection (mm)	2.15	3	3	4.7
Weight (kg)	175.4		127.8	
Weight reduction (Kg)	Existing		47.6	
Inference	Existing		ok	

Hence form Table 2 shows the Theoretical and Analytical results, in for the new trolley Theoretical maximum stress is 201 Mpa, & the Analytical result maximum stress is 205.8 Mpa Hence both method's results are approximately matches. Also, design is in safe mode.

For observing the maximum deflection for the new trolley Theoretical and Analytical results, the Theoretical maximum deflection is 3mm and the analytical maximum deflection is 4.7mm. Hence we say that it also matches approximately. Also, weight reduction is shown at 47.6 kg as compared with the existing trolley.

Regarding cost estimation, the existing design was purchased directly from the seller, so one trolley cost INR 18000. Now, once this design is accepted by the plant team, it will be made in-house, lowering the cost of the trolley. So all we need to bring is the material; everything else, including welding equipment, welders, and welding material, is available at the plant. The detailed proposed cost estimate for one trolley is presented below.

Table 3. Proposed cost estimates per trolley

Item	Cost (INR)
Square hollow pipe 125 kg	8125 (65/kg)
MS electrodes	1000
Labor Cost	800
Other cost	1000
Total Cost	10925 ~= 11000

Hence we can say that cost is reduced as compared with the existing trolley, which is near about INR 7000. Only one qty of the trolley is reduced up to 40 % cost. & Monthly 4 to 5 Qty. is required to company i.e. near about 50 Qty in yearly basis. This design will benefit the existing use, and based on the requirements of several trollies, it provides an additional benefit.

CONCLUSION

Theoretical and analytical design optimization is performed. In this study, design and optimization methodology are employed to achieve better results with the given design in a shorter time frame. Looking at the results, it is evident that the new design outperforms the current model. The main purpose of minimizing the overall cost of assembly, weight reduction, and easy-to-be handling purpose as well as storing purpose is done. Also transporting leads to saving costs this. Furthermore, the prior model was expensive, and the current design's estimated cost study indicates a 40% cost decrease. So, based on this study utilizing finite element analysis, I recommend that the corporation use the proposed design and production process to save more money.

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Stress Analysis and Optimization of Deep Freezer Door Hinge

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ABSTRACT

The purpose of this analysis is to enhance the design of a door hinge assembly to comply with the IS 7872:2020 test requirement and improve its reliability. The door hinge is an operating system that consists of a combination of MS connecting rod, Cylinder rod, body, and spring. During the opening and closing operations of a deep freezer, the door hinges hold the door on a predefined axis. To achieve this, the design of the door hinge is developed using Uni graphics- NX V220.6. The Hyper Mesh Altair V 21 software is used to create mesh and boundary conditions on the designed parts. Structural analysis was carried out using ANSYS 2023, and the Von-Misses stresses were calculated in stress analysis. The design verification was done by calculating the factor of safety, and the improvement in the factor of safety was achieved. The optimization of design analysis was performed by using Six Sigma analysis techniques and validated by performing a door opening test and hinge reliability test.

***KEYWORDS** : Uni graphics door hinge, Von-misses stresses, Finite element analysis, Hyper mesh, Six sigma ANSYS 2023.*

INTRODUCTION

The doors of a deep freezer are used to open and close it for loading frozen food and ice cream. The hinge system is responsible for controlling the door swing and positioning it relative to the body structure. This hinge is crucial for ensuring customer safety, and it undergoes various tests to guarantee its reliability.

This project involves analyzing the stress on the current hinge design, validating it and improving its factor of safety. Uni graphics-NX V220 software is used, along with Hyper mesh Altair V 21 for pre-processing meshing. Structural analysis is performed on ANSYS 2023 under dynamic loading conditions. Von Mises stress distribution is studied on the hinge, and experimentation is conducted to verify the results. The optimization of hinges in terms of material, shape, and space can greatly benefit the industry.

LITERATURE REVIEWS

In the white goods industry, the product service lives are measured in years or decades. The reliability of the component is prime important.

Accelerated Life Testing to forecast an Appliance door's Service Life and Reliability for an Appliance Door Hinge Seunghyeon Cheon, Hyunsoo Jeong, Sogang University, Seoul, Korea, Marquette University, Milwaukee, Wisconsin, USA. 2018:.

Historically, appliance manufacturers would physically test prototypes to evaluate the reliability and service integrity of new product designs. However, given that white goods often have service lifetimes measured in years or decades, endurance testing is not a cost-effective way to assess long-term reliability. To address this, appliance makers are turning to accelerated life testing (ALT) as a more efficient and cost-effective method of reliability testing.

As part of this trend, a simulation-based ALT approach was utilized in a recent study to predict the service life of a polyacetal hinge found in a consumer refrigerator.

A predictive life cycle model was developed based on cumulative surface wear under accelerated stress conditions, which allowed for the prediction of time to failure under consumer use.

Design of a Hinge System for a Kimchi Refrigerator Receiving Repetitive Stresses: After conducting field research and accelerating the life testing process, the hinge assembly of the Kimchi refrigerator door closer underwent a redesign. Our team utilized force and moment balance analysis to estimate the mechanical loads generated by door closure. Through experimental analysis, we discovered that the failure modes and mechanisms were similar to those experienced in the field. By employing failure analysis, accelerated life tests, and corrective action plans, we identified the key control parameters and level of the serial mechanical hinge system. We determined that design parameters controlled by the hinge assembly system, such as the angular roundness and rib of the hinge housing, the oil seal method of the oil damper, and the cover housing material, were missing from the initial design stage. To address these issues, we implemented a customized series of accelerated life tests followed by corrective action plans. As a result, the new hinge kit design is now guaranteed to last over 10 years with a yearly failure rate of only 0.1%.

Research on lightweight door hinges for commercial vehicles using aluminium instead of steel in sustainable traffic 2016: Vehicle manufacturers are increasingly prioritizing environmentally responsible practices, such as exploring alternative materials to lower fuel consumption and reduce air pollution. One popular method involves designing components with low-density materials to decrease CO2 emissions. To ensure safety standards are met, finite element analysis (FEA) and rigorous testing are conducted. Remarkably, tests using an Al7075-T73 alloy revealed that the weight of a door hinge can be reduced by up to 65%.

OBJECTIVES

The objective of the project is

i. To Study the von Misses stress on door Hinge

ii. The Existing Hinge is under or over-designed.

iii. Design improvement and optimization.

iv. Material Reduction.

v. Compliance to IS 7872: 2020

METHODOLOGY

The design Methodology used as per Fig no.1.The modelling, meshing and analysis were done by using the Uni graphic, Altair V21 and ANSYS 2023. The key parameters have to be identified and optimization opportunities found by using Six Sigma techniques. The best-optimized concept goes through a validation process.

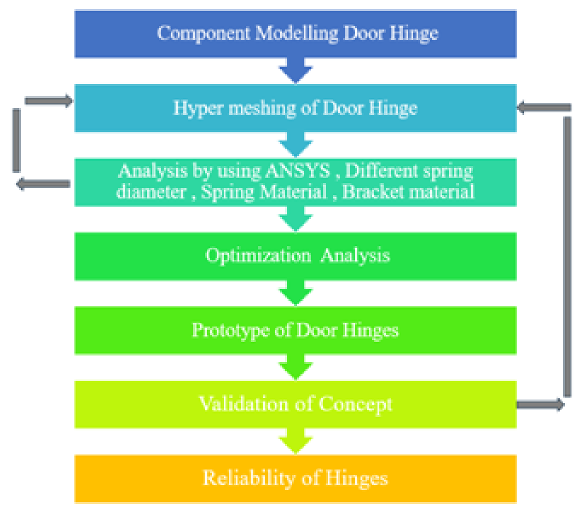


Fig 1 Methodology

EXISTING HINGE DESIGN ANALYSIS

The existing hinge design stress analysis was done by considering the following parameters.

Material Properties

The material used is mild steel and the material is considered linear so linear properties are taken into consideration while analyzing the model.

Door Weight = 5 kg

Hinge Material: Mild Steel, 1.5 mm Thickness

Table 1 Material Properties

Material	Modulus of Elasticity (MPa)	Poisson's Ratio	Tensile Yield Strength (MPa)	Tensile Ultimate Strength (MPa)
Mild Steel	200000	0.30	250	460

The meshing of the hinge assembly is done by using Hyper mesh software 2020. Auto meshing is applied to the hinge assembly. The elements are fine-tuned by using tetrahedral mesh.

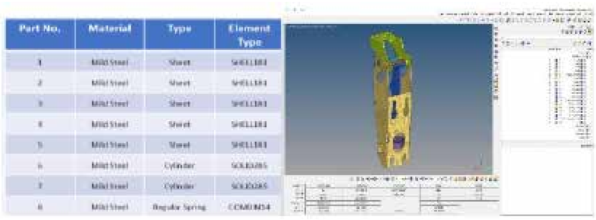


Fig 2 Material content and Hyper Mesh

Boundary Conditions are as follows

- Fixed support at slots in component 3 to be screwed with cabinet.
- Fixed support at end faces of component 6.
- Component 1 (attached to the lid) is defined as a revolute joint with component 6 and given a rotation of 80°.
- Lid weight of 5 kg is assigned to slots in component 1 to be screwed with lid.

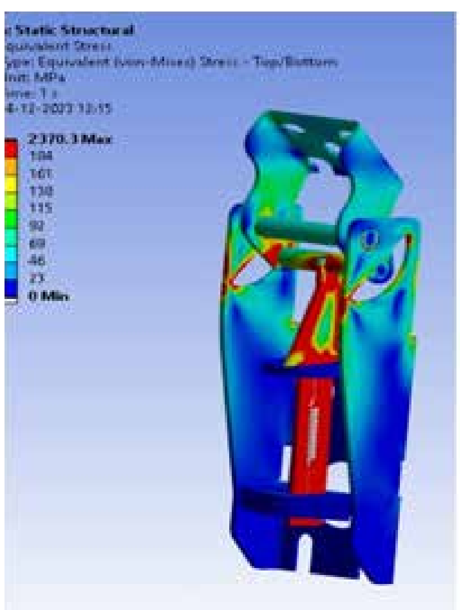


Fig 3 Stress Distribution

The connecting rod shows maximum stress value. It crosses the yield strength of 250 Mpa. Hence the design failed under stress conditions.

Design Experiment

The sleeve was added in between the connecting rod and cylinder to avoid failure in stress analysis. The mild steel sleeve was added to the existing model.

Fig 4 Addition of sleeve on rotation road

The calculated Van Mises stress is 151.08 Mpa

Von Mises stress safety Factor

= Yield Stress / Van Mises Stress

= 1.65

The Material selection and Hing Design are safe. Safety factor for the appliance industry 1.4 Hence design optimisation is possible.

HING DESIGN OPTIMIZATION

The hinge component thickness changed to 1.2mm

Hinge Stress Analysis

Table 2 Assembly Part

Part No.	Material	Type	Thickness
1	**Mild Steel**	**Sheet**	**1.2mm**
2	Mild Steel	Sheet	1.2mm
3	Mild Steel	Sheet	1.2mm
4	Mild Steel	Sheet	1.2mm
5	Mild Steel	Sheet	1.2mm
6	Mild Steel	Cylinder	No change
7	Mild Steel	Cylinder	No change
8	Mild Steel	Regular Spring	No change

The modified modelling and hyper meshing were done again and analysis was done in Ansys software by keeping the same boundary condition. the maximum displacement occurs at the maximum angle. The stress distribution was done for each component.

Component level Analysis

The component level analysis was done to find out the material reduction opportunity.

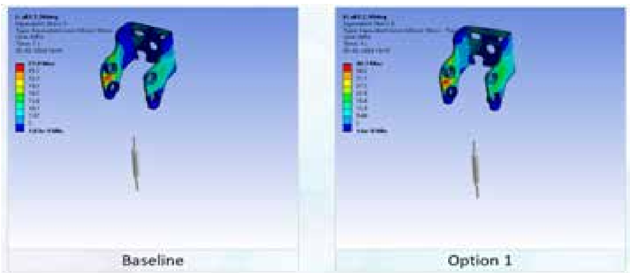


Fig 5 Component No 1

Reducing the sheet thickness of components from 1.5 to 1.2 mm results in a stress increase of 46%. The resultant factor of safety reduces from 9 to 6, and component 1 ok.

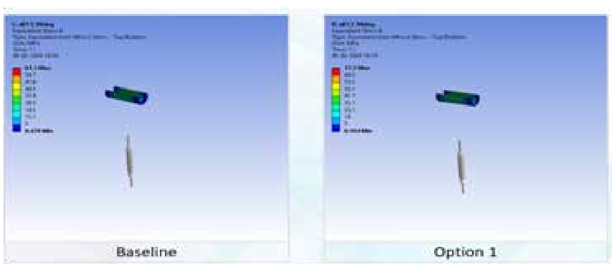


Fig 6 Component no 2

Reducing the sheet thickness of components from 1.5 to 1.2 mm results in a stress increase of 25%. The resultant factor of safety reduces from 4 to 3.2, and component 2 ok.

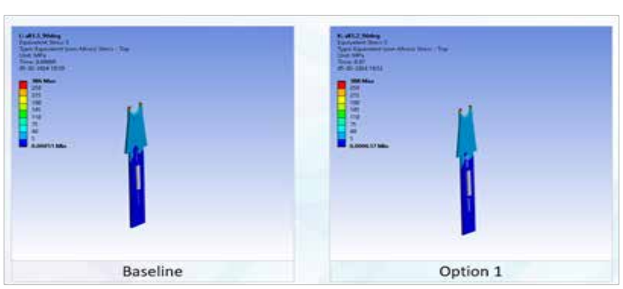


Fig 7 Component no 4

Stress beyond yield at the tip (sharp corner) of component 4, expecting minor deformation of less than 1 mm only in the red highlighted region. Stress below ultimate strength of 450 MPa, will not break.

Reducing the sheet thickness of components from 1.5 to 1.2 mm results in a negligible change in the stress of component 4.

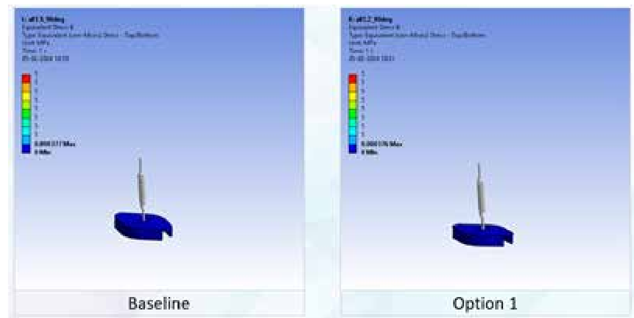


Fig 8 Component No 5

Reducing sheet thickness of components from 1.5 to 1.2 mm, negligible stresses in component 5 for both cases.

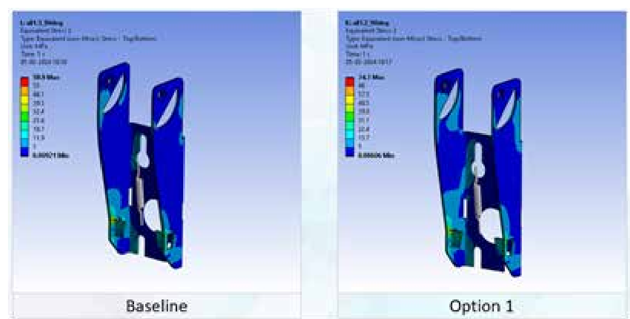


Fig 9 Component No 4

Reducing the sheet thickness of components from 1.5 to 1.2 mm results in a stress increase of 25%. The resultant factor of safety reduces from 4.2 to 3.3, and component 3 ok. Observed stress concentration in component 4 only, however, anticipated deformation is less than 1 mm. Observed in the baseline as well; this can be avoided by modifying the corner only.

The resultant factor of safety for other components: minimum is 3.2 which is ok.

The cylinder component no 6 materialschanged to Nylon 66 and POM. The analysis was done by keeping all the parameters. in option, no 4-spring stiffness changed to 15 N/mm

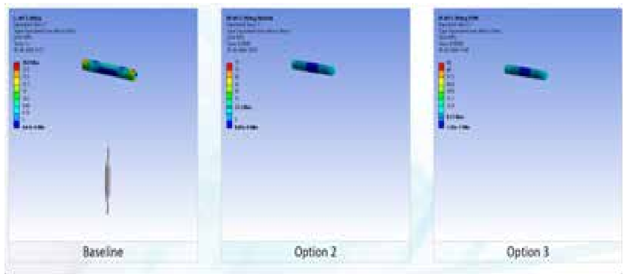


Fig 10 Component No 6 (Nylon 66 and POM)

Option 2: Component 6 with Nylon 66, resultant factor of safety 3.2, component ok.

Option 3: Component 6 with POM, resultant factor of safety 7.7, component ok.

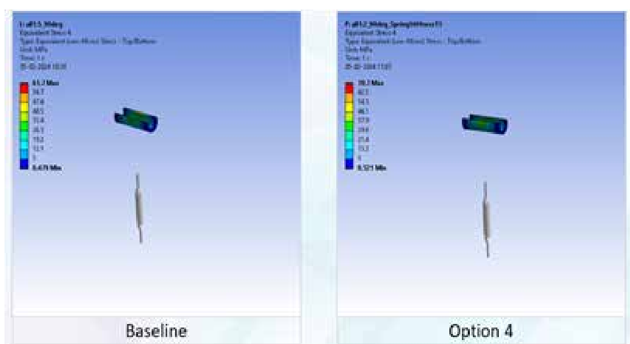


Fig 11 Component No 6 (Spring stiffness 15 N/mm)

Option 4: Component 6 (spring) with reduced stiffness value from 20.5 to 15 N/mm, in component 3 stress increased by 16%. The resultant factor of safety decreased from 4 to 3.5, and component 3 ok.

The below table shows the summary of the experiment done on the hinge

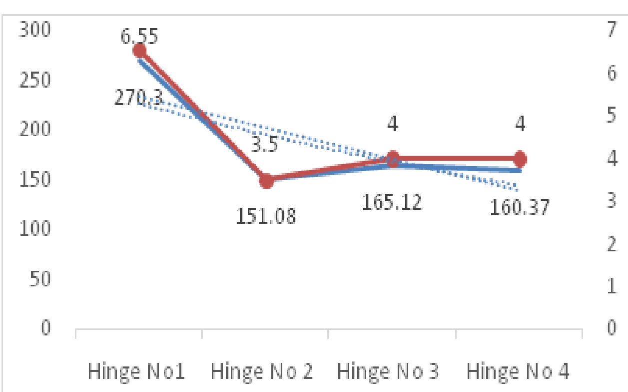


Fig 12 Stress and deformation graph

- Hinge No 1: Baseline
- Hinge No 2: Sleeve added below cylinder, Material Thickness 1.5 mm,20N/mm
- Hinge No 3: Sleeve added below cylinder, Material Thickness 1.2 mm,20 N/mm
- Hinge No 4: Sleeve added below cylinder, Material Thickness 1.2 mm, Cylinder material Nylon, POM and Spring stiffness 15 N /mm

REGRESSION ANALYSIS

Body thickness and spring stiffness are variables for stress in hinge assembly. The regression analysis was done by using Minitab software to get the regression equation. The regression formula is

Hinge stress (σ) = 202-46.8 Thickness + 0.950 spring stiffness.

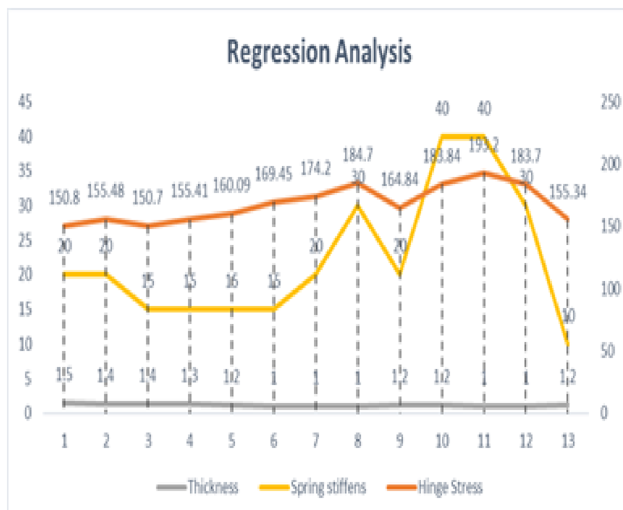


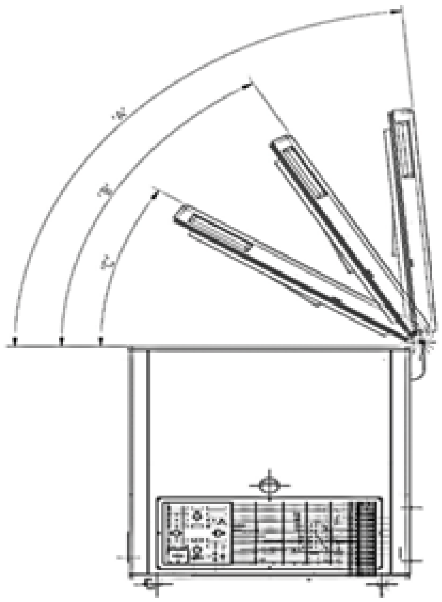
Fig 13 Regression result graph

Combination no 5, combination no9 and combination 13 are selected based on the stress value at the rotating point.

VALIDATION OF HINGE

Door opening Test

Basedon regression analysis three different combination hinges are made and tested in the door opening test. Combination 13 and combination 5 are not accepted due to noncompliance with IS 7872 standards. Combination no 9 was selected for the door reliability test.



A: Full open Angle

B: Door Dropping Angle

C: Door Holding Angle

Fig 14 Door Open Angles

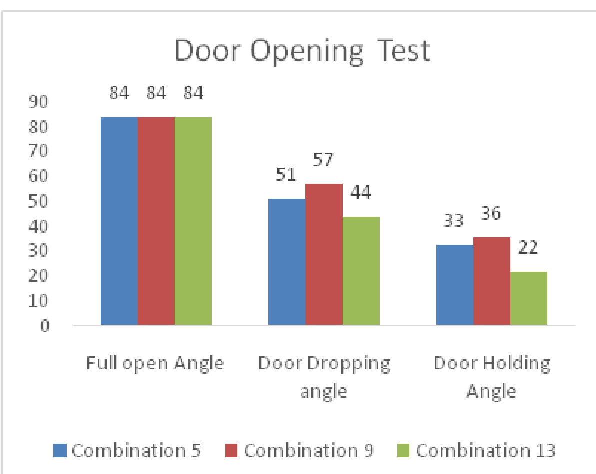


Fig 15 Door opening angle in different combination

Hinge Reliability Test

The test sample is placed on the platform of the reliability test fixture. The inspection of the door, hinge, and gasket checked for any abnormality. The initial angles are noted down. The machine opening arm fitted to the handle and tension of the belt is adjusted to have free movement of the door in the opening and closing sequence. The clamp is tightened in such a way that no movement of the cabinet during testing. The control panel is set to zero value. The reliability test started.

Fig 16 Hinge Reliability Fixture

The opening sequence is controlled from an angle of 0°to opening angle of 60° followed by free movement of the door and closing sequence. The closing sequence of the door shall be controlled from the angle of opening of 60° to 50°followed by the free movement of the door.

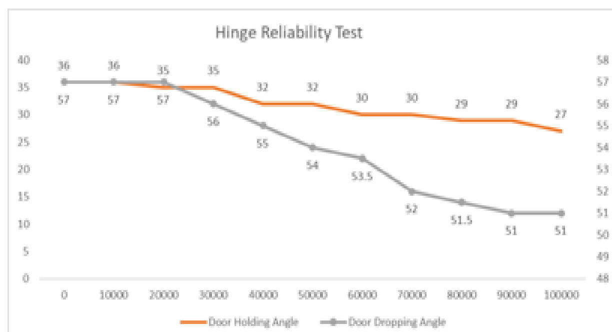


Fig 17 Door open-angle in Reliability test

The door holding angle and door dropping angle were reduced by 9° and 6 ° respectively.

CONCLUSION

In this study by using finite element analysis the existing designs are verified and new designs are proposed based on the stress concentration level. In hinge design, the material thickness, door load and spring design are important variables. This solution gives a cost advantage over the existing design. The proposed solution shows 25% material reduction, better reliability and IS 7872 standard compliances.

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Review Paper on Performance based Analysis of Elevated Based Reservoir (ESR)

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ABSTRACT

Since the dawn of civilization, there has been a need for a service reservoir to store water for use in many purposes such as chemical manufacture and drinking water. In order to store fully treated potable water close to the point of distribution, this study analyzes a single-structured RCC Underground and Elevated Service Reservoir with a capacity of 1500000 liters square shaped and 900000 liters circular shaped. The primary goal of planning and evaluating a single structured service reservoir is to boost pressure and water storage capacity without negatively impacting the local ecosystem or natural resources. need to provide both adjacent and farther-off residents with the proper water pressure. The study on the response of single-structured UGSR and ESR to seismic and wind forces is presented in this publication. The review begins by elucidating the significance of ESRs in ensuring reliable water supply to growing urban populations, emphasizing the need for comprehensive performance assessments to optimize their functionality and effectiveness

***KEYWORDS** : Single structured elevated service reservoir, Building information modeling (BIM).*

INTRODUCTION

It is difficult to survive without water. One of the most significant elements in the universe is water. For their survival, all plants and animals need water. Life on Earth would not exist if there was no water. Water is extremely valuable, and since drinking water is scarce in daily life, one must cherish every drop. To have enough water on hand for each day, there is a water tank. The imperviousness1 of concrete is crucial for building structures made of it for the storage of liquids, including water. The best storage space for residential or even commercial purposes is an above water tank. Clean water is kept in an elevated steel reservoir, which is a steel tank atop a raised stand or tower. All locations inside the distribution system's pressure zone receive water pressure from the tank's elevation. Ground reservoirs are underground storage or treatment facilities constructed like tanks.

PROBLEM STATEMENT & AIM

Problem Statement

The majority of people in India—more than 68%—live in rural areas. One of the main issues in these places is domestic water, there for creative design and methods and solution to existing problem is necessary, hence for that study of Elevated Storage Reservoir (ESR) is undertaking. In recent years, there have been an abundance of case studies and reports on ESR failure both during and after construction.

The goal of the ESR study is to develop and construct affordable, safe ESR that will minimize damage to the structure and its structural elements even from natural hazards like earthquakes.

Aim of the Project

Main aim behind our project is to analyze the performance of an Elevated Storage Reservoir {ESR}, by Self Healing Concrete and Building Information Modeling {BIM}.

Objective of the project

- To calculate loads on an ESR
- To analyze performance of an ESR on the basis of materials and techniques used

METHODOLOGY

Design of an Elevated Storage Reservoir

The design of an elevated storage reservoir (ESR) involves several key considerations to ensure structural integrity, safety, and functionality. The specific design parameters can vary based on factors such as the intended use of the reservoir, local conditions, and engineering standards.

Structural Design

Select the appropriate structural design, which can be circular, rectangular, or another shape depending on factors like available space and aesthetics. Consider materials such as reinforced concrete or steel for construction based on structural requirements and durability.

Self Healing Concrete

Self-healing concrete is an innovative material designed to repair cracks and other damage autonomously without the need for external intervention. The concept of self-healing concrete is particularly valuable in improving the durability and longevity of concrete structures, reducing maintenance costs, and enhancing sustainability.

Figure 1: Self Healing Concrete

Autonomous Healing

The healing process is autonomous, meaning it occurs without external intervention. This property makes self-healing concrete particularly useful in structures where access for repairs is challenging, such as in deep foundations or infrastructure submerged in water.

Building Information Modeling

Building Information Modeling (BIM) can play a crucial role in the performance-based analysis of Elevated Storage Reservoirs (ESRs) by providing a comprehensive digital representation of the reservoir's design, construction, and operation. Here's how BIM can be utilized for this purpose:

Integrated Design and Collaboration: BIM facilitates integrated design processes by allowing stakeholders, including architects, engineers, and construction professionals, to collaborate on a shared digital platform. This enables seamless coordination and communication throughout the design, construction, and operation phases of the ESR project.

Visualization and Simulation: BIM enables stakeholders to visualize the ESR in a 3D model, providing a better understanding of its spatial relationships, components, and systems. Simulation tools can be integrated with the BIM model to analyze various performance aspects, such as water flow, pressure distribution, and structural behavior under different operating conditions.

Performance Analysis and Optimization: BIM software can be used to conduct performance-based analysis of the ESR, including hydraulic modeling to simulate water distribution and storage behavior. By integrating real-world data with the BIM model, stakeholders can evaluate different design alternatives and operational scenarios to optimize the ESR's performance in terms of capacity, efficiency, and reliability.

Clash Detection and Risk Mitigation: BIM allows for clash detection, identifying potential conflicts or interferences between different components or systems within the ESR and its surrounding infrastructure. This helps mitigate risks and avoid costly errors during construction and operation.

Lifecycle Management: BIM supports lifecycle management of the ESR by providing a centralized repository for project data, documentation, and information. This facilitates asset management, maintenance planning, and decision-making throughout the ESR's lifecycle, from design and construction to operation and decommissioning.

Sustainability and Energy Efficiency: BIM can be used to evaluate the environmental performance of the ESR, including energy consumption, carbon footprint, and water conservation measures. This enables stakeholders to identify opportunities for improving sustainability and energy efficiency through optimized design, materials selection, and operational practices.

Regulatory Compliance and Documentation: BIM facilitates regulatory compliance by documenting design decisions, specifications, and construction details in a structured digital format. This streamlines the process of obtaining permits and approvals while ensuring adherence to relevant codes, standards, and regulations.

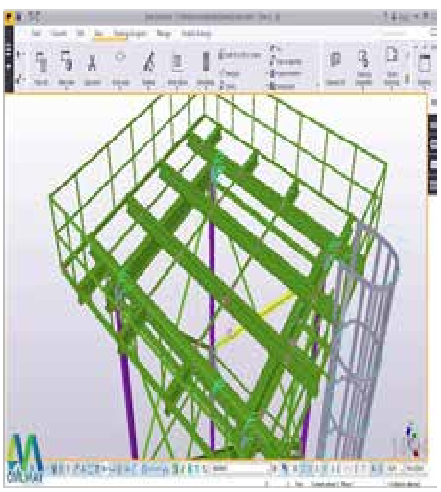

Figure 2: BIM Model Analysis

Designing an Elevated Storage Reservoir (ESR) involves several critical steps to ensure its functionality, safety, and efficiency within a water supply system. Here's an outline of the key design steps:

- Needs Assessment
- Site Selection and Feasibility Study
- Hydraulic Analysis
- Structural Design
- Water Quality Considerations
- Mechanical and Electrical Systems
- Safety and Security Measures
- Regulatory Compliance
- Cost Estimation and Financial Analysis
- Documentation and Procurement
- Construction Planning and Management
- Commissioning and Testing

PROBABLE CONCLUSION

A performance-based analysis of an elevated storage reservoir (ESR) would probably yield conclusions based on the particular results and goals of the study. Nonetheless, the following conclusions might be drawn:

Sufficient Capacity: It may be determined that the ESR has enough capacity to supply the water demand both now and in the future, or it may need to be optimized or expanded to guarantee sufficient storage capacity.

Hydraulic Efficiency: Based on constant water pressure and flow rates over the distribution network, the hydraulic performance of the ESR may be considered sufficient, or enhancements may be suggested to maximize efficiency and correct any shortcomings.

Structural Integrity: To ensure long-term dependability, the structural integrity evaluation may either validate that the ESR satisfies safety requirements and is capable of withstanding environmental stresses, or it may indicate sections that need to be reinforced or maintained.

Water Quality Management: Conclusions regarding water quality management may indicate effective measures in place to maintain water quality within the ESR, or recommendations may be made to enhance strategies for contamination prevention and control.

Operational Optimization: Opportunities for operational efficiency improvements may be identified, such as refining filling and emptying procedures, implementing smart monitoring systems, or upgrading equipment to reduce energy consumption and minimize water losses.

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A Compact High Gain Patch Array Antenna for RFID Application

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ABSTRACT

In the ISM 2.4 GHz band, a compact 2x1 array is suggested for RFID reader applications. With the help of parasitic components, antenna gain has been enhanced. The basic element of the proposed array involves of two equal elements. A quarter-wave impedance transformer is used to match a circular patch, SIW and 50 Ohm microstrip wire that make up the antenna. The proposed array structure has been implemented on a FR4 substrate with 1.6 mm height of and 4.4 dielectric constant. Dimensions of the displayed array antenna are 85 x 130 mm2.The suggested antenna exhibits good matching impedance, high gain with directed radiation pattern.

KEYWORDS *: Microstrip antenna, RFID reader, Antenna array, Corporate feed and high gain.*

INTRODUCTION

The explosive rise of wireless communication over the earlier few years had a major impact on the manufacturing and communication sectors. The successful implementation of communication systems depends on the accurate transfer of information. Communication system using EM waves for transmission and receiving, improved antenna structures must be conceptualised, designed, and implemented. Novel antenna design techniques, are crucial for keeping up with sophisticated systems for wireless applications. Due to their small size, light weight, and affordable price, microstrip antennas are the popular antenna [1]. However, the low gain [2] issue, it has limits the range of applications it can be used for.

The contactless RFID technology-based systems exchange data over radio waves between a reader antenna and tag antenna. Antennas are a key solution for the object detection because are utilised in tags and readers, system is utilised in RFID systems [3]. Numerous studies have looked into various microstrip array antennas for RFID applications, with maximum strengths of roughly 4.73dB [4]. The two truncated slots 2x1 array antenna has a gain of 9.6 dBi [5]. Additionally, some 1x4 array antenna topologies with increased gain are suggested for RFID. Array antenna with DGS that offers a 7.75 dBi peak gain[6]. The H-shaped patch antennas with slot array antenna, with peak gain of 6.6 dB has been reported in [7].

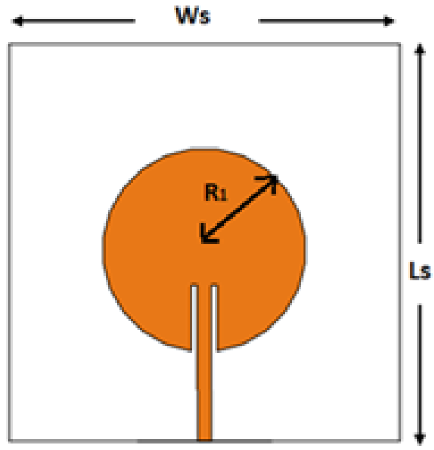
A small, high-gain slotted array antenna is suggested in this study. The 2.4 GHz antenna was created for RFID applications. The suggested antenna has a very wide 60 MHz bandwidth. The suggested array antenna peak gain is 4.3 dBi.

ANTENNA DESIGN AND GEOMETRY

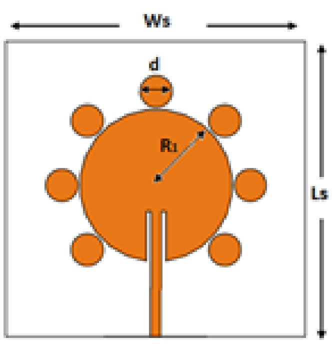
Design of Single Element Antenna

The proposed element construction is represented in figure.1 (a), FR4 substrate with a height of 1.6 mm and a dielectric constant of 4.4 used to create basic element antenna. The typical circular element incorporates a SIW in its structure to achieve resonance frequency at 2.4 GHz with better gain characteristics. Equation (1) is to calculate the antenna radius (R1).

$$R_1 = \frac{2\lambda}{3*\sqrt{\varepsilon_r}} \quad (1)$$



(a)

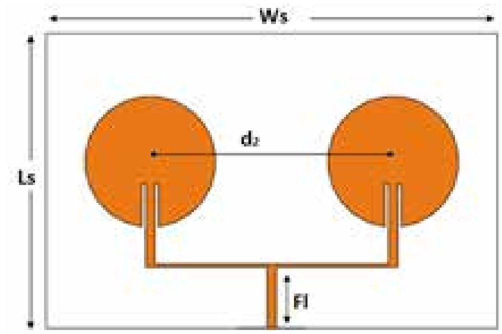


(b)

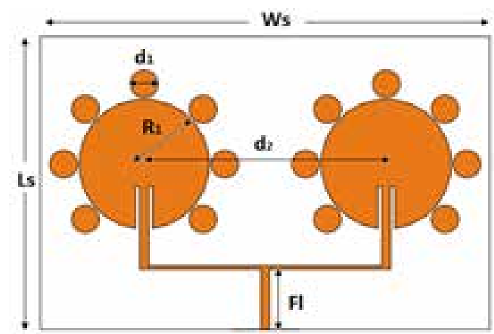
Figure 1 antenna geometry with single element (a) Circular antenna without SIW (b) Circular Patch Antenna with SIW

Two Element Array Antenna Design

An array antenna with two radiating elements is proposed in Figure 2 as a way to improve gain as well as radiation efficiency of circular patch. The configuration of the suggested high gain 2x1 array is created on FR4 substrate measuring 85 mm by 130 mm with a height of 1.6 mm and a dielectric constant of 4.4. The array needs to be properly excited, which calls for a feed network that has been optimized. For this reason, a power divider structure with input impedance 50 ohm is created after numerous iteration procedures. This allows for improved impedance matching, which enhances the radiation characteristics parameters of the array antenna.



(a)



(b)

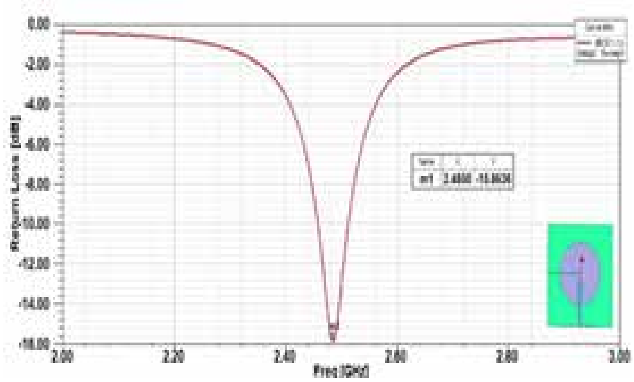
Figure 2. Geometry of the Proposed 2x1 array (a) 2x1 Circular Patch Array Antenna without Slot (b) 2x1 Circular Patch Array Antenna with Slot

Table 1 Array dimension

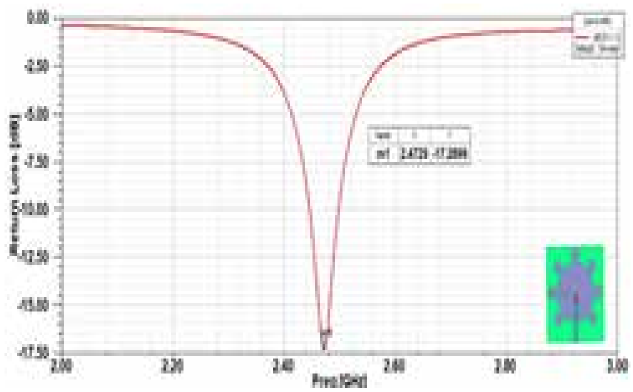
Parameters	Dimensions (mm)	Parameters	Dimensions (mm)
R1	18.5	Ls	85
d1	8	Ws	130
d2	70	F1	17.5

RESULTS AND DISCUSSION

The simulated results of proposed antenna designs are presented. The HFSS software being used for antenna design and simulation. According to the Return Loss vs. Frequency figure, the resonance occurs precisely at 2.45GHz with strong impedance matching properties and a respectable return loss of 17.28dB.



(a)

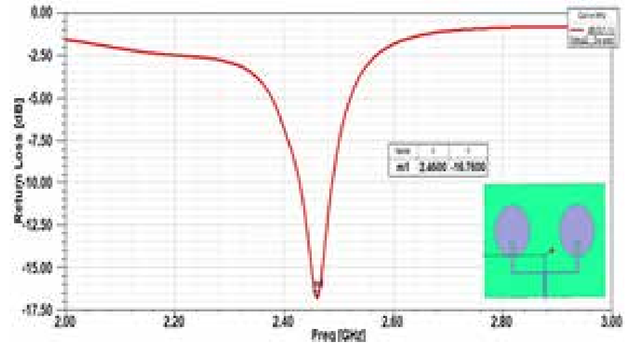


(b)

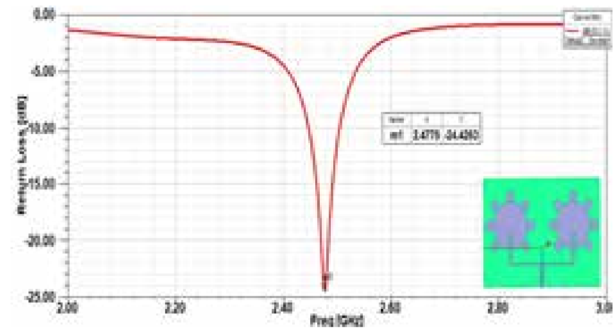
Figure. 3 Return Loss of Single Element (a) without & (b) with SIW

Table 2 Array dimension

S N.	Performance parameters of	Frequ-ency	Return Loss (dB)	VSWR	Band-width (MHz)	Gain (dB)
1.	Single Element without SIW	2.48	-15.86	1.38	60	5.6
2.	Single Element Antenna with SIW	2.47	-17.28	1.31	60	6.6
3.	Dual Element Array Antenna without SIW	2.46	-16.76	1.34	60	8.3
4.	Dual Element Array Antenna with SIW	2.47	-24.42	1.12	60	9.3



(a)

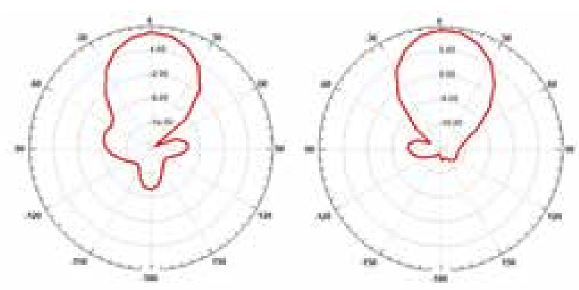


(b)

Figure 4. Return Loss of 2x1 Array Antenna (a) without & (b) with SIW

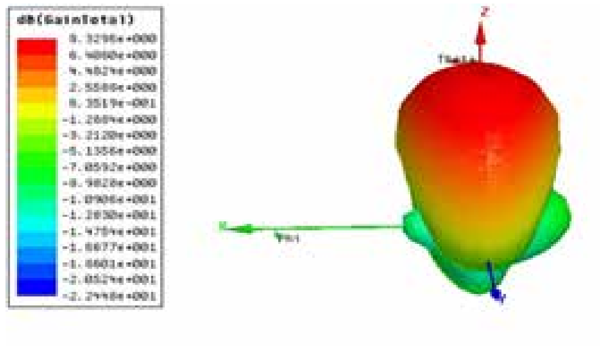
An array is made up of radiating two elements with SIW is suggested in order to improve gain as well as return loss. Fig. 5 shows the radiation pattern of 2x1 array, it concludes that radiation pattern of array is more stable with SIW. The Gain of proposed array antenna with SIW is 9.3 dB at 2.45 GHz which is better than without SIW.

Proposed system array has a better performance. The array has a maximum gain of 9.3 dB.

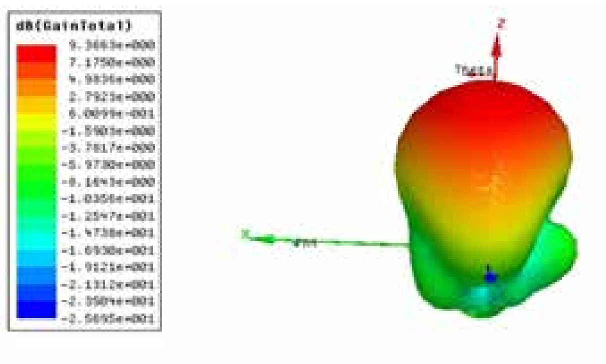


(a) (b)

Figure 5. Radiation pattern of antenna array (a) with & (b) without SIW



(a)



(b)

Figure 6 Gain of 2x1Array Antenna (a) without & (b) with SIW

Table 3 Comparison of proposed system array with various reference antennas

Ref.	Size (mm2)	Freq. (GHz)	Gain (dB)	Antenna technique used
[4]	75 x 95	2.45	4.7	Patch with Slot loading
[5]	83 x 100	2.45	9.2	Patch with Slot loading
Proposed work	85 x 130	2.45	9.3	Patch with SIW

CONCLUSION

Proposed array antenna with 2.4 GHz used for RFID reader application. Peak gain is enhanced by the specified array configuration. In order to optimize the impedance matching, a single element circular patch is initially constructed with SIW and an integrated feed line for a quarter wave transformer. Finally, identical patch components are used to build a array antenna. The proposed system has a 9.3 dB peak gain, which is very high. HFSS software is used to analyses the design and outcomes. At 2.45 GHz, the suggested planar 2x1 array antenna resonates with a high return loss and low VSWR.

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Design & improvement in Machining Process and Cost Optimization for Tooth Wheel used in Traction Motor for Metro

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ABSTRACT

This paper is base on machining improvement and cost reduction of part tooth wheel; which is used in the traction motors for metro in mosco. The main reason is to reduce the stress developed in the job because of more machining process is done on the job. In this paper we have tried to reduce the setup of job and the cost of the job by using the forging material. We reduce the three setup also tried to reduce the debarring cost of job by using the cutter on machine after the milling operation also tried to save the insert cost by re sharpening of insert and use this for roughing process.

KEYWORDS *: Traction motor, Forging, Debarring, Sharpening.*

INTRODUCTION

As Tooth wheel is which is used in the train assembly in the Moscow train. In this we are tried to reduce the set up because the more setup are released the stress from the job and the job life was decrease. Due to more setup the job is not dispatch on the date so customer complaints are occurs. First the plate material was used so the material taking more time to come in company for machining. Also the plate material is not hard material so chips are not form and this material is not machining so fast as compare to forging material. In forging material the chips are formed and due to the hardening the material this material is easy to machining. The material is used for to produce this job is not costly also that material doesn't gone any cracks on it. Also time required is less for machining.

Problem Faced

- Due to plate material cost and cycle time is increased.
- Customer urgency.
- Stress release due to more machining.
- Machining flow of work is not defined (not fixing the machine for job).
- Inserts break due to the not hardening material and chips are not formed.
- Hole shifting on VMC operation.
- Milling Cutter is break due to cutting speed high.
- Debarring time so more after the machining process.
- Not Standard process is set while packing the material.

DIFFERENT MANUFACTURING PROCESS OF MODEL

New Process by using Forging material

Forging: - Forging is the application of thermal and mechanical energy to steel billets or ingots to cause the material to change shape while in a solid state. Forged steel is generally stronger and more reliable than castings due to the fact that the grain flows of the steel are altered, conforming to the shape of the part. Forged components such as crankshafts and connecting rods are extensively used in the automotive and power sectors.

Material used in the forging is S355J2+N. Material use in this job is S355J2+N. These EN 10025 S355J2 N plates are well tested and inspected with flattening test, hardness test, impact test, raw material test, ultrasonic test and third-party inspection. S355J2+N Grade Specifies "+N" means normalized when rolling, while J2 doing Ch arpy V-notch impacting test.

1st set up:-Roughing O.D. & I.D

In this operation the I.D. and O.D both are roughing at same time. Depth is 47.5mm, 16.2mm, dia. 111.3mm, 75 mm, 71mm, 57 mm, depth 25mm. In this job due to forging material used first three steps are reduced. Tool is used in this operation CNMG1.2, Drill dia.18mm, CCMT dia. 16 bore. Clamping pressure is 12kg.cycle time of operation is 10 min 30 sec. in the forging material the insert life is good because of the hard material the chips are formed. Insert life up to 20 to 30 jobs.

Fig. 1. Roughing O.D.

2st setup: - Finish First side

In this operation the first side is finished. Finish dia. 152.8mm, 111.5mm, 14.45mm, R15 & R10, depth 24mm. tools used in this operations are 2 TNMG 0.8,TNMG 1.2, VNMG 0.8, 2CCMT0.8 16 dia. Bore. Cycle time of this operation is 12 min 30 sec. tool life is increased in the forging material up to 30 to 40 nos.

Fig.2. finish Face

3rd set up:-Finish 2nd side & groove

In this operation the 2nd side is finished and grooving operation is done. Tools used in these operations are TNMG0.8, 2 CCMT 0.8 20 dia., 2 face groove 4 mm. tool lives is up to 30 to 40 jobs. Cycle time of this operation is 15min.

Fig.3. finish & groove

4th set up: - Drilling

In this operation drilling is performed of drill size are 9mm, 10.05mm, M8 threading.

Tool are used drill 6.8mm carbide,9mm s/c, 9.7mm s/c,2*10*45º chamfer,M8*1.25 6G threading gauge,10.1 rimer for good finish 10.1 drill. Cycle time of this operationis 5min.

Fig. 4. Drilling

5th setup:-teeth cutting (Milling)

In this operation the milling is done. Tool are used in this operations 63*2.9 teeth cutter, 63*3.4 dia., 2*10*45ºchamfer cutter. There are 80 teeth on the job 3.4 mm thick and 8 mm depth of these teeth. Cycle time of this operation is 100 min

Fig. 5 Milling.

PROBLEM FACED AND SOLUTIONS

Problem Solved

while doing this operation we faced the problem like shifting the hole because first the operation is performed job was clamp in chuck i.e. hole are shifted after the rejection of 3 job I have implemented the method of drilling. The job is fixed on the surface plate and i.e. the job shifting problem is reduced.

Before

After

Problem Faced And Solved

Problem faced is the cutter is break due to the more cutting feed of job. The cutter 2.9 dia. is break. Cycle time is 80 min.

Before the cutting feed is 273 rpm i.e. the cutter is break after reducing the feed up to143rpm the cutter was not break and cycle time increased 110 min. by using this feed cutter was not break after some time feed is increased 163 rpm and cycle time reduced10 min now 163 feed is fixed and cycle time is 100min.

Problem Faced

After the milling operation the bur is produced in large no. so for debarring the more time is required and its affect on the dispatch plan because the debarring is nit done then that job is not coming for the final inspection if the final inspection was not done then third party inspection is pending in this way the job is not deliver at the given time.

So customer complaints are comes due to the delay of the job dispatch. For avoiding this problem start the cutter use on machine for reducing the bur and by using this cutter the debarring time is reduced.

Problem faced of flow of material

For solving this problem I have made the work order for tooth wheel job. By using this work order easily finds out the process of the job and on which machine it gets performed. Also the use of work order is to identify the actual quantity come for machining and how much come at the final dispatch. Easy to find rejection happen on which machine

Problem faced of packing

Made the packing standards of tooth wheel and dispatch detail i.e. box size of primary packing.

Roughing

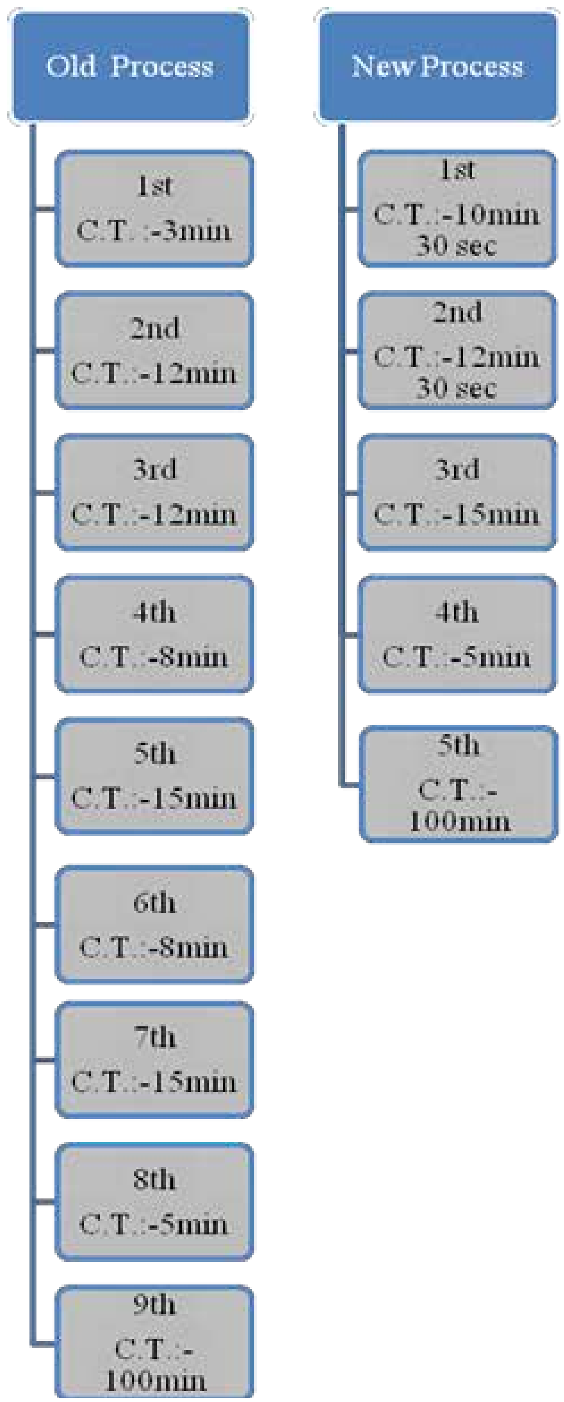
we are using the new insert and due to hard material the inserts are break easily so for reducing this problem I have tried to use the re sharpening the inserts and use that inserts for roughing reduce the cost of insets CNMG & TNMG

Price of CNMG is MS Insert is 170 and SS insert is 200 after re sharpening the inset into 100 and 110 Rs. Price of TNMG is MS Insert is 160 and SS insert is 200 after re sharpening the insert price is 100 and 110 Rs

Price of CCMT is MS Insert is 160 and SS insert is 200 after re sharpening the insert price is 100 and 110 Rs

Price of VNMG is MS Insert is 300 and SS insert is 300 after re sharpening the insert price is 190 and 190 Rs

CALCULATION



1) Old Process total C.T.:-3 + 1 + 12 + 8 + 15 + 8 + 15 + 5 + 100 = 178 min.

New Process total C.T.:-10.30 + 12.30 + 15 + 5 + 100 = 143min. Total time saves per job:-178-143=35 min.

2) Debarring time saving calculation:-Before use of cutter C.T.:- 30 min. After use of cutter C.T.:- 15min.

Total time saves: - 15 min.

3) Cost saving calculation:-

As per company hourly based price of machining:-

• CNC: - 300 per hr

• VMC: - 500 per hr.

Machine = cycle time *RS /min

cnc =300/60=5 rs/min   vmc = 500/60= 8.33 rs/min

Sr no.	Old process	New process
1	3*5=15	10.30*5=52.5
2	12*5=60	12.30*5=62.5
3	12*5=60	15*5=75
4	8*5=40	5*8.33=41.65
5	15*5=75	100*8.33=833
6	8*5=40	
7	15*5=75	
8	5*8.33=41.65	
9	100*8.33=833	
Total =	1239.65	1064.65

Total cost saving of machining = 1239.65-1064.65=175 Rs per job.

4) Cost saving of purchase material = old- new

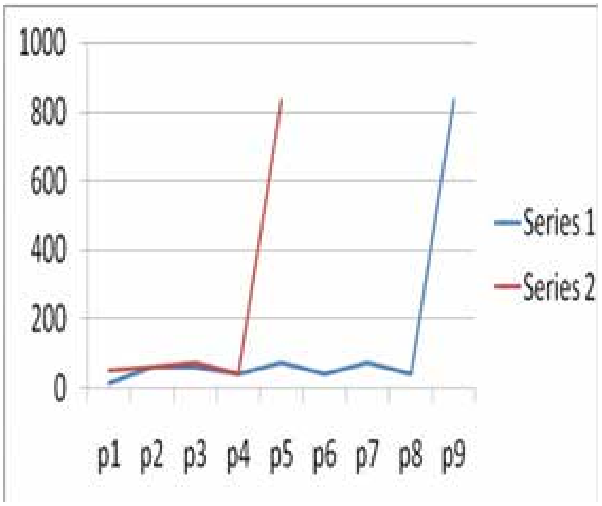
= 887-761=126 Rs per job.

Total cost saving of material & machining = 175+126=301Rs per job.

RESULT

Sr no.	Time and cost save	Amount and Time
1	Time saving in C.T.	35 min per job
2	Time saving in Debarring	15 min per job
3	Cost saving in material purchase	126 Rs per job
4	Cost saving in machining process	175 Rs per job

CONCLUSION



From above graph we concluded that the machining time required to manufacturing of the job tooth wheel is less than old process time so we save the time at new process makes for manufacturing same job.

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Application of EPANET 2.2 for the Planning and Design of Water Distribution System

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ABSTRACT

The planning and design of water distribution networks play a crucial role in ensuring efficient and reliable water supply to communities. This paper presents an approach to designing water distribution networks using EPANET, a widely used software tool. The behavior of water distribution system is very well analyzed and simulated by using it. Now a dayit is one of the most extensively used platform for designing, evaluating and optimizing of network layouts. The software incorporates features such as pipe sizing, demand estimation, and pressure zone delineation, making it an essential tool for network planning. In the planning and design process, EPANET is used to prepare digital maps of the water distribution network. It includes demand points, pipes, nodes and pumps. The software allows engineers to define pipe characteristics like roughness, length, diameter and specify demand patterns at various nodes. EPANET's simulation capabilities allow for the evaluation of different design scenarios and the assessment of network performance under varying operating conditions.

In this study water distribution system for a small village Tavadi was designed and the designed data is submitted to the village authorities and Deputy Engineer, water resources dept. It would be used by authorities for the implementation of the proposed water distribution system of said village. Application of software EPANET contributes to the development of efficient, reliable, cost effective and sustainable water supply systems for communities.

KEYWORDS *: EPANET, WDN, Google earth pro, Sustainable development.*

INTRODUCTION

Water is one of the most basic needs for human life. The water distribution system is an integral part of the infrastructure of any organization. It was also noted that about 750 million people around the world does not have access to improved drinking water sources. In rural areas of developing countries, this problem is even worse and will get worse with population growth, change in living standards and awareness of the importance of clean water for health. Large-scale projects are undertaken by the government to provide water to large populations with initial capital costs as well as operating and maintenance costs [2]. The project consists of several infrastructure components such as reservoirs, tanks, pipelines, fittings and accessories etc., which are essential to provide potable water to consumers. The designer of this project must choose the type, size, location, and configuration for each of these components. This option affects not only the quality of service but also the cost of the system. For rural systems, piped water systems are usually gravity fed because there is no electricity supply. The most important aspect of this system design is the selection of the pipe diameter from a specific set of commercially available pipe diameters. It comprise of a system of water-flowing pipes or joints connected to joints (points) that may be at different heights. Connection (node) is usually one of the two main functions to get supply for the system or to satisfy the demand needed by customers. The design of the water distribution system was done manually using EPANET 2.2 software (Environmental Protection Agency Network).

A regional water supply system was established to provide sufficient, safe, and sustainable water in rural areas. It supplies several villages from a common water source through a pipe system. EPANET is software developed by United states Environmental Protection Agency for hydraulics and water quality analysis in water distribution network (WDN) system. It also used to analyze each link's flow and the WDN node's pressure head.

The key objectives of this study are:

i. To minimize the cost of water supply system.

ii. To ensure permanent drinking water security in villages.

iii. To encourage the peoples in the villages to have a properly managed water supply to make villages Nirmal Gram.

The main requirement of the multi-village piped water scheme is that water should be delivered from the reservoir to storage tanks. Some of these components include pipes, pumps, reservoirs, treatment plants, valves, etc. It was noted that cost of the project and quality of service provided will totally depend on the selection of these components. It is the prime goal is to minimize the costs associated to maintain expected quality of service [3]

PIPE DISTRIBUTION NETWORK COMPONENTS AND DESIGN CONSIDERATIONS

There are mainly two types of water resources namely surface and sub-surface type. To service the scheme mostly surface resources like lake, reservoirs, rivers and sub -surface resources like wells, aquifers would be selected. In the present work, there is a single known water source of supply dug well that provides a constant water head to the network irrespective of the amount of water drawn.

The water is pumped to the ESR and GSR by pumping during the electricity hours from the supply well, storage reservoirs are filled with full capacity. It takes approx. 2 hrs. for GSR and 3-4 hrs. for ESR to fill it with its full capacity. The water is supplied daily for 2 hrs in the morning or in evening time to the villagers.

Figure 1: Existing supply well

Figure 2 Elevated service reservoirs

The term junction implies, Point at which two or more pipes meet. The main function of the junction is to release the required qty. of water from the system or provide a place to calculate the flow into the system.

Main component of the WDN system is Pipe. While selecting type of pipe various factors need to be considered. Pipe diameter, length and material, as well as the amount of water in the pipe are the main factors will contribute for frictional loss. It would result in the overall head loss along the length of the pipe.

In particular, these three types are used for distribution networks

Polyvinyl Chloride (PVC): Cheap and available in large diameters (up to 300 mm). However, if the water is acidic and too hard, it can be susceptible to corrosion, so it is difficult to solve this problem.

Ductile iron (DI): More expensive than PVC, but it rusts better and lasts longer. It is also available in large diameters (up to 1000 mm).

High density polyethylene (HDPE) The most cost-effective of the three options. Resistant to light and corrosion but requires special brazing, easy to break and not available in larger diameters (up to 630 mm)

In the present work, we assume that there is only one type of pipe for each pipe diameter. Because pipe selection is not limited to hydraulic and cost considerations. The choice is determined by practical considerations, such as the quality of available water and the reliability of the desired pipe beyond the scope of the current operation.

Pumps and valves help control the head of water in the network. When water is unable flow by gravity, it is required to pump the water by using different types of pumps mostly used type of pump is centrifugal type. The power requirement (HP) depends on the quantity of water to be pumped and the water head provided. Pumps are one of the main sources of operating costs so their use should be strictly based on need. In the present study for the computation of power requirement,pump efficiency and motor driving efficiency are considered to be constant.

Practical controls such as push switches are used for automatic switches in response to element status or time of day or network conditions. For example, a switch can be set to turn on the pump when the pressure in the system falls below a certain value. Alternatively, the pump can be programmed to fill and refill the tank in the morning. Models can display controls in different ways. Some consider the control to be a separate modeling element, while others consider it a feature of a pipe, valve, or pump control.

In addition, we make the following assumptions about the set in the present work

Typically, the demand at one location will be distributed to many households. We concentrate demand in one village. If necessary, the third system distributes water in the village, which can be specially designed.

Demand at any point is known and constant throughout the day. This is known as steady state analysis. In practice, after the network is developed, an extended simulation period is required to verify the network performance. Our 4gsystem outputs optimization results in EPANET format, which can be used to perform long-term simulations.

The network configuration is the link that connects the request points, known and branch. There are no loops in the grid. As the requirements are known, adjust this pipe through each pipe.

STEPS IN DESIGNING WATER DISTRIBUTION NETWORKS AND SITE SELECTION

Tavadi village is selected for designing of water distribution network. The village Tavadi is situated at distance of about 9 Km from the Phaltan Taluka head quarter. The nearest railway station is Phaltan. The general topography of the village is plane and low hilly. At present, water resource is Supply well. Water pumped from supply well to ESR. The water stored in the ESR with a capacity of 100000 liters and a height of 12 floors is distributed from the existing lines throughout the day. Thus, people get their water from the struts on the connected faucets. Now that communities need water in their communities, MJP needs to install new water supply systems in Shindevasti, Ghanwatvasti and Kaikadivasti, respectively.

Figure 3 Tavadi village map

SURVEY

Tavadi village is located in Phaltan tehsil of Satara district,Maharashtra. The geographical area of this village is 461.73 hectares 4.6173 square kilometers (km2) / 1140.9596778484 hectares.

The number of households in Tavadi village is 240. It depends on the number the population is1181 people. As for the male population, the population of Tavadi Village is 621 and the total female population is 560. The publication reference for this information is 2011. The data source is the Census of India.

Roads, roads, paths, etc. junctions, electricity and telephone lines, sewer lines, existing water supply lines (if any), etc. shows the status of underground service lines were identified in primary survey.

The main purpose of this survey is to collect the data of the nature of ground, topography which is essential to get information about the ground stratas. We also collected the information by circulating questionnaire among the villagers . From surveying, we get to know that there is plenty of space in the area where the ESR can be built. About 80% of the total strata area hard rock and the rest is soft rock and soft soil. About 150 people will depend on the new proposed ESR. In other words, 21500 liters of ESR will be sufficient to meet water demand per day.

POPULATION FORECASTING

Arithmetic increment method:

The future population after N decades is given by

$P_n = P_0 * e^{kt}$

Where

P_n = future population at end of n decades

P_0 = Present population

k = Percentage increment for a decade

t = Time period years

By assuming 1% increment per year,

$P_n = P_0 * e^{kt}$

$P_{2021} = P_{2011} * e^{0.1}$

$P_{2021} = 135 * e^{0.1}$

$P_{2021} = 150$

Likewise, Population forecasting for 2011-2061 (50 years) with approximate 1% increment per 10 years is as follows:

Table 1 Population forecasting

YEAR	Population Forecasting (Nos.)
2011	135
2021	150
2031	166
2041	184
2051	204
2061	226

TENTATIVE LAYOUT

The default configuration of existing distribution lines is shown in fig.4. The whole area is divided into different distribution districts. Average number of people per hectare of land, length of the pipe is also determined. Figure shows the location of GSR and ESR, distribution network, distribution and balancing reservoir, valves, hydrants, etc.

Figure 4 Tentative Layout

EPANET Design Procedure

Survey of Tavadi village was conducted by Google earth pro and survey by Auto level to determine the height of various intersections, road lengths and locations of important facilities such as religious places, educational institutions and water bodies. Search data is converted to EPANET files.

File conversion - Google earth pro file (.bmp) is converted to EPANET file (.net).

EPANET - After getting the location of the village in EPANET, Various parameters are selected such as units, labels, colors, formulas, scales etc.

Input (ELEVATION) - Parameters such as Elevation are entered for each point / cross from the AutoCAD file.

Input (Basic Demand) - The basic demand for each point is calculated by using the population and taking the water demand as 135 liters / day / capita and distributing it to each point according to the length of the pipe connected to each point.

Inlet (reservoir) - the reservoir is placed near the highest elevation point. The reservoir is at a height of 12-15 m above the highest point of the point.

Connection - Reservoir is connected to the network using pipes.

Performance analysis - After the connection is made and all data is entered, the network is operational for analysis. If negative pressure occurs at the point, a warning message is generated.

Correction - To correct the negative pressure, the pipe diameter is connected to the button with increased negative pressure and the analysis is repeated [3]. That is, until the negative pressure occurs and the analysis of the case "successful run" Analysis of Water Distribution Using EPANET

Table 2 Comparison between Google Earth

Junction	Google Earth Elevation	Actual Survey Elevations
5	587.5	595.43
6	589.2	595.23
7	591.7	597
8	592.3	595.63
9	588.6	595.73
10	595.8	596.80
11	587	592.6
12	588.7	594.09
13	585	585
14	588	589
15	581	581
17	588	592.85
18	587	595.43
19	595	596.88
20	595.1	596.73
21	595	596.78
22	595	596.88
23	587	592.63
24	588	593.50
25	591	597

Figure 5 Flowchart of EPANET Process

DETAILED SURVEY

From the survey of village, Information about elevation levels of various junctions, length between two adjacent nodes ware collected and used for design of water distribution network. Other information like locations of important facilities such as natural water resources, temples, schools etc. and water bodies were obtained and was pin pointed on map of village in Google Earth Pro.

Figure 6 Map of Tavadi village

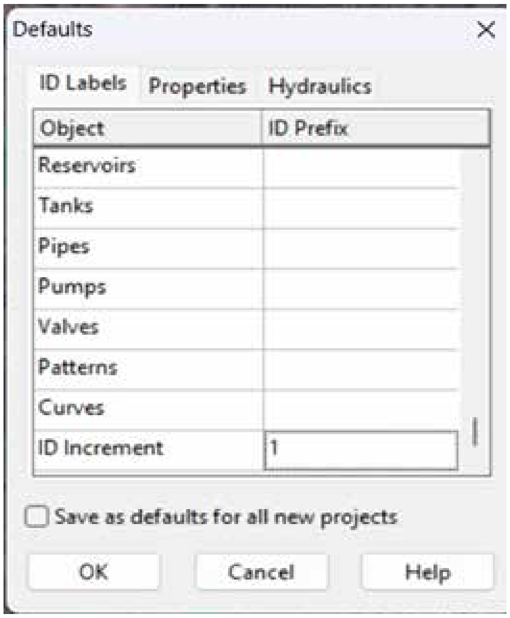

Figure 7 ID labels

EPANET 2.2 workspace

The first step is to create a new project in EPANET and make sure that certain ID Label of the default options are selected as shown in fig. 7.

Figure 8 shows hydraulics page of the dialog and the selection of unit. Unit set as LPS (liters per second)

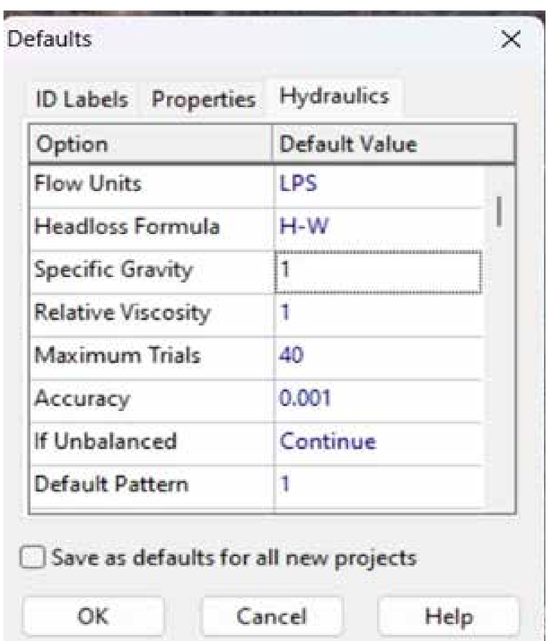

Figure 8 Hydraulic options

Figure 9 shows notation page selection and dialogue boxes of display nodal values, link values and use of transparent text were checked.

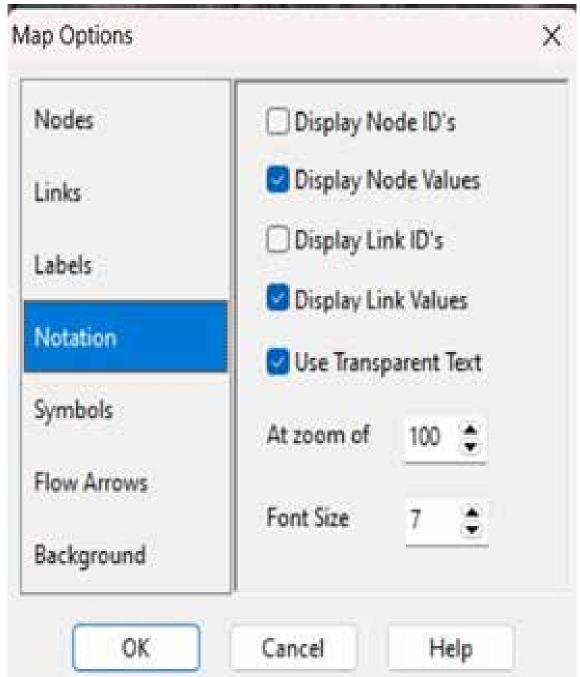

Figure 9 Map options dialog box

Figure 10 shows selection of map dimensions dialog from maim menu bar. X and Y coordinate and map unit as a meters.

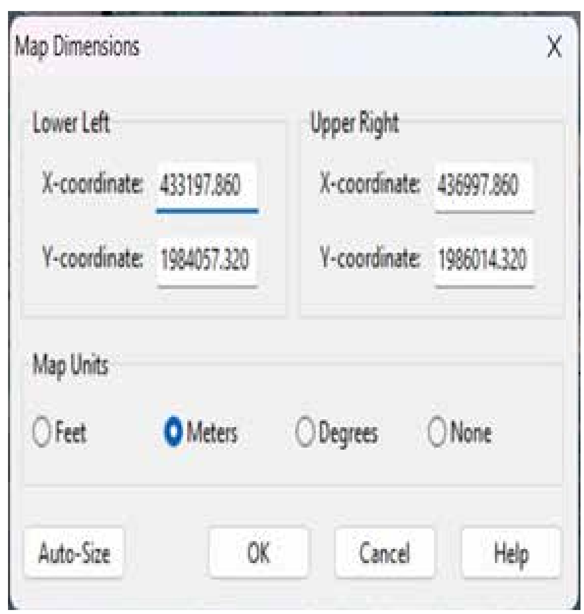

Figure 10 Map dimensions

Import map image into EPANET

After survey, first we collected map coordinates of Tavadi village from google earth. So we entered the coordinates into the EPANET software. The .jpg map file of google earth is converted into .bmp. So we imported the .bmp file for further software analysis.

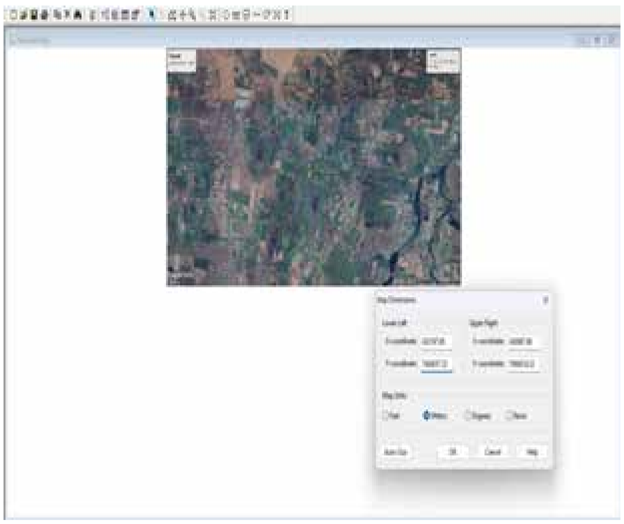

Figure 11 Map image import into EPANET

Preparation of water distribution network layout

The map of existing water distribution network in Tavadi was collected from Tavadi gram panchayat. The map is a existing layout of WDN, which includes the length and diameter of the pipe network with their relative positions. With the help of existing data and surveyed data, new Water distribution system for nearby peoples is designed.

Figure 12 PDN Layout

Assigning Node Properties

Elevation data was taken using Google earth from Digital Elevation Model (DEM) data. The data was converted and adjusted with the available datum in Tavadi. Then the elevation data to each node were assigned and the contour map of the Tavadi village found out as shown in figure. It has been found that the invert elevation varies from 0 to 12 m. As Tavadi village is in the normal hilly region, there is normal much variation of elevations as a result the distribution network need special attention.

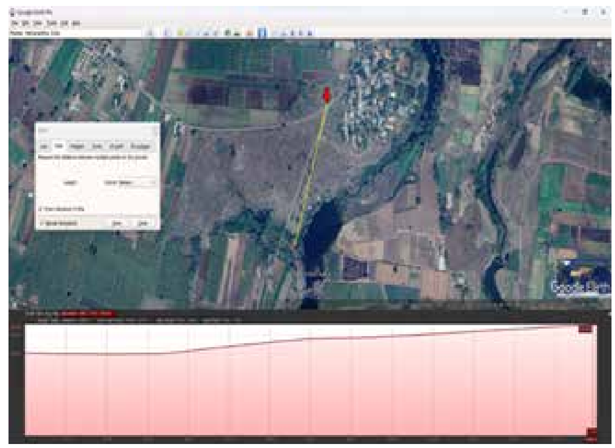

Figure 13 Elevation Profile from Google earth pro

These are the elevation levels of Supply Well point and 1st junction (node). The elevation differs as shown in above fig.13 there is rise in elevation from source to junction 2.

Table 3 Node Properties

Junction	Elevation	Base Demand
5	595.43	2
6	595.23	1.8
7	597	1.5
8	595.63	2
9	595.73	1.2
10	596.80	1.60
11	592.6	3
12	594.09	1.2
13	585	10
14	589	10
15	581	10
17	592.85	1.4

18	595.43	1.2
19	596.88	1.5
20	596.73	2
21	596.78	1.5
22	596.88	1.5
23	592.63	2
24	593.50	1.2
25	597	1.2

Node data collected from survey shown in above table were assigned in Workspace of EPANET Software's dialog box as shown below fig.14

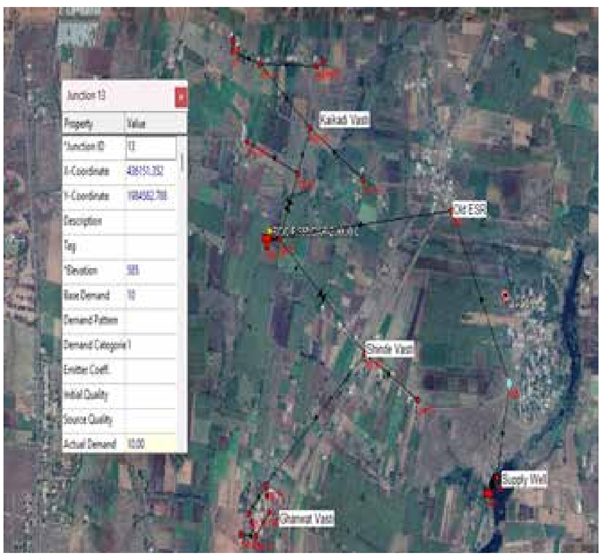

Figure14 Node Elevation

Assigning Pipe Properties

Figure 14 depicts water distribution model. It consists of 21 numbers of pipes. Information about the dimensions like pipe length and diameter were collected. The values are verified, adjusted and assigned to the model. It has been observed that main water of 150 mm was provided and the branch lines had diameter of 63 mm, 75 mm and 100 mm respectively

Table 4 Pipe Properties

Pipe	Length(m)	Diameter(mm)
2	78	75
3	64	75
5	162	90
6	123	75
7	212	75
8	141	110
10	20	110
12	410	110
13	187	90
14	610	110
15	110	75
16	580	110
18	66	75
19	318	140
20	818	110
21	74	75
22	100	110
23	162	90
24	42	90
25	5	75
26	12	75

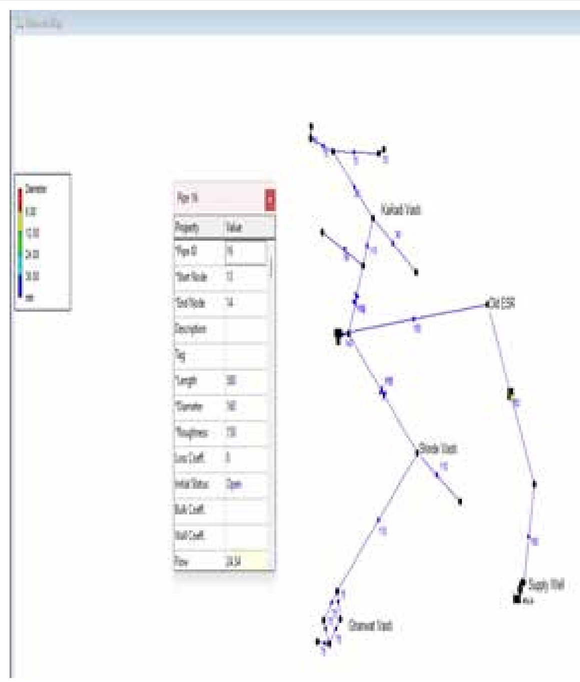

Figure 15 Assigning Pipe Properties

Assigning Pump Specifications

Pump efficiency and pump curve data were assigned to pumps as shown in fig Water distribution model consist of 1 pump required to supply water which cannot be supplied naturally via gravity.

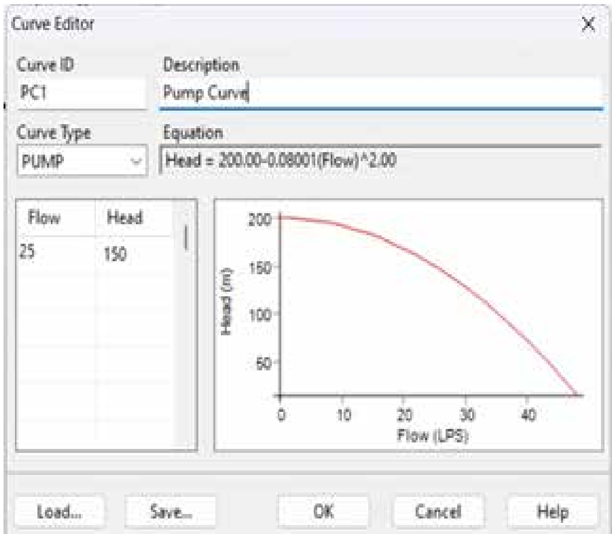

Figure 16 Pump Characteristics

Analysis in EPANET

Figure 17 shows the after entering all the data, connections in software, the whole network is run for analysis. If negative pressure occurs at the nodes then the warning messages will get generated. You may find increase in diameter of pipes connected to node because negative pressure generated. After some trial and errors, negative pressure at all nodes gets nullified and run analysis showed the message "Run Successful".

Figure17 Analysis successful

CONCLUSION

The planning and design of a water distribution network using EPANET provide a valuable insight into the hydraulic behavior of the system. By optimizing the network layout, determining pipe sizes, implementing pressure control measures, and evaluating performance, engineers can create an efficient and reliable water distribution network that meets the demands of consumers. It also found efficient in minimizing operational costs and maintenance requirement.

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Use of Steel Fibers in Pocket Hole Grouting

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ABSTRACT

The following report summarizes the findings of an experimental program aimed at determining how steel fiber reinforced grout affects the tension stiffening effect in reinforced concrete masonry. The impact of several factors on the tension-stiffening behavior of steel fiber-reinforced concrete masonry is examined, including steel fiber content, steel reinforcement ratio, unit type, fiber aspect ratio, and loading type. A background review was conducted, looking into fiber-reinforced concrete, reinforced concrete masonry, and the tension stiffening effect. A review is conducted of the conventional testing methodologies for identifying structural characteristics and the constituent materials of reinforced concrete masonry. A detailed examination of steel fiber-reinforced concrete and the suitability of fiber-reinforced technology for grout are covered. The idea of reinforcing a brittle material is the same for fiber-reinforced grout as it is for fiber-reinforced concrete, notwithstanding their differences. Along with techniques for minimizing fiber pullout, like the use of hooked-end steel fibers, the mechanics of fiber pullout are covered. Through the use of both indirect and direct testing methods, the behavior of fiber-reinforced concrete under tension and compression is studied. Lastly, the topic of the tension stiffening effect in concrete is covered, along with models that are pertinent to the industry, like the Gopalaratnam and Shah model, the Vecchio and Collins model, and the Stevensetal model. Both the tension-stiffening behavior of reinforced concrete with steel fiber reinforcement and the factors influencing tension stiffening in reinforced concrete are covered. The scant literature on tension stiffening in reinforced masonry is summarized.

***KEYWORDS** : Tension stiffening effect in steel fiber reinforced grout (SFRG), Reinforced concrete masonry (RCM).*

INTRODUCTION

The standard component of modern Canadian reinforced masonry building is hollow concrete blocks that are joined together with mortar and have rebar inserted into the voids to provide horizontal and vertical reinforcement. Once the structural element has been built, grout is injected into the voids to attach the rebars to the concrete blocks. Masonry and concrete are essentially comparable in many aspects, however masonry has a far lower tensile strength. Tensile strengths for concrete range from roughly 2 to 3MPa, while reinforced masonry typically has tensile values between 0.4 and 0.8MPa. Masonry, like concrete, is fragile under tension. Therefore, it is essential to reinforce the material under tension. One distinction between the two materials is that it is much more difficult to insert reinforcement into masonry than it is into concrete. Because of the concrete blocks, the reinforcement is obstructed, making it difficult to build and install typical reinforcement cages within an element. When designing elements for seismic resistance, the degree of ductility that can be obtained is another distinction between reinforced concrete construction and reinforced masonry. Because they are unable to adequately contain concrete in compression, reinforced masonry elements often have less ductility than equivalent concrete elements.Fiber-reinforced grout may be used to increase the tensile strength of reinforced masonry and lessen the need for rebar. Moreover, research has demonstrated that fiber-reinforced concrete has superior ductility in comparison to ordinary concrete (Johnston and Coleman, 1974). Therefore, using fiber-reinforced grout in masonry may potentially augment these advantages. The addition of fiber reinforcement to concrete has several noteworthy advantages, including increased shear and moment resistance, decreased fracture widths, improved ductility, and improved resistance to cracking. Reinforcement can become crowded in reinforced concrete at high-stress areas, including beam-column connections; however, the use of fiber-reinforced concrete can lower the primary reinforcement requirements, so reducing the congestion. Reinforcement can get congested in reinforced concrete at high-stress points, including beam-column connections. However, by using fiber-reinforced concrete, the major reinforcement requirements can be reduced, which relieves the congestion. It is believed that by using less rebar, the use of fiber-reinforced grout may also lessen the difficulties associated with rebar placement within reinforced brickwork. The benefits and drawbacks of employing fiber-reinforced grout in reinforced concrete masonry will be examined in this thesis.

PROBLEM STATEMENT & AIM

Problem Statement

Due to flaws, aging, or other causes, certain buildings may develop pocket holes. These gaps may jeopardize the structural stability and result in issues such as

- Decreased load-bearing capacity: Holes weaken the structure and increase the likelihood of a failure under load by reducing the available cross-sectional area.
- Stress concentration sites are created by the edges of the hole, which increases the concentration of stresses and raises the failure risk.
- Water infiltration and corrosion: Holes in materials can let water seep in, which can cause the surrounding material to corrode and deteriorate even more.
- Functionality loss: The way the hole affects the structure or equipment will depend on its size and position.

Aim of The Project

To overcome the drawbacks of conventional techniques and offer a stronger, more long-lasting answer.

OBJECTIVES & SCOPE

Objectives of The Project

* In addition to determining the extent to which the addition of steel fibers to the grout improves the tension stiffening behavior, the goal of this study is to examine the impact of steel fiber reinforced grout on the overall tensile performance of reinforced masonry.

*To ascertain their impact on the tension-stiffening behavior, variables such as bar diameter, fiber volume fraction, fiber length, and unit type will be examined experimentally on 42 direct tension specimens under both monotonic and cyclic loading

*An equation characterizing the tension-stiffening behavior of fiber-reinforced structural brickwork will be established using the experimental data gathered.

*By incorporating steel fibers into the grout matrix, masonry can become a more competitive structural material due to the enhanced performance it offers.

Scope of The Project

1. Test different grout doses and varieties of steel fiber.
2. Strength, shrinkage, and bond of restored specimens are compared to those of conventional procedures.
3. Examine the steel fiber grout's simplicity of application and long-term durability.
4. Provide useful advice that may be applied in the actual world.

5. Brief report with conclusions and suggestions.
6. A useful manual for grouting steel fiber pocket holes.

OVERVIEW

This is a very thorough introduction to steel fiber-reinforced grout (SFRC) and fiber-reinforced concrete (FRC). It addresses many different subjects, such as

The background and uses of FRC: You've talked about the history of the usage of FRC as well as its numerous contemporary uses, including foundations, industrial flooring, and precast pieces.

The advantages of SFRC You've shown how, in comparison to ordinary concrete, SFRC can enhance tensile strength, ductility, crack management, and durability.

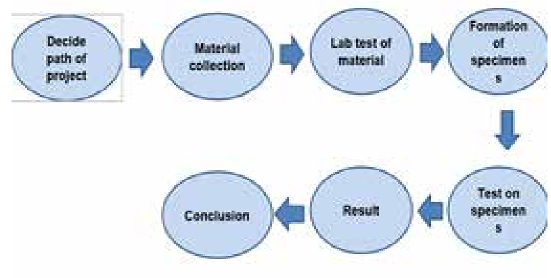
Steel fiber kinds: You have discussed the benefits and drawbacks of the three most prevalent forms of steel fibers, which are spiral, crimped, and hooked ends.

Research materials needed: You've mentioned the precise materials you'll be using to study the tensile performance of SFRC-reinforced masonry components.

All things considered, this is an insightful and well-written summary that shows a solid grasp of FRC and SFRC technology. Here are some more ideas and recommendations: intended audience Knowing who this overview's intended audience is would be beneficial. You can use more jargon and technical terminology if it's intended for a technical audience. If it's intended for a broad audience, you might need to make some of the ideas simpler. Images: The summary might be made more interesting by including illustrations or diagrams that serve to clarify some of the important ideas. The subject matter of your study: You could briefly outline the precise questions that your study on SFRC-reinforced masonry elements aims to address. This would assist in setting the scene for the summary and highlighting the importance of your work.

METHODOLOGY

A. The goal of plate grouting is to counteract vibrations caused by large machine base plates being fitted with concrete and bolts. This vibration is what causes the base plate to become de-bound.



Choose the project's direction by establishing the goals and research topic.

Material collection: This entails obtaining the information and resources required for the study.

Material test in a lab: This entails evaluating the materials to determine whether they fulfill the needs of the project.

Formation of specimens: This refers to the process of making the test samples for the study.

To conclude, one must analyze the data and make judgments regarding the study issue.

Process

- Formwork is applied over the slab from all sides where grouting is done.
- Formwork should be watertight as grout is free to flow and should not leak.
- One face is kept upwards for grouting to flow properly.
- Holes are drilled for bolts.
- Steel bases are fitted on the slab with the assistance of bolts. The stopper is left on the opposite face to prevent grout flow. The base plate can be taken out after the four-hour water curing period and the twenty-four-hour grouting period.

Apparatus and Test Specimens

- Concrete cylinder molds: Made by AASHTO M 205, these molds have double the diameter in length. The standard specimens will be cylinders measuring 150 mm (6 in.) by 300 mm (12 in.). Mold diameters cannot be less than three times the largest aggregate size unless wet sieving is carried out in compliance with WAQTC TM 2 FOP. When the nominal maximum aggregate size is less than 25 mm (1 in.), agency specifications may permit cylinder molds measuring 100 mm (4 in.) by 200 mm (8 in.).

- Rectangular shapes with sides and ends at right angles to one another are called beam molds. need to be sufficiently stiff to withstand warping. Surfaces have to be flawless. Molds must yield lengths that are no more than 1.6 mm (1/16") shorter than the minimum length (longer lengths are permitted). The most deviation from the nominal cross section allowed is 3.2 mm or 1/8 in. The smaller dimension must be at least three times the maximum aggregate size, and the width-to-depth ratio cannot be greater than 1:5. Beam molds used for casting specimens in the field should produce specimens with a minimum width and depth of 150 mm (6 inches), unless specified differently in the requirements. The long axes of the specimens must be horizontal when they are cast and hardened.
- Standard tamping rod dimensions: 16 mm (5/8 in.) in diameter, 600 mm (24 in.) in length, with a hemispherical tip that matches the diameter of the rod used to prepare 150 mm (6 in.) x 300 mm (12 in.) cylinders. This little tamping rod is about 305 mm (12 in.) long and has a diameter of 10 mm (3/8 in.). Its hemispherical tip is the same diameter as the rod used to prepare 100 mm (4 in.) and 200 mm (8 in.) cylinders.
- For use with low-slump concrete, the vibrator should have a minimum diameter of ¼ the mold's diameter and width and a minimum length of 75 mm (3 in.) beyond the part being vibrated. It should also have a minimum vibration rate of 7000 vibrations per minute.
- A container of sufficient size is called a scoop, which allows each representative increment of the concrete sample to be added to the container without spilling.
- Sturdy base and cover plates: these might be made of plywood, glass, or metal.
- Thermometer: Able to record the highest and lowest temperatures during the first healing period.

Procedure – Making Specimens – General

1. Sample acquisition must follow the FOP for WAQTC TM 2. For specimens with a diameter of 150 mm (6 in.) or more that comprise aggregate with a nominal maximum size larger than 50 mm (2 in.), wet sieving by the FOP for WAQTC TM 2 is necessary; screen the sample over the 50 mm (2 in.) sieve.
2. Once the sample has been transported to the testing site, remix it.
3. Within fifteen minutes of receiving the sample, start creating specimens.
4. Place the molds upright on a level, stable base in a vibration-free area not far from their intended storage location.
5. Try to slightly overfill the mold on the last layer as you fill the molds with the necessary number of layers. To prevent having too much or too little concrete, add or remove concrete before consolidation is complete.
6. Internal vibration and rodding are the two ways to consolidate the concrete. If the slump is more than 25 mm (1 in.), vibration or rodding may be used for consolidation. Vibrate the sample internally to consolidate it if the slump is less than 25 mm (1 in.). The application of vibration or rodding may be restricted by agency specifications.

Procedure – Making Cylinders – Rodding

1. Fill each mold in three roughly equal layers for the standard specimen measuring 150 mm (6 in.) by 300 mm (12 in.). Use a scoop or trowel to distribute the concrete uniformly around the mold's perimeter. Fill the mold in two layers for the specimen measuring 100 mm (4 in.) by 200 mm (8 in.). Fill the mold to a tiny overflow while adding the last layer.
2. Using the rounded end of the suitable tamping rod, consolidate each layer with 25 strokes. Over the concrete's cross-section, uniformly distribute strokes. Without forcefully touching the bottom, rod the first layer to the bottom.
3. After rodding each layer, lightly tap the sides of

each casting with your open palm (for single-use light-gauge molds) or ten to fifteen times with a mallet (for reusable steel molds).

4. Use a straightedge or tamping rod to remove the mold's surface and start the initial curing process.

Procedure – Making Cylinders – Internal Vibration

1. Add two layers of filler to the mold.
2. For each layer, insert the vibrator at the necessary number of distinct spots (two points for cylinders with a diameter of 150 mm (6 in.); one point for cylinders with a diameter of 100 mm (4 in.). Avoid letting the vibrator come into contact with the mold's sides or bottom when vibrating the bottom layer. The vibrator should pierce the underlying layer by about 25 mm (1 in.) when vibrating the top layer.
3. Carefully remove the vibrator to ensure that the material is free of any big air pockets.
4. After each layer has vibrated, lightly hit the sides of each mold with your open palm (for single-use light-gauge molds) or ten to fifteen times with a mallet (for reusable steel molds).
5. Use a straightedge or tamping rod to remove the mold's surface and start the initial curing process.

Procedure – Making Flexural Beams – Rodding

1. Divide the material into two almost equal layers, the second of which slightly overfills the mold.
2. Using the rounded end of the tamping rod, consolidate each layer once every 1300 mm2 (2 in2). When compacting the initial layer, be careful not to force the bottom of the mold by rodding each layer down. The second layer should be rodded all the way through, around 25 mm (1") into the lower layer.
3. After rodding each layer, use a trowel to finish and pound the mold ten to fifteen times with a hammer to spade along the edges.
4. Use a float or trowel to strike off to a level surface and start the initial curing process.

Procedure – Making Flexural Beams – Vibration

1. In one layer, fill the mold to the brim.
2. Use a vibrator inserted vertically down the centerline at intervals of no more than 150 mm (6 in.) to consolidate the concrete. Be cautious not to vibrate excessively, and remove the vibrator gradually to prevent wide spaces. Avoid placing the vibrator in contact with the mold's sides or bottom.
3. After the mold has vibrated, pound it with a mallet ten to fifteen times.
4. Use a float or trowel to strike off to a level surface and start the initial curing process.

Procedure – Initial Curing

1. Use a trowel, your hands, or another tool to support the mold's bottom while transferring cylinder specimens manufactured using single-use molds.
2. Depending on the agency, there are two procedures for the initial curing of cylinders. The curing location for both techniques needs to be stable, ¼ inch from a level surface, and free from vibrations or other disturbances.
3. Maintain an initial curing temperature of 16–27°C (60–80°F) or, for concrete with a strength of 40 Mpa (6000 psi) or more, 20–26°C (68–78°F).
4. Stop the moisture from escaping.

Procedure – Transporting Specimens

1. Following the first 24 to 48 hours of curing, the specimens will be brought to the lab for a second, final cure. The identity of the specimen, the time and date of its creation, and the highest and lowest temperatures recorded during the initial cure will all be recorded.
2. Specimens must be shielded against jarring, abrupt temperature fluctuations, freezing, and moisture loss while being transported.
3. Cylinders must be fastened with their axis vertical.
4. The maximum duration for transportation is four hours.

Final Curing

1. After the cylinders are received at the lab, take the cylinder out of the mold and label it properly.
2. The last cure for all specimens (beams or cylinders) needs to begin within thirty minutes, and moisture needs to remain on the specimens' surfaces the entire time. Curing can be done in a water tank or a moist environment; specimen surfaces must always remain free of moisture until testing is completed. Temperature restrictions can be disregarded.
3. Beams must be immersed in water saturated with lime for at least 20 hours before testing as part of the final curing process.

Initial cure in a temperature-controlled chest-type curing box

1. Use the trowel, float, straightedge, or tamping rod to finish the cylinder. The final surface must be level and free of any depressions or protrusions larger than 3.2 mm (1/8 in.).
2. Insert the mold into the box for curing. Take care not to distort light-gauge molds by supporting the bottom and not compressing the sides when raising them.
3. To stop moisture loss, cover the mold with a lid.
4. Label the cylinder mold and lid with the required identifying information.

Fig. Column with Pocket Hole before Grouting

Fig. Column with Foundation Bolts after Grouti

CONCLUSION AND RECOMMENDATIONS

The excerpt that is given provides a thorough summary of the research that has been done on Steel Fiber Reinforced Grout (SFRC) in reinforced concrete masonry (RCM). In light of the findings and suggestions, here is how "pocket hole grouting" is related:

Pertinence to Grouting Pocket Holes:

Since shear and compressive stresses are more prevalent in pocket hole grouting applications, the research's primary focus on direct tension behavior may not translate well there.

Nonetheless, the results on workability, fiber content, and crack prevention provide important information for pocket hole grouting:

Workability: According to the study, 0.8% fiber content is the ideal amount for workability. Taking into account the requirement for optimum flowability and consolidation within the pockets, this information can help guide the selection of fiber content for pocket hole grouting.

Crack Control: The study demonstrates how SFRC can lessen the width and spacing of cracks. This is advantageous for pocket hole grouting because, when paired with conventional reinforcement, it can increase the joint's durability and structural integrity.

Fiber percentage: For best results while preserving workability, the study suggests a 0.8% fiber percentage. Examining appropriate fiber composition for pocket hole grouting might begin with this, taking into account variables such as grouting technique, intended strength, and pocket size.

Extra Points to Remember: Grout, not precisely pocket hole fillers, is the subject of this study. To evaluate the behavior of SFRC specially designed for pocket hole applications, more investigation may be required.

The study ignores factors that affect long-term durability, including shrinkage, creep, and freeze-thaw resistance, which are crucial factors to take into account when grouting pocket holes in a variety of settings.

The fiber kinds and geometries utilized in the study may not be optimal for pocket hole grouting.

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Review Paper on its Using Hydraulic Traffic Reduce System

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ABSTRACT

Traffic congestion has been one of the main issues. India's economy is among the ones growing at the fastest rate in the globe.

India has an extensive population, which implies that a lot of private cars are driven on its roadways, which makes traffic control a problem. To tackle this problem, we have therefore developed an innovative approach.

When there is severe traffic congestion and an emergency vehicle needs a path, it is necessary to provide one on the side of the road. The installation of a hydraulic mechanism beneath the sidewalk, or a hydraulic traffic reduction system, allows the sidewalk to move vertically, facilitating easy vehicle crawling on to it and clear their way. With the use of this technology, which is also helpful in emergency situations, we can reduce the cost of developing the new road. Consequently, we can lessen traffic jams on the roads under dire circumstances.

***KEYWORDS** : Walkway, Hydraulic system, Emergency, Traffic jam.*

INTRODUCTION

Congestion in the roads has been one of the biggest problems.. The rise in car traffic resulted in an increase in street congestion, which impeded the safe and effective flow of traffic.

The emergency's mode of operations may be directly impacted by traffic congestion.

Therefore, in order to prevent these, we have developed the idea of Dynamic TRS for quick and effective vehicle crisis maneuvering.

PROBLEM STATEMENT & AIM

Problem Statement

There is delay for passengers due to heavy traffic. Unnoticed traffic rise as a result of not paying attention to traffic. There is a barrier restricting vehicles on the authorized roadway.

OBJECTIVES & SCOPE

Objectives of the Project

1. To decrease traffic when conditions are unstable.
2. To boost traffic flow speed.
3. To use the sidewalk as an extra lane in case of an emergency.
4. To reduce traffic congestion and facilitate transportation flow.

Scope of the Project

1. To reduce traffic when there is an emergency.
2. Quicken the flow of traffic.
3. Create extra lanes on the sidewalk.

STUDY AREA

The number of vehicles that utilize the road heading into our study area in cities each day is in the lakhs, and it is growing. This additionally contributes to the worsening of traffic jams, which worsens the issues. In addition, the pathway doesn't look great due to how crowded the area is and how neglected certain parts of it are,according to experts (Channel on the way). We will be able to enhance the present path by including additional features and modifying it to anewer, high-level version once this framework is put into place. Since the mechanism of the hydraulic jack serves as the foundation for our proposal, we make use of the principles and ideas of hydraulics. Basics of Hydraulics. The law of Pascal forms the basis of hydraulics. A fluid that is confined and at rest experiences a pressure increase that is transmitted to every point in the fluid with lowering pressure, according to Pascal's Principle.

Problem Identification and Planning

Identify specific issues and barriers associated with traffic congestion in the chosen study place. Study circulation patterns, obstacles, and the causes behind congestion in detail. Engage with stakeholders in order to understand their needs and objectives to decrease traffic, including city planners, traffic engineers, and transportation authorities.

Data Collection and Analysis

Build to make use of an array of traffic sensors, such GPS units, cameras, and loop detectors, to get real-time traffic data. Collect past traffic information for the subject of the research area in order to determine baseline patterns and degrees of congestion. Determine circulation patterns, hotspots for congestion, and important puts that call for action by analyzing the data that was collected.

System Design

The results of the research and identified issues with traffic congestion, develop an idea for the hydrologic traffic reduction system. Determinethe most suitable locations to put hydraulic actuators, such as junctions and areas with congestion. Create the structure of a control system that can take in real-time data inputs and interact with present traffic management systems.

Simulation and Optimization

Use traffic modeling tools or computer simulations to mimic the hydraulic traffic reduction system's behavior. To determine the optimal combinations of hydraulic actuators, apply optimization techniques like machine learning and predictive modeling. To optimize traffic flow, lessen bottlenecks, and accelerate travel times, research various scenarios and traffic management techniques.

Implementation

At the specified research areas, install the required hardware, including hydraulic actuators. Attach the hydraulic traffic reduction system to the current infrastructure for traffic control, which includes the traffic signals and surveillance cameras. The system should be optimized and adjusted in response to user feedback and actual use cases.

Hydraulic Jack

What is a hydraulic jack? The provided figure (b) included all the information needed to lift large objects using a hydraulic cylinder to apply force and a survey of the road's design. Prior to construction, a hydraulic location survey is conducted, and the road's force is used to raise the loads. the cylinder chamber's pressure.

The schematic diagram of the conceptual hydraulic mechanism/jack is shown in fig. (a).

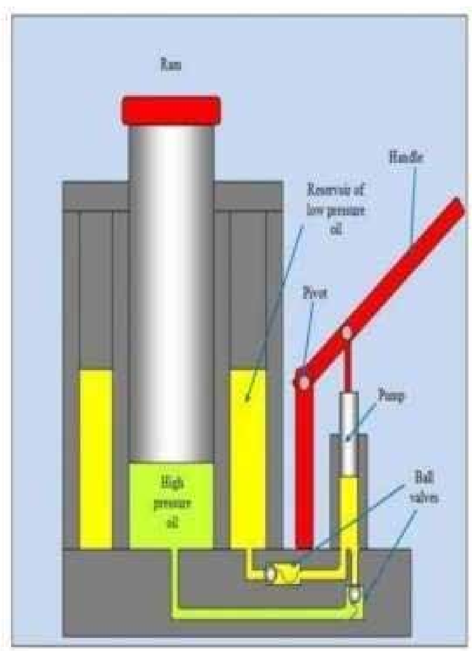

Figure a

The provided fig. (b) included a detailed survey of the road's construction as well as a study of the location chosen prior to road construction.

Figure b

RESULT & DISCUSSIONS

One worldwide issue that leads to energy and time waste as well as pollution of the environment is traffic congestion. The first step in selecting the best course of action to prevent this scenario is to identify any congestion.

Congestion has been separated into different kinds in order to be simply understood. There are several causes for the traffic issue.

There are many potential approaches to deal with congestion. The two related traffic management solutions that are advised are the regularity measures and the economic measures. Pricing strategies, parking management, access control, and regularity measures are examples of economic measures.

All things considered, we can resolve the issues with this mechanism. I have no doubt that it will help to lessen future traffic jams. It brings me a great deal of joy to offer this article on the "HYDRAULIC TRAFFIC REDUCE

SYSTEM," which is the product of my guide Prof. Zope M.T.'s unwavering support, technical direction, and focused direction. I would want to convey my sincere appreciation and modest thanks for his invaluable advice during the presentation process.

The successful outcome of this paper has consistently relied on a precise combination of diligence and continuous support and direction provided to me by our college's superiors.

Finally, but not least. I want to express my gratitude to the staff, my teammates, and everyone else who has supported me in any way and offered many suggestions that undoubtedly increased the caliber of my work.

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Retrofitting of Concrete Beam by Banana Fiber

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ABSTRACT

The idea of this study is to evaluate how well banana fibers work with the mechanical characteristics of RC beams. In order to do this, some investigational researches the use of banana fiber improves the qualities, durability of material construction are carried out in order to accomplish this goal. Based a set of seven different concrete beam sample, with varying Characteristics the experimental studies aim to: identify the key factors influencing fatigue activities of RC beams by means of banana string bars, investigate the aspect of RC banana string bar mix design; investigate the influence of RC banana fiber bars on material activities and investigate influence of RC banana fiber with varying material grade. These results recommend utilizing banana bars can be used to provide important reinforcement.

KEYWORDS : *Cracking, Reinforced concrete constructions, Banana fiber.*

INTRODUCTION

Affordable, eco-friendly building materials are becoming increasingly important because of the increasing amount of environmental, social, and economic issues. Thus, the establishment of affordable and easily accessible housing is essential. This is significant since over a billion people live in inadequate housing or are homeless globally. There are several advantages for the economy and environment when plant waste is used as readily available raw materials and resources, eliminating the need for expert labor. For many uses, it is now believed that natural materials are more environmentally friendly than industrial ones. Reinforcement increases the necessary strength and stiffness to support loads. Although the different components restrict the mechanical and chemical properties of the composite buildings, the completed composite.

PROBLEM STATEMENT & AIM

Problem Statement

Generally speaking, a variety of environmental factors can cause beams to split, shear fail, etc. Usually, fibers are added to concrete to stop cracks caused by plastic shrinkage and drying shrinkage. They also reduce the concrete's permeability, which lowers water leakage. Certain types of fiber enhance the resistance to impact, abrasion, and shattering in concrete.

Aim of the Project

Our project's primary goal is to use banana fiber to lessen concrete beam failures and cracking.

Objective of the project

- To regulate and minimize the diameters of cracks caused by early-age shrinkage
- To increase shear and flexural strength.

- To increase ductility and load capacity.
- To improve resistance to abrasion and toughness.

METHODOLOGY

General

The materials used and their method are covered in this chapter. The materials used in this experiment are coarse aggregate, fine aggregate, and water. Laboratory experiments is carried out using the same and aggregate.

Materials and Procedures

The materials used in this job included fly ash, water, coarse and fine aggregates, and ordinary Portland cement (53 grade).

Cement

Masses or fragments of solid material can be joined together form compact hole using cement, an adhesive substance. Tetra calcium alumina ferrate, tricalcium silicate, dicalcium silicate, and tri calcium aluminates are the popular names for the four primary potential elements. In this research effort, ordinary Portland cement (OPC) of grade 53 is used for all experimental operations.

Figure 1: Banana Fiber

Aggregate

Fine Aggregate

(Sand found in nature) Separate, bound aggregate pieces make up concrete.

When mixed with the cementing material, the quality of the cement paste mostly determines its characteristics. Its strength is also influenced by the cement paste's connection with the aggregate. Strong aggregate is a prerequisite for strong concrete; inadequate paste strength or the bond between the paste and the aggregate will produce low-quality concrete regardless of the strength of the aggregate. In compliance with IS 383-1983 zone II, locally accessible Pravara River sand is used as a fine aggregate after taking the previously given parameters into account.4.75 mm is the largest aggregate that can be used. The fineness modulus of the fine aggregate is empirical.

Coarse Aggregate

While it shouldn't go over one-fourth of the minimum size, the notional maximum size of coarse aggregate should be as big as is practical given the constraints thickness of the member, presuming that enough concrete can be poured to fill the corners of the form and completely surround all reinforcing. When creating concrete mix, properties like moisture content and water absorption might be useful in adjusting the water's quality. The utilized crushed stone aggregate has a maximum size of 20 mm and a size range of 12.5 mm to 20 mm, all of which are readily available locally. The fineness modulus is typically used to quantify the coarseness of an aggregate.

Water

Water is an essential ingredient in concrete since it actively participates in the chemical reaction with cement. Careful assessment of the quantity and quality of the water is required, as it contributes to the production of the strength of the cement gel. Its PH value is limited to a value of 6.Concrete can be made from drinking-quality water.

Concrete Mix Selection

1. Mix Design: The method of mix design consists of two connected parts.

1) Choosing the right concrete ingredients (cement, aggregate, water)

2) Calculating the proportionate amounts needed to create concrete with the right workability, strength, and durability in the most cost-effective manner. While there are many significant qualities of concrete, most design processes center around reaching a particular compressive strength at a given workability and age.

Mix Design for Grade M 20

(IS: 10262-2009) There are several approaches to mix design. In the current work, concrete with natural sand as a fine aggregate is made using the Indian Standard technique (IS: 10262 - 2009).

1. Proportioning requirement
2. Material test data.
3. Goal mean strength
4. Water cements ratio selection
5. Cement and banana fiber calculations.
6. Calculations for the ratio of fine aggregate and coarse aggregate volume

Specimen Preparation

The specimens that are used are cubes, beams, and cylinders. The dimensions of each test specimen are as follows: Cube Cylinder Beam

Cube dimensions: 150 x 150 x 150 mm;

Dimensions of the beam: 150 mm x 150 mm x 700 mm; length of the cylinder: 300 mm; diameter: 150 mm 230 x 230 x 2000 mm is the beam.

1) Beam specimens were used to measure the flexural Strength.

2) The compressive and bond strengths were found using the 150 mm cubes.

Measuring the components

Cement, sand, and coarse aggregate are measured with a computerized balance. The water and fly ash are measured using a one-liter measuring cylinder, 1000 and 2000 milliliter measuring jars, and a digital balance with a one milligram precision.

Concrete mixing: Utilizing a G. I. sheet, the parts are effectively assembled. When the mixture is dry, the components of normal concrete—sand, fly ash, coarse aggregate, and cement—are carefully measured and mixed together. The dry concrete mix is next mixed thoroughly and evenly until it is determined to be uniformly blended and homogenous.

Figure 2: Details of specimen for reinforcement

3. Concrete workability: Every batch mixing, the concrete slump is measured and recorded in compliance with IS 1199-1959. A slump cone piece of equipment is used for this. Sag is the metric used to assess workability.
4. Concrete placement: Freshly mixed concrete was troweled into the molds, taking care to fill each specimen's representative volume evenly, to avoid segregation.
5. Concrete compaction: Molds are inside cleaned and oiled to guarantee a smooth demoulding process. The concrete is manually crushed with a tamping rod after being precisely mixed and layered three times inside the mold. To stop spillage and help it separate, cement slurry is carefully sprayed.
6. Concrete finishing: The specimens are given an embossment across their surface after first drying.

PROBABLE CONCLUSION

The experimental program and the computational analysis of reinforced concrete beams reinforced with banana fiber bars yield the following conclusions:

1. Waste products from banana fibers can be chemically processed to become building materials.
2. By reducing this waste, recycling banana fiber helps to lessen the consequences of global warming by lowering the quantity of CO_2 in the atmosphere.
3. Using banana fiber bars has a favorable economic impact because banana fibers are inexpensive.

4. The flexural strength increases by 25% when conventional concrete is substituted with banana fiber bars.

5. Banana fibers can be obtained for commercial usage because they are considered a renewable resource.

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Comparative Thermal Analysis of Battery Pack Using Different Softwares

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ABSTRACT

With the development of electrical vehicles, the battery technology has made significant progress but still it faces several challenges. The battery efficiency is highly influenced by its operating temperatures, and due to this it became important to develop an effective battery thermal management system in order to ensure that batteries are maintained within its recommended operating temperature range and ensure its efficient operation. Keeping this in view, a numerical analysis of heat generation phenomenon is examined in this article to understand the thermal concerns of the battery pack. A computational fluid dynamic analysis is carried out to understand the temperature profiles of battery pack and the heat release performance of its thermal management system. Also, different cooling phenomenon is taken in to consideration by changing the surface area and position of coolant inlet and outlet in the system. Here, the battery pack is modelled using Solid Works software and the analysis is done by adopting solvers in Altair's AcuSolve 3D and GE's Flow Simulator. It is noticed that the most favorable operating temperature of battery varies between 45°C to 85°C. However; following to this observed that the life of battery is enhanced by using an impactful thermal management system related to battery pack.

KEYWORDS *: BTMS, Battery pack, Altair CFD, MATLAB simulink, Thermal analysis.*

INTRODUCTION

Sustainable energy solutions have gained lot of importance in today energy intensive era for addressing the modern era energy challenges and ensuring sustainable and efficient energy utilization and hence the energy storage technologies have gained a lot of importance. In this context, the battery role has become crucial, due to its applications ranging from portable electronic devices to electric vehicles and grid-scale measurement for energy require to storage systems and ability to store and release electrical energy easily and conveniently. Research and development in battery technology is crucial for increasing its range, reduce charging time and make it more reliable and relevant. As the demand for efficient, durable, and environmentally friendly batteries increased, it becomes essential to understand parameters governing their behaviour and efficiency and optimize the battery performance for their efficient utilization. Also, it will help in laying a foundation for proper battery designing to meet the diverse applications.

Therefore a lot of research is being done worldwide to decipher the underlying mechanism influencing the battery performance, its degradation and failure modes. Moreover, as new types of batteries are being introduced by researchers with novel materials and their chemistry, the understanding of the vulnerabilities and failure modes of batteries is essential for ensuring their reliability and safety. Thus the research that works like linkage between fundamental research and applications that are related to actual conditions is the need of the hour.

This technique along with specific tools that leads to analyze different issues, like the co-simulation of actual real cycle regarding driving. Computational Fluid Dynamics (CFD) is the tool to understand the cooling effect that utilized during this simulation work and the computing of the electrochemical formulas are adopted to examine the voltage curves, additional to this heat developed during various current rates. The temperature issues with nickel-cobalt-aluminum cells suggest that a cooling system that promotes dissipation of heat and thermal runaway is necessary for a battery pack. For an automobile nickel-cobalt-aluminum battery, it is necessary to have both minor temperature changes and an ideal working temperature range. Methods for optimising the geometrical and fluid dynamic characteristics in cooling design have been examined by several researchers.

To make efficient cooling and see the result of Tesla Model S battery system, designed the battery module and integrated with full scale MATLAB module with calculation of 60 kWh battery pack.

Saw et. al [1] in their study has demonstrated a easy method to calculate approximately the thermal performance of huge Lithium-ion battery packs using steady-state simulation and experimental testing for improving the cost and the reliability in the electric vehicles. She et. al. [2] in their work have proposed an enhancement capacity analysis phenomenon for accurately estimating the working condition of the battery in the actual working conditions for electric vehicles thereby reducing the need for extensive laboratory tests, making the analysis more cost effective and faster. A design optimization methodology was proposed by shui et. al. [3] to optimize a battery pack enclosure features for electric vehicles, for enhancing their safety, range, and battery life. A new combination of several material battery pack arrangement for electric vehicles which exhibits a promising performance in random vibration fatigue tests, enabling efficient performance evaluation without physical models was proposed by Kim et . al in their work. Cicconi et. al. [5] has ended a numerical analysis initially on a single cell and then on a battery pack for vehicle has hybrid mod. The investigation has been done to understand the effectiveness of battery pack air cooling system. An heat transfer analysis is carried out by Sun et. Al. [6] to understand the factors influencing the battery pack heat flow pattern in the battery structure. Initially, battery model be analyzed regarding different temperatures and different working conditions as well as finally an optimization is carried out. The effects of discharge rate of flow regarding the coolant, number of cold plates, coolant flow distribution and flow direction are studied to understand their effect on the thermal behaviours and efficiency and effectiveness of the battery pack by Deng et. al.[7].

A customized Lithium Nickel Manganese Cobalt Oxide (NMC) is used as foundation regarding battery pack was initially designed and numerically analyzed by Jindal et. al [8] to test the utility of a combination of ethylene glycol - water with nanoparticles suspended in it, for lowering the working temperatures of the battery pack. Further, optimization was done to increase the effectiveness of the system. Different studies have been done by different researchers [9,10] to understand the performance of different air cooling strategies used in air-cooled heat management system for battery packs which are used in different applications.

It has been noted that the battery's performance is mostly subjective by the arrangements of cells in battery pack and different cooling strategy used for cooling the battery pack. Thus every arrangement with different cells and capacity requires to be analyzed again to ensure its performance. Keeping this in view, a nickel–Cobalt-Aluminium battery packs which is preferably used in electric vehicles in analyzed for its performance in this study.

MODELING AND ANALYSIS

Batteries play a very critical role in operation of electric vehicles as they influence their range, performance and overall feasibility. Presently research and development related to electric vehicles largely focuses on the improvement of efficiency, durability, and environmental impact of batteries used in electric vehicles to further promote their adoption and sustainability. Researchers often choose simulation tools based on the specific aspects they are investigating, such as thermal management, electrochemical behavior, or control strategies, etc. The choice of a simulation tool depends on the application and the level of detail required and the specific goals of the research.

Recently, the Nickel-Cobalt-Aluminum (NCA) batteries have gained a lot of attention for their high energy density and thermal stability. Following to this, NCA batteries were preferably utilized in electric vehicles, where a compact and efficient energy storage solution is essential. A thermal analysis of the nickel-cobalt-aluminum battery pack used in electric vehicles is conducted in this work since temperature has a significant impact on battery performance.

The use of Software like Altair's AcuSolve 3D and GE's Flow Simulator Students versions are used to do flow simulation over it. Battery Pack CAD model imported at Altair CFD and its meshing is shown in figure 1 and figure 2 respectively. Modules made up of individual battery cells can be arranged in series, parallel, or both. Moreover, battery packs can be made by connecting battery modules in series, parallel, or both. Multiple degrees of modularity may exist, contingent upon the characteristics of the battery.

The number of cells connected in series determines the overall voltage of the battery pack. We connected a total cell of 1.6 v * 30 that is 48v with properties of nickel-cobalt-aluminum battery properties having 10mm aluminum shield to cover it. Following parameters have been considered for designing battery pack and using Solid Works software battery. The specifications of the battery total cell are as follows.

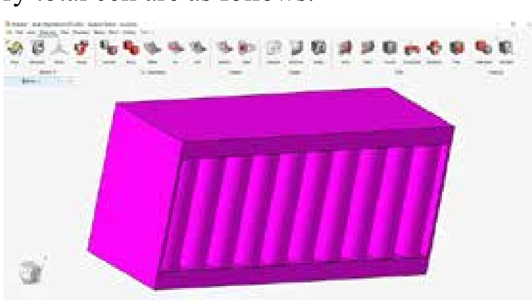

Fig.1 Battery Pack at Altair CFD window

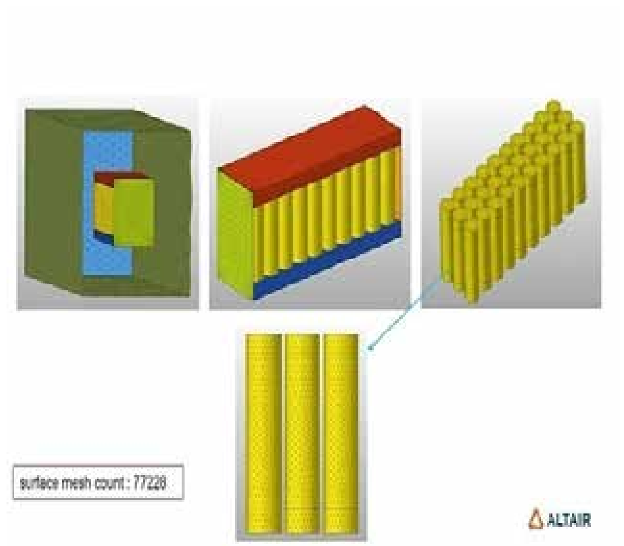

Fig. 2 Meshing

- Diameter – 18mm
- Length – 65mm
- Shield size – 10mm
- Gap between cells – 2mm
- No. of cells – 30
- Software – Solid Works 2020
- Material - Nickel-cobalt-aluminum based

The following assumptions are made in the simulation of battery pack.

- Steady state simulation
- Transient simulation
- Flow induced turbulence model with Sparta Allmaras model
- Material properties at constant temperature

Altair's AcuSolve 3D:

The step by step procedure followed while carrying out the simulation using Altair's AcuSolve 3D is as mentioned below.

1. Import CAD file to Altair HyperWorks AcuSolve work space
2. Meshing
3. Applying Boundary Conditions

- Volumetric Heat Source is applied to the cell
- Gravity Negative Y direction
- BMS Initially is constant at 45oC
- Normal Velocity- 11m/s
- Dynamic Viscosity – 1.93e-05 kg/m-s

GE Flow Simulator

The fluid system design tool GE Flow Simulator offers interdisciplinary modelling and optimisation capabilities on a single platform for machine design that takes into account thermal, fluid dynamics, and combustion inside of a 3D design environment. As seen in figures 5 and 6, this programme enables users to import real hardware and use 3D CAD point-cloud to automatically generate the computational model overlaid on the machine hardware.

1. Import & convert 3D CAD file.
2. Connection of Batteries

- Battery Nodes – Are the end point of thermal network. It is an associated with an element from the thermo network.
- Internal Nodes – Are the internal connection points of thermal network along with heat flow coming into and leaving from T Nodes.
- Conductor Resisters – Are used to model a simple conduction. The conductivity of the conductor can be assigned to the conductivity of custom material are defined by the user.
- Convector resistor – Is used to model the convection with in environment where heat transfer due to convection is significant enough to affect the solution.

Battery connections have been made as shown in figure 3 (a) 3 (b).

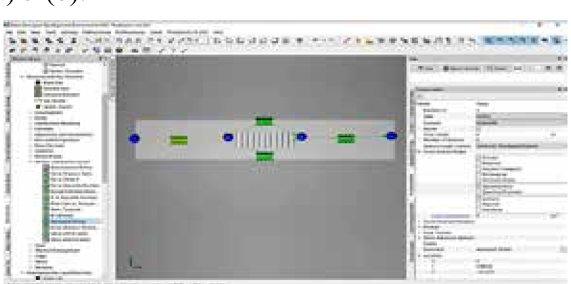

Fig.3 a) Battery connections

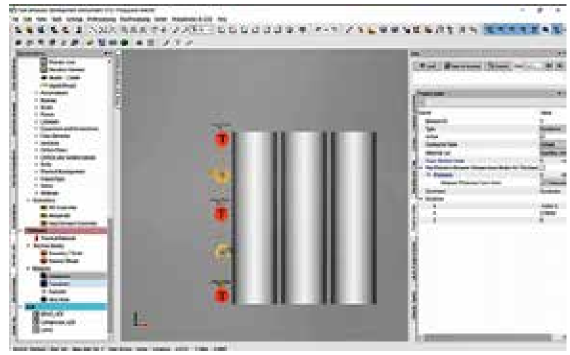

Fig.3 b) Battery connections

RESULTS AND DISCUSSIONS

The simulations are run for 900 second time for understanding their cooling performance. It has been observed that when cooling fluid ethylene propene (50:50) flows through battery pack, heat rejection of battery pack is comparatively better than when pure water is used as coolant. As discussed in the methodology, with both software tools i.e. Altair's AcuSolve 3D and GE's Flow Simulator 1D, simulation has been carried out and it has been found that, the temperature of battery pack initially increases from 45oC to 80oC – 90oC for 800 seconds and then it remains constant. When cooling flow is started, the temperature decreases continuously with increase in coolant flow rate. Comparison of results obtained using Altair's AcuSolve 3D and GE's Flow Simulator 1D is shown in figure 4.

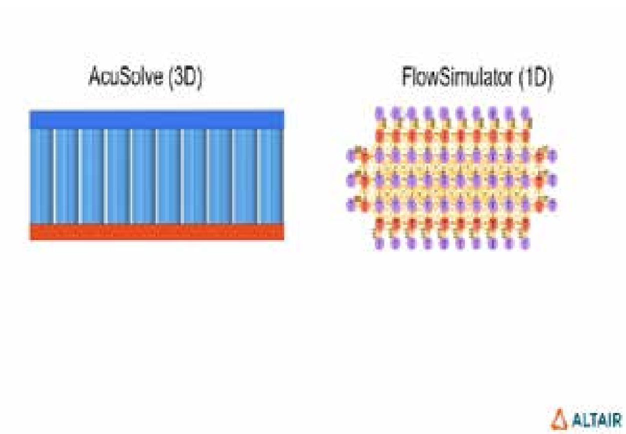

Fig.4 Comparison of Altair's AcuSolve 3D and GE's Flow Simulator 1D

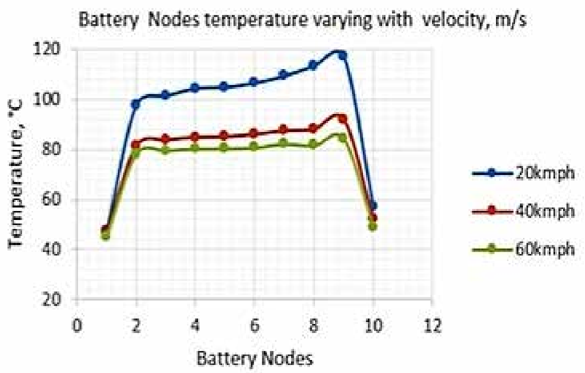

Fig.5 Battery nodes temperature variation with different coolant velocity

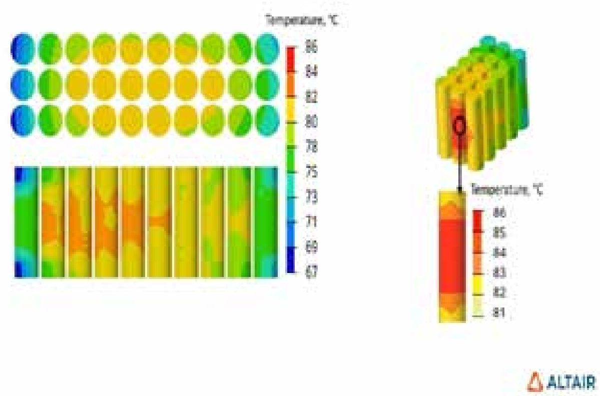

Fig.6 Temperature contour of battery cells

Figure 5 to 14 shows the temperature distribution under different conditions during simulations. The results obtained are found to be almost similar and therefore the simulation results obtained can be considered to be verified.

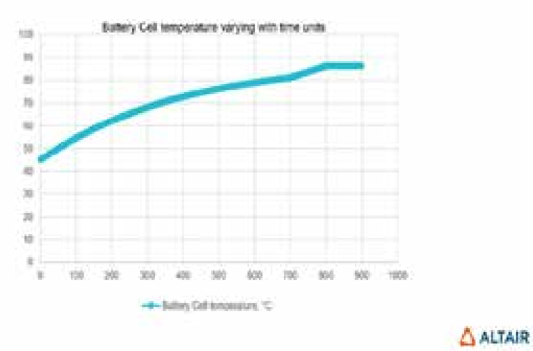

Fig.7 Battery cell temperature variation with time

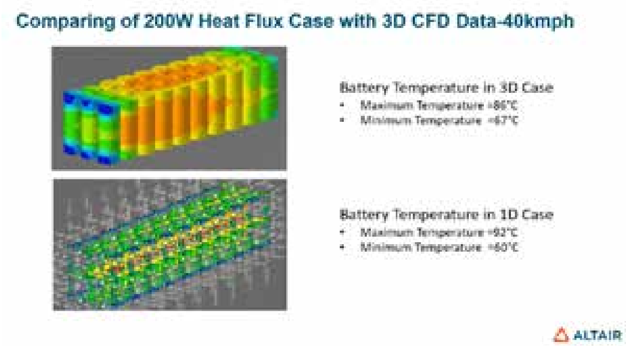

Fig.8 Comparison of 200W heat flux case with 3D CFD data

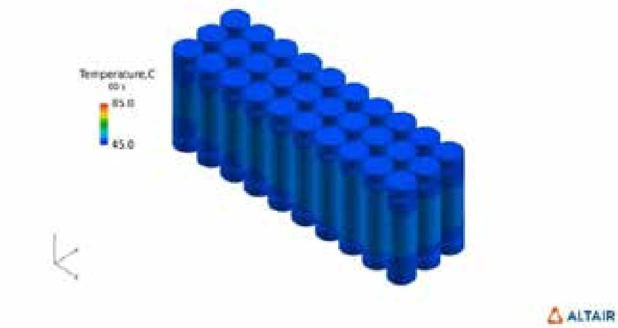

Fig.9 Temperature variation with time at 60 sec.

Fig.10 Temperature variation with time at 210 sec.

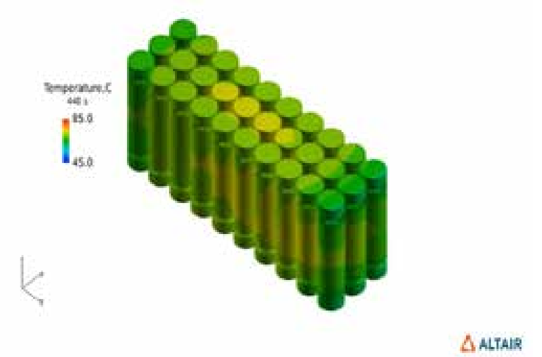

Fig.11 Temperature variation with time at 440 sec.

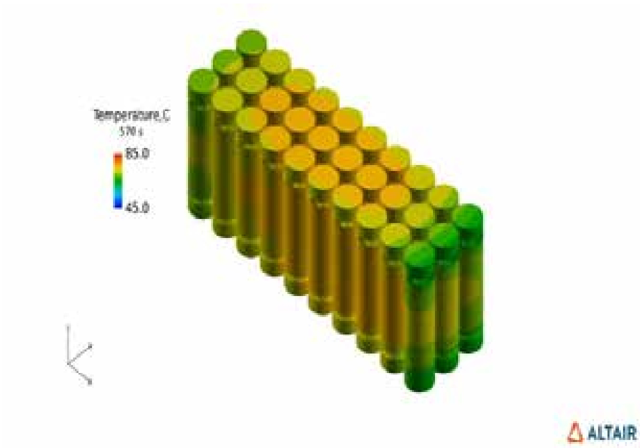

Fig.12 Temperature variation with time at 570 sec.

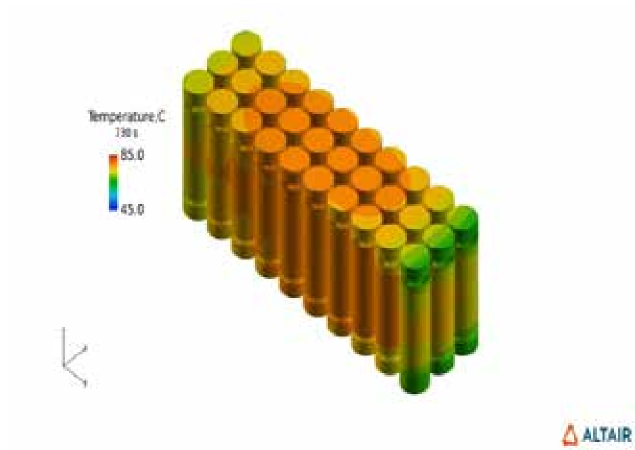

Fig.13 Temperature variation with time at 730 sec.

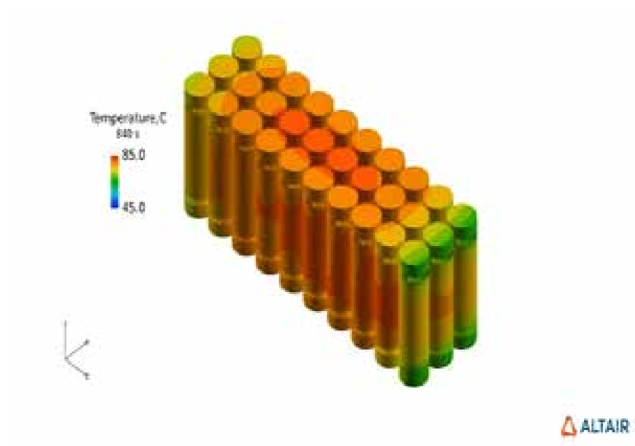

Fig.14 Temperature variation with time at 840 sec.

Temperature and velocity profile over battery pack is shown in figure 15 & 16 respectively. Flow simulator temperature variation can be seen using figure 17.

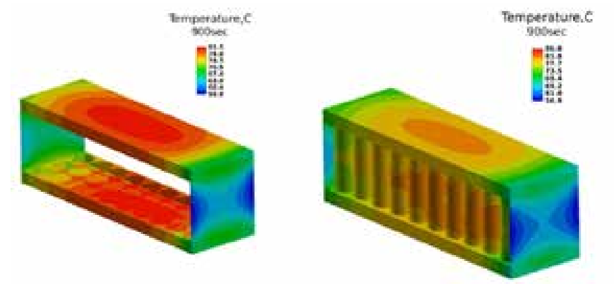

Fig.15 Temperature over battery pack

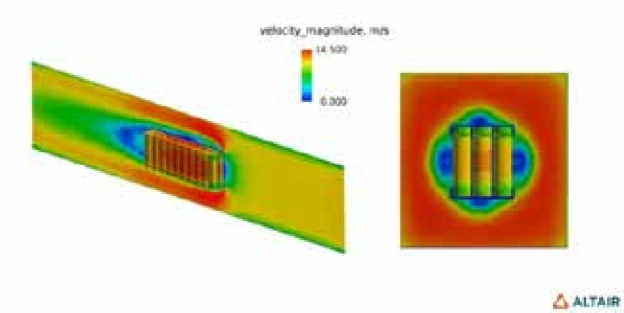

Fig.16 Velocity over battery pack

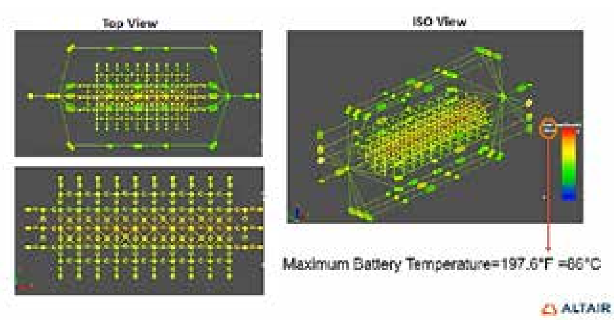

Fig.17 Flow simulator temperature variation

CONCLUSION

Due to its high energy density and long cycle life, nickel-cobalt-aluminium is commonly used in electric vehicles. Temperature has a big impact on the performance and life of batteries, therefore it's crucial to keep them in the right range. Therefore, simulations are carried out to understand the heat generation phenomena in battery module. In this study, it is observed that in a Battery Thermal Management System (BTMS), the velocity and the mass flow rate of the coolant are two critical parameters that determine their cooling performance. These two performance parameters determine the range of vehicle, which considered in this study, is 400km for Tesla Model S battery system. After 13min., it is observed that the temperature of the module remains constant in the range of at 85oC to 90oC. Further it starts reducing after BMS operation starts. The results obtained by both the software are found to be almost similar.

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Air Purification System

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ABSTRACT

The program focuses on the development and use of new air filters to improve the air quality of construction sites, lighting areas and dusty areas. The system has a steel (small) square corner frame and includes multiple 12V blowers powered by solar-charged batteries. Additionally, the system integrates sensors such as humidity and temperature for real-time monitoring and has a remote operation feature. A variety of filters are used to remove airborne pollutants, including activated carbon, AAA filters, and stone filters. The structure of the system involves the assembly of a square frame mounted on the collection tank, leading to the air inlet and several layers of filters. The visible process involves aqueous filtration using fine filters to remove dust. The system is designed to provide fresh air to the environment by cleaning an area of 1 to 2 meters around the device.

INTRODUCTION

Air pollution is a big problem in construction sites, illuminated areas and open dusty areas, and pollution can harm workers and neighbors. To solve this problem, our project focuses on creating an air-optimized system that can improve air quality in such places. This report describes the design, construction and operation of air filters.

OBJECTIVE

The main objectives of the project are as follows:

Design and manufacturing of air filters for construction sites, lighting areas and dusty areas.

Used steel (mild) square angle frames as the structural frame for the filtration system.

Equipped with 2 to 4 12V blowers, powered by 12V batteries and solar panel powered.

Integrated humidity and temperature sensors for real-time monitoring and control.

Use a variety of filters to improve air quality, including activated carbon, AAA filters, and stone filters.

Create a filtration system using filter powder to filter water.

For ease use and control Ensure remote operation capability.

SYSTEM DESIGN

The air filter has the following components:

Light Steel Square Angle Frame: provides structural support to the saw machine.

12V blower fans for assist in drawing air into the filtration system.

12V battery for powers the blower fans and is charged by solar panels.

Humidity and temperature sensors for provide real-time data on environmental conditions.

Activated Carbon, AAA Filter and Stone Filter: Removes airborne particles and pollutants.

Water pumps and plastic pipes: Use filter powder to promote water filtration.

Circular collection tank: Collects the filtered air and distributes it to the environment.

Construction and Operation

The construction process involves assembling a 1 x 1 foot, 2 foot high square frame mounted on a round catch tank.

Three-way air intake system is adopted to ensure good air intake. The water filter has many layers, including plastic fiber mesh (difference 1 inch and 0.25 inch), main filter cloth to block dust, and pump with plastic water pipe for filtering.

When operating, first start the water pump to discharge the filter powder and water mixture into the filter cloth. This creates a moist environment that traps airborne particles. After this, the vacuum is started and air is sucked through the filter. Then, the air filter is blown and an area of at least 1 to 2 meters around the system is cleaned.

Fig 1 Existing trolley Structure

Surface Roughness Correlation Constants

Material	k	A	b	c
Aluminum, Black Iron, Stainless Steel	0.00015	0.0425	0.0465	0.602
Galvanized	0.0005	0.0307	0.533	0.612
Flexible Duct	0.003	0.0311	0.604	0.639

k = Roughness factor for the material

Mathematics The important thing when calculating an air purifier is to determine the size of the room and choose the product. The fan size of the air purifier is determined according to the cfm value (cubic feet per minute), and then the air purifier fan is selected according to the cfm value of the room. The cfm of the fan is determined by the speed of the fan. Formulas (1) and (2) are derived from the following formula: CFM = (L x W x H x Q) / 60 minutes (see [9]) □□ (□) L = room length (square feet) W = room width (square feet) H = Room height (square feet) Q = Airflow CFM = 3.1416(PI) as follows: 1) Measure the room to determine CFM L = 1 FT, W = 1 FT, H = 2 FT, Q = 4 CFM = (L X W X H X Q) / 60 MIN CFM = (1 2) Measure fan CFM by fan RPM (revolutions per minute) S = 150 mm = 0.242 ft2, R= 2000 rpm, A = 2 ft CFM = 3.1416(pi) x (0.5 - S) x A CFM = 3.1415 (0.5 - 0.242)

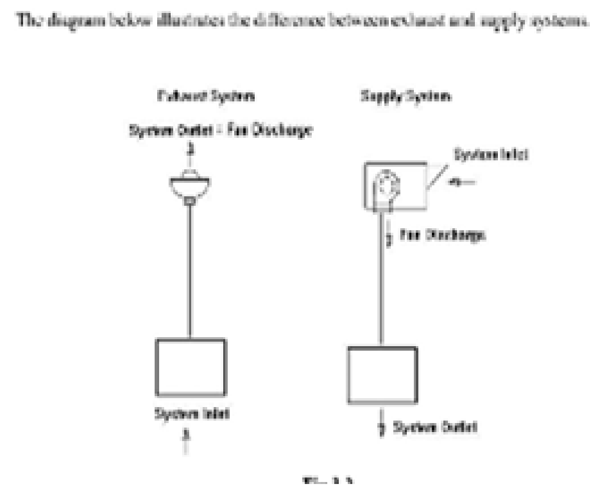


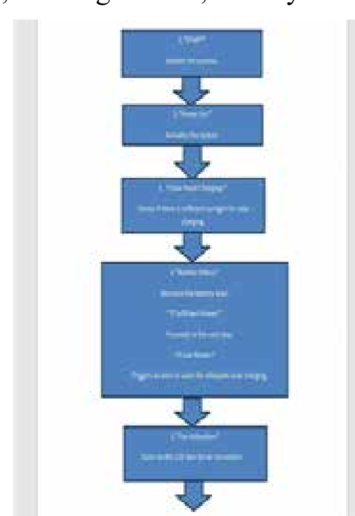
Fig 2 Free body diagram

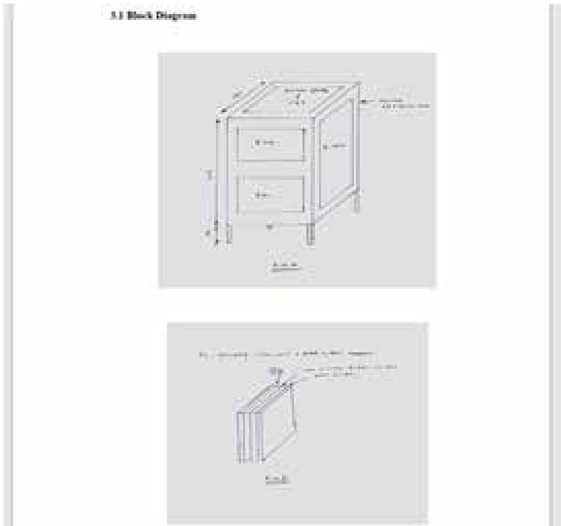
DATA FOR PURIFICATION AIR FILTER

Purifying air filters play an important role in removing dust and pollutants from the air. Filters used in our study include: Pre- and post-filter activated carbon: removes odors and volatile organic compounds (VOCs) from the air, improving air quality and freshness. AAA Filter: This high-performance filter is designed to keep the air clean by capturing fine particles such as dust, pollen and allergens.

Stone Filter: Use porous stone to capture large particles and debris and prevent them from entering cleaning equipment.

These filters work together to remove various pollutants from the air, creating a clean, healthy home.





When calculating the size of an air purifier for a room, there are several factors to consider to ensure good air purification. Here are the important steps

Determine the Room Size

Measure the length, width and height of the room in feet. Add these dimensions together to calculate the total volume of the room in cubic feet (ft^3).

Calculate Air Changes per Hour (ACH)

ACH refers to the number of times an air filter cleans the air in a room per hour. The recommended ACH for residential areas is generally between 4 and 6, although higher ACH values may be needed for sensitive areas or where air quality is important.

Formula for calculating ACH

ACH

= Airflow Rate (CFM) Room Volume (ft3)×60

ACH= Room Volume (ft 3) Airflow Rate (CFM)

×60

Determine the Clean Air Delivery Rate (CADR)

CADR is a measure of how well an air purifier removes harmful airborne particles such as dust, pollen and smoke. It is usually measured in cubic feet per minute (CFM).

Selecting the Air Purifier

Choose an air filter with a CADR rating that is appropriate for the room size and needs ACH. The CADR must be equal to or greater than the volume of the unit that equals the required ACH.

CADR

≥

Room Volume (ft 3

)

×

Desired ACH CADR≥Room Volume (ft 3

)×Desired ACH

Multilayer filters can be used in conjunction with other cleaning methods to effectively remove and remove dust from the atmosphere. This is a very technological approach to achieving clean air:

Pre-Filtration:

Install a filter in front of the air filter intake to capture large particles such as dust, hair, and lint. These pre-filters help extend the life of the filter element by preventing it from becoming clogged with large debris.

High-Efficiency Particulate Air (HEPA) Filtration:

Add a HEPA filter to your cleaning routine. HEPA filters; Effectively captures particles as small as 0.3 microns, including dust, pollen, mold spores and pet dander. For maximum efficiency, make sure the air purifier is getting enough air through its HEPA filter.

Activated Carbon Filtration:

The integrated activated carbon filter absorbs gaseous pollutants, odors and volatile organic compounds (VOCs) found in the air. Activated carbon has a porous structure that captures and removes these chemicals, making the air fresher and cleaner.

Electrostatic Precipitation:

Use electrostatic dust collectors to attract and capture airborne particles. As air passes through the dusty material, the charged paper pulls the dust and other particles out of the air.

Ultraviolet (UV) Germicidal Irradiation:

Incorporate UV-C lamps into the air purification system to disinfect the air by inactivating airborne pathogens such as bacteria, viruses, and mold spores. UV-C light destroys the DNA of microorganisms, rendering them unable to replicate and cause harm.

Negative Ionization:

Use a negative ion generator to release negative ions into the air. These ions bind to dust and other pollutants, weighing them down, and fall out of the air, reducing air pollution.

Ozone Generation (Optional):

Consider adding an ozone generator as an option, especially in environments with strong odors or microbial contamination. Ozone molecules react with pollutants, rendering them harmless and improving air quality. However, due to the health risks of exposure to ozone, ozone generators must be used carefully and in the right place.

Regular Maintenance:

Maintain the cleanliness of your system by regularly cleaning or replacing filters, emptying pans, and making sure everything is working properly. Regular maintenance helps increase efficiency and effectiveness, ensuring long-term effectiveness in removing dust from the air.

Regular maintenance of UV-C lamps is important to ensure efficient and effective operation. Over time, the UV-C light will deteriorate or become less effective and will need to be replaced. Manufacturers often provide guidelines for light replacement times based on use and degradation of UV output. Additionally, cleaning the lamp and surrounding objects helps encourage the spread of UV rays and disinfectants.

In summary, UV germicidal irradiation is an effective way to kill air and space, especially in an environment with microbial contamination. When used correctly and safely, UV-C lamps can improve indoor air quality and reduce the risk of airborne diseases.

CONCLUSION

Designing effective air filters for construction sites and dusty areas is important to reduce air pollution and promote a healthy environment. Using a small frame, 12V blower, solar cells and numerous filters, our system effectively removes pollutants and contaminants, improving air quality in the area.

FUTURE RECOMMENDATION

Future research can focus on optimizing the sensing process, improving the performance of the sensor, and exploring other materials for filter models. Additionally, combining advanced functionality and remote monitoring capabilities can further increase system efficiency and availability.

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Using Silica Fume, GGBFS, and Colloidal Silica as Cementitious Materials, an Experimental Examination of the Strength and Durability of HPC

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ABSTRACT

The rapid growth of urbanization of any country increases the demand of High Performance Concrete (HPC) for Important structure and skyscrapers. Demand of concrete directly affect on demand of Ordinary Portland Cement (OPC) and OPC demand led to environment damage by producing carbon dioxide (CO_2) emission. The CO_2 produced by the cement industry accounts for around 7% of the total CO_2 produced by all other human endeavors. Concrete with superior performance such as strength and durability can need a larger cement concentration but increased cement concentration raises the heat of hydration, causing thermal fractures in the concrete. As a result, the concrete's structural performance deteriorates throughout the structure's life.

Taking into account the long-term drawbacks of more usage of OPC on concrete performance and environment, this study attempts to substitute cementitious materials for OPC. This study carried out by substituting Silica Fume (SF), Colloidal Silica (CS) and Ground Granulated Blast Furnace Slag (GGBFS) for OPC by percentage weight to examine outcomes of these materials on properties of High Performance Concrete (HPC). The workability, compressive strength, water permeability, Rapid Chloride Penetration were experimentally examined for concrete containing SF, GGBFS, CS as cementitious materials for 100% Artificial Sand (AS). The result shows that the SF, GGBFS, CS have a more effective synergistic effect on performance of HPC.

KEYWORDS *: Ordinary portland cement, GGBFS, Silica fume, Colloidal silica, Strength, Durability, High performance concrete.*

INTRODUCTION

The two main environmental problem brought on by carbon dioxide (CO_2) emissions are change in climate and global warming [1,2]. Studies from the past indicate that in cement sector 522 million tonnes of CO_2 were released in 2016 [3,4,]. A most of carbon dioxide emissions are caused by the construction sector, which has a substantial negative influence on the environment [3,5]. The manufacturing of one tonne of cement produces around 0.8 tonnes of CO_2 [5,6]. Researchers from construction sector are always looking for alternative materials to replace cement, either completely or partially [7-8]. Focus has been placed on replacing cement with supplementary cementitious materials like GGBFS and Silica Fume from a decade [9-10].

Millions of tonnes of industrial byproducts are produced, which causes problems with dumping and consequent environmental problems. However, when these byproducts are substituted for cement in concrete, they can somewhat improve the performance of concretes workability, durability, and strength. GGBFS is a glassy, granular residue of blast furnaces used to produce iron and steel. The main contents of GGBFS are SiO_2 (29–39%), MgO (1–17%), CaO (30–52%), and Al_2O_3 (8–24%). Compressive strength frequently increases with increasing CaO content in the slag. The use of GGBFS improves resistance to sulphate and other chemical attacks and enhances resistance to chloride infiltration, reducing the risk of reinforcement corrosion. Additionally, it significantly reduces the possibility of alkali-silica reaction (ASR)-related problems [11,12].

Silica Fume (SF) is a residue that left over when silicon or silicon alloys are produced. The finer particle size of SF fills in the voids between cement particles and enhance packing. Because Silica Fume is highly reactive with calcium hydroxide, which is developed due to hydration of portland cement, it may be possible to substitute small amounts Silica Fume with cement [13,14,15].

Silica Fume with a silicon level of at least 75% that contains 85–95% non-crystalline silica [16,17,18]. Supplementary cementitious materials are now one of the main products used to lower the carbon dioxide emissions during the manufacturing of concrete and may be able to somewhat enhance the concrete's performance [19,20.21,22].

MATERIALS

Cement

The cement used was 53-grade OPC with 3.15 specific gravity. The details of cement are shown in table 1.

Artificial Sand (AS)

From RMC Plant (Navdeep Construction Company), a nearby source, artificial sand (AS) was acquired. It satisfies IS: 383 zone-II standards and was rated correctly. Artificial sand has finer particles of less than 150 micron of 4.70 %, water absorption of 4.6%, specific gravity of 2.62, and FM of 2.93.

Coarse Aggregate

The same RMC plant produced the coarse aggregate used in this study. Metal-1 with maximum size of 10 mm, and Metal-2 of 12 mm.

Water

Concrete was made using easily accessible regular tap water from the laboratory.

Silica Fume (SF)

The particle size of SF was 1.23 micron, and specific gravity of 2.2.

Ground Granulated Blast Furnace Slag (GGBFS)

The GGBFS used was Confirming to IS 16714.

Colloidal Silica

Colloidal silica supplied by Vivek Chemicals, with silica content of 30%.

Polypropylene fibre (PP)

In the investigation, PP with an aspect ratio of 50 and a length of 12 mm were employed.

Superplasticizer (SP)

In this study, the high range water-reducing additive used was Sika Viscocrete 5201. Its specific gravity is 1.12.

Table 1. OPC Cement Chemical components

SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	Na_2O	K_2O	CL	C3A	C3S
20.22	5.68	4.45	62.56	0.80	0.25	0.20	0.006	7.53	49.19

MIX PROPORTIONING

The reference mix for concrete of M60 grade was established as per Indian Standard. 18 different concrete combinations were produced. The 560 kg/m^3 cement with 0.26 w/cm ratio were used for reference mix. The OPC in the reference concrete was substituted with GGBFS at 40%, 45%, and 50%, Silica Fume at 2.5%,5% and 7.5% and Colloidal silica at 1.5%,2% and 2.5%. The mix combination of GGBFS, SF and colloidal silica for HPC is shown in Table 8. To enhance the durability quality of concrete, PP was added to all combinations except the reference mix, at rate of 0.2% by weight of cement.

Mixing Procedure

To create high performance concrete, the water-to-cement ratio was minimised. It is therefore necessary to employ a specific mixing procedure. The current experimental investigation was conducted using the following Procedure:

The mixer was filled with metal M-2, M-1, and M-sand, and it was stirred for a minute. M-2 consisted of particles larger than 10 mm, whereas M-1 consisted of particles smaller than 10 mm.

PP fibre and fine components (cement, SF, GGBFS, and CS) were added to the mixer in accordance with the mix proportioning, and the mixture was stirred for a minute.

After filling the mixer with around 50% superplasticizer and 50% of water, the mixture was stirred for two minutes.

The remaining 50% superplasticizer dose and 50% water were mixed together in pan mixer to create a homogenous concrete.

Despite the fact that the mix design included varying proportions of cementitious components. For 120 mm of workability, the control mix was created. The w/cm ratio of 0.26 was the design value for every concrete mixture. By weight of binders, each combination had 0.52% super plasticizer. The mix percentage employed in the experiment is shown in Table 2.

Specimen Casting and Testing

To avoid moisture affecting the materials, samples were placed in the laboratory at a temperature of 27 ± 2 0C.

Several experiments were carried out to determine the required mix proportion, and the best mix was selected. Pan mixer used to mix the materials to meet IS 12119:1987 standards.

After 28- and 56-days cube compressive strength were measured. The permeability tests were measured at 28 days.

Rapid Chloride Penetration Tests (RCPT) were performed on standard size sample of size 100 mm in dia. and 50 mm thickness.

TEST RESULT AND DISCUSSION

Workability of concrete

The workability of all mixtures was measured in accordance with IS 1199-1959. The workability of fresh concrete for all the mix proportions ware measured by slump cone test. Superplasticizer was utilised in order to increase workability without compromising compressive strength.

The workability of all the samples is shown in table. 2 The mix were designed for slump of 120mm. A 40% substitution of GGBFS for cement resulted in a 140 mm slump value. Whare as the slump increased by 180mm from 140 mm in tandem with the increasing of GGBFS from 40% to 45%, the workability value remained unchanged when the percentage of GGBFS increased from 45% to 50%.

Because of its pozzolanic, latent hydraulic properties and more finely ground than Portland cement the smoother surface of its particles might enhance the lubricating action in the mixture.

Also, it improves the cohesion of concrete mixes so improves workability of concrete. GGBFS allowing for longer workability periods because it reacts slowly with water compared to Portland cement so, this delayed hydration process and extends the setting time.

Slump value for 2.5% replacement of silica fume was determined to be 170 mm, which was less than 50% replacement of GGBFS. Slump value was seen to decrease when ageing increased the amount of silica fume from 2.5% to 5%. For combination of GGBFS and silica fume the slump value shows slightly higher for different replacement percentage as compared with M0 mix.

The reduction in workability observed when cement replaced with SF and with increasing percentage of SF because SF particles much finer than OPC, it has large surface area, so water is largely absorbed by SF particles, these particles tend to occupy the space created by the cement particles in concrete. Due to this particle packing becomes denser and reduces the workability of concrete [14-15].

Like SF, the finer particle size of colloidal silica raises the surface tension of concrete, which minimize the slump value. So, very less slump observes in concrete mix with CS.

Compressive Strength

The concrete strength was measured at 28 and 56 days. The tests were performed according to IS Standard. The samples were cured for normal temperature. The average of three samples were considered. Cementitious materials show the strength variation at both the ages. Table 3 displays the strength of compressed concrete from M0 to M18 at 28 and 56 days. Figure 1 shows comparison of compressive strength.

Except M10, M12 and M18 remaining all concrete mixes achieved designed compressive strength at 56 days. This may be due to when compared to OPC the GGBFS, SF and CS required less water for hydration. Therefore, the w/cm ration of concrete may decrease leads to increase in compressive strength. the additionally formed C-S-H gel filled between concrete matrix this improve more particle packing and it leads to improve compressive strength.

Concrete with 40% GGBFS,2.5 % SF and 1.5% CS gives higher strength compared with other replacement percentage of same group.

Table 2. Mixture Proportions for High Performance Concrete (HPC)

Mix No	Notation	Cement (Kg)	GGBFS (Kg)	SF (Kg)	(CS)	M-Sand (Kg)	CA* (Kg)	w/cm Ratio	SP * (Kg)	PP* (%)	Slump (mm)
M0	Control Mix (M60)	560	0	0	-	583	1226	0.26	2.91	-	120
M1	40GGBFS	336	224	-	-	583	1226	0.26	2.91	0.2	140
M2	45GGBFS	308	252	-	-	583	1226	0.26	2.91	0.2	180
M3	50GGBFS	280	280	-	-	583	1226	0.26	2.91	0.2	180
M4	2.5SF	546	-	14	-	583	1226	0.26	2.91	0.2	170
M5	5 SF	532	-	28	-	583	1226	0.26	2.91	0.2	120
M6	7.5 SF	518	-	42	-	583	1226	0.26	2.91	0.2	105
M7	1.5 CS	551.6	-	-	8.4	583	1226	0.26	2.91	0.2	120
M8	2 CS	548.8	-	-	11.2	583	1226	0.26	2.91	0.2	110
M9	2.5 CS	546	-	-	14	583	1226	0.26	2.91	0.2	90
M10	40GGBFS + 2.5 SF	322	224	14	-	583	1226	0.26	2.91	0.2	200
M11	45GGBFS + 2.5 SF	294	252	14	-	583	1226	0.26	2.91	0.2	180
M12	50GGBFS + 2.5 SF	266	280	14	-	583	1226	0.26	2.91	0.2	140
M13	40GGBFS + 5 SF	308	224	28	-	583	1226	0.26	2.91	0.2	190
M14	45GGBFS + 5 SF	280	252	28	-	583	1226	0.26	2.91	0.2	185
M15	50GGBFS + 5 SF	252	280	28	-	583	1226	0.26	2.91	0.2	180
M16	40GGBFS + 7.5 SF	294	224	42	-	583	1226	0.26	2.91	0.2	140
M17	45GGBFS + 7.5 SF	266	252	42	-	583	1226	0.26	2.91	0.2	130
M18	50GGBFS + 7.5 SF	238	280	42	-	583	1226	0.26	2.91	0.2	130

*CA- Coarse Aggregate, M- Sand- Manufactured Sand, SF- Silica Fume, w/cm- Water to Cementitious Materials Ratio, SP- Super Plasticizer, PP- Polypropylene Fiber

Durability study of High Performance Concrete

One of the crucial characteristics of concrete is its durability, which defines how well it can tolerate different operating and environmental conditions over time without suffering severe degradation. Regarding concrete, durability pertains to the substance's capacity to withstand the impacts of physical, chemical, and biological factors that may cause deterioration.

many governments all over the world not more focus on durability so, importance given to durability by end user it leads to long term negative effect bared by end user.

Water Permeability Test

The water's permeability was conducted in compliance with DIN: 1048 (part-5)-1991. A 150x150x150 mm cube samples was applied a 5 kg/cm2 water pressure for 74 hrs. After that, the samples were taken out and split in to two parts. The Water penetration was measured with the scale. The findings of the depth of water penetrated were shown in Figure 2.

The sample containing replacement of SF content for all the percentage shows comparatively less permeability as compared with control mis as will as other replacement percentage except 45GGBFS+ 2.5 SF replacement.

Permeability test performed at 28 days for different samples. Result shown in table 4. Fig. 2 and 3 shows the depth of water penetrated and result.

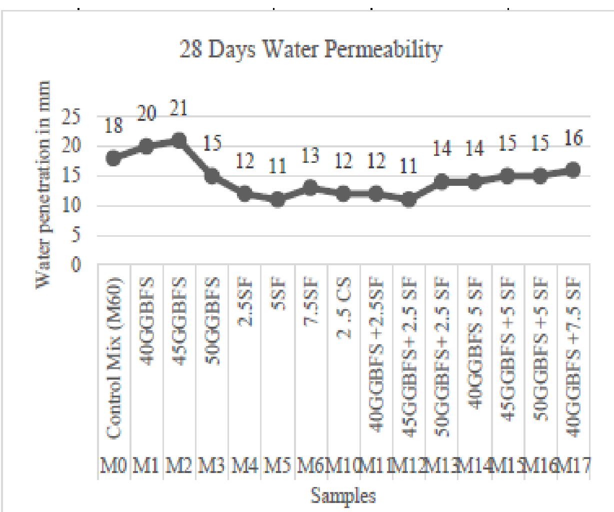

Fig 2. Water Permeability for Different Sample at 28 Days

Table: 3 Compressive Strength of Concrete

Sr. No	Cementitious material Percentage	Sample Notation	28 Days Comp. Strength (N/mm²)	56 Days Comp. Strength (N/mm²)
1	Control Mix (M60)	M0	69.14	71.26
2	40 GGBFS	M1	66.59	69.24
3	45 GGBFS	M2	62.79	64.8
4	50 GGBFS	M3	61.91	67.54
5	2.5 SF	M4	71.08	72.53
6	5 SF	M5	66.41	68.8
7	7.5 SF	M6	64.52	69.56
8	1.5 CS	M7	72.15	75.78
9	2 CS	M8	65.07	67.93
10	2.5 CS	M9	55.30	62.22
11	40GGBFS+2.5SF	M10	56.62	58.21
12	45GGBFS+2.5SF	M11	56.10	62.50
13	50GGBFS+2.5SF	M12	48.87	56.89
14	40GGBFS+5SF	M13	62.30	67.33
15	45GGBFS+5SF	M14	56.81	64.55
16	50GGBFS+5SF	M15	56.10	59.82
17	40GGBFS+7.5SF	M16	55.32	62.70
18	45GGBFS+7.5SF	M17	62.30	62.37
19	50GGBFS+7.5SF	M18	56.81	59

Table 4 Permeability test Result

Sample Notation	Mix. Percentage	28 Days Water Permeability in mm
M0	Control Mix (M60)	18
M1	40GGBFS	20
M2	45GGBFS	21
M3	50GGBFS	15
M4	2.5SF	12
M5	5SF	11
M6	7.5SF	13
M10	2 .5 CS	12
M11	40GGBFS +2.5SF	12
M12	45GGBFS+ 2.5 SF	11
M13	50GGBFS+ 2.5 SF	14
M14	40GGBFS 5 SF	14
M15	45GGBFS +5 SF	15
M16	50GGBFS +5 SF	15
M17	40GGBFS +7.5 SF	16

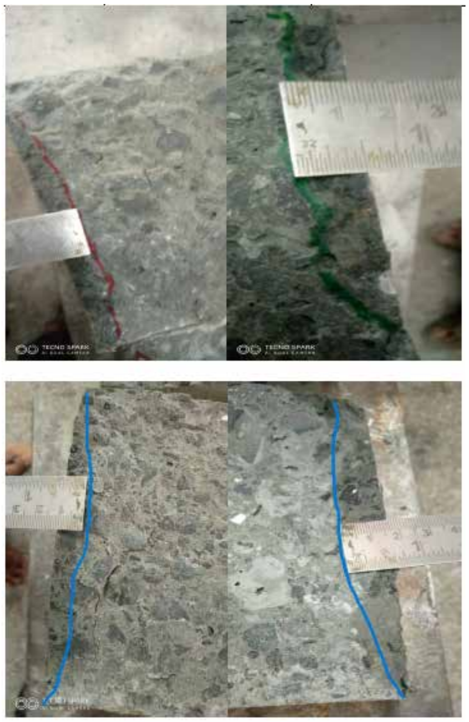

Fig 3. Water Permeability Test sample

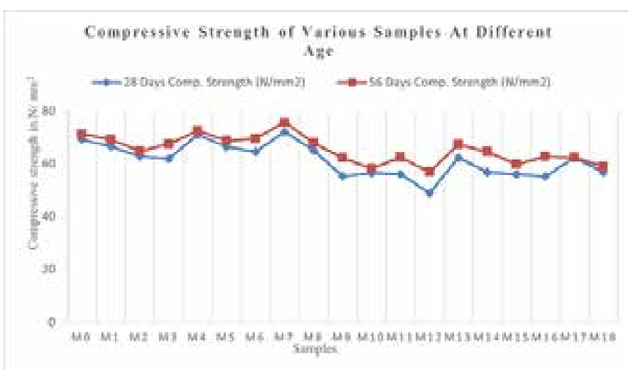

Fig.1.: Cube Compressive Strength over various ages and samples in N/mm²

Rapid Chloride ion Permeability Test

The RCPT Test conducted as per AASHTO T277. In this test, chloride ion penetration through concrete is measured in the form of electrical conductivity of concrete [3]. The fundamental idea behind the test is that more charge may travel through concrete that is more permeable and vice versa. The test finds the amount of charge that passes through a standard sample for 6 hours. The sample is placed into a 3.0% salt (NaCl) solute on one side and the other end is in 0.3 M Sodium hydroxide (NaOH) solution. A constant current of 60V is kept across the sample. The RCPT experiment setup and samples are displayed in Figure.5.

The chloride permeability test was performed for the samples listed in Fig. 5, to understand the performance of different cementitious materials with different combinations. Fig.4 shows the average chare of different samples at 90 days.

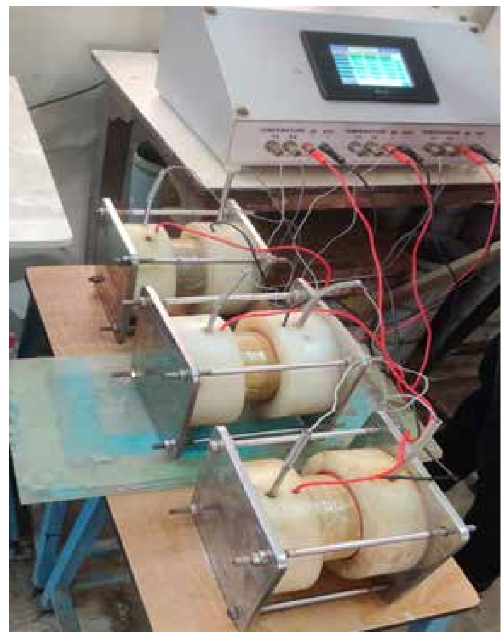

Fig. 4 RCPT Test Setup

Fig. 5 Test samples before and during RCPT Tests

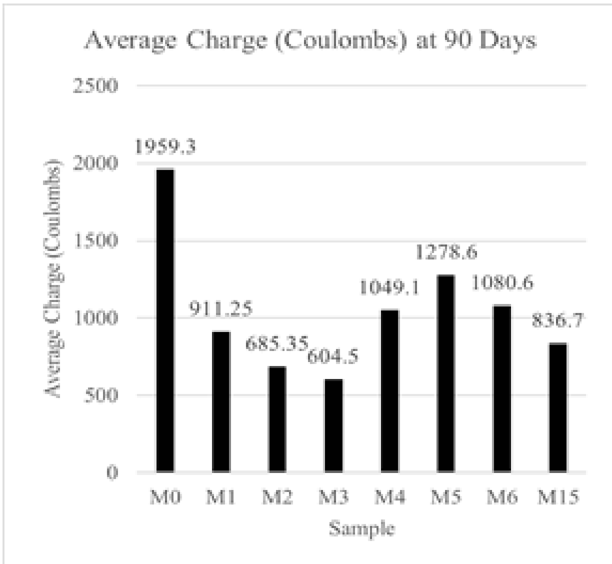

Fig.6 RCPT Tests Result

CONCLUSION

1. HPC with every mixture ratio The compressive strength of each mix was shown to have increased after 56 days as compared at 28 days.
2. M12, M14 and M18 shows less compressive strength even after 56 Days.
3. When GGBFS was substituted for cement at a ratio of 40% to 50%, the compressive strength of the mixture decreased at both the ages but achieved target strength when compared to the standard mix.
4. Compared to the replacement of GGBFS, the compressive strength rose when cement was substituted by 2.5% SF.
5. The slump value grew from 140 mm to 180 mm in tandem with the percentage of GGBFS rising from 40% to 45%. However, when the percentage of GGBFS was increased by 50% again, the slump value remained same at 45% replacement.
6. All of the mixes' water permeability measurements were less than 25 mm, however after 28 days, the permeability value rose when cement was substituted by 40% to 45%.
7. Less permeability were observed when cement replaced with Silica fume
8. Very low chloride permeability observed when cement replaced with 45GGBFS +5 SF

Based on the findings, concrete's performance can be enhanced by adding supplementary cementitious elements, both during the fresh and hardened phases. It is possible to do experimental checks on different durability parameters.

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Synthesis, Characterization & Gas Sensing Study of Palladium Doped and Undoped Zinc Oxide Nanostructures by Hydrazine Method

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ABSTRACT

Hydrazine Method is used to Synthesise Pd-ZnO Nanostructures. The ratio of Pd-ZnO to hydrazine is observed to change the surface structure of Pd-ZnO.hydrazine can also be used to change surface structure of Pd-ZnO. At lower concentration of Zinc Nitrate with Palladium Chloride as compared to hydrazine the Surface Structure of Pd-ZnO is developed to be spherical. After enhancement of the concentration of hydrazine the surface structure is modified from spherical (diameter~100Å) to Different structure containing shapes (dia.~39 nm & length~149 nm). Pd-ZnO microrods are observed for more than 50% of Hydrazine. There are rods of diameter ~ 121 nm and length of about 1µm. For Zinc Nitrate with Palladium Chloride to hydrazine ratio of 1:9 Individual rods are created in Scanning electron microscopy (SEM) for 1:9 ratio. The X-Ray diffraction (XRD) gives the phase formation including size of particle of 38 nm it is found from Sherrer's Formula.Gas sensing analysis is carried out for Palladium doped ZnO be seen most selectivity and efficiency to LPG for temperature range 250^0C to 350^0C

KEYWORDS *: ZnO, Gas sensor, Hydrazine, Palladium chloride.*

INTRODUCTION

Controlled synthesis of semiconductor nanostructures in terms of size and shape has been strongly motivated and novel applications can be investigated depending on their structural properties. Among various semiconductor nanostructures, a variety of nanostructures of ZnO has been investigated presenting it as the richest family of nanostructures. It crystallises in a wurtzite structure and exhibits n-type electrical conductivity. ZnO is nanomaterial with one-dimensional structure, such as nanowires or nanorods, are especially attractive due to their tunable electronic and opto-electronic properties, and the potential applications in the nanoscale electronic and opto-electronic devices .

Zinc oxide has proven itself as one of the competitive and promising candidates to replace expensive materials like CdS, $Ti0_2$, GaN, $Sn0_2$, and In_20_3 for applications such as solar cells , photocatalysis , ultraviolet laser , transparent conductive oxides , spintronics , and gas sensors . For gas sensor application, SnO_2 has been the most investigated material. However, ZnO is particularly applicable to gas sensors because of its typical properties such as resistivity control over the range 10^{-3} to 10^{-5} cm, high electrochemical stability, absence of toxicity, and abundance in nature. ZnO gas sensors have been fabricated in the form of powders, pellets, thick and thin films.

The most important aspect for an ideal sensor is to have

3 'S', i.e. sensitivity, selectivity, and stability. Many reviews on current research status of sensors based on various new types of nanostructured materials such as nanotubes, nanorods, nanobelts, and nanowires are available. These nanostructure-based sensors represent a powerful detection platform for a broad range including biological sensors, electrochemical sensors, gas sensors, optical sensors, pH sensors, orientation sensors,etc. The sensing devices include individual nanostructured sen-sors, multi-nanostructured sensors, MOSFET-based sensors and nanostructured film sensors. These nanosensor devices have a number of advantages such as high sensitivity, selectivity, fast response, and recovery time which sets them apart from other sensors available today . Furthermore, development of gas sensors to monitor combustible gases is imperative due to the concern for safety requirements in homes and for industries, particularly tor detection of LPG, which is one of extensively used but potentially hazardous gases, because explosion accident may be caused when it leaks out accidentally or by mistake. So the detection of LPG is necessary for domestic appliances. Many researchers worldwide are tailoring ZnO either in doped or undoped form to be used as gas sensor. Few Researchers reported the synthesis of different morphologies ZnO nanostructures using hydrothermal technique by controlling the content of ethylenediamine (soft surfactant)

Herein we report tailoring of various morphological changes from nanosphere to nanorods in various shapes and to micron rods using controlled hydrazine as surface directing agent .Their gas sensing study has also been carried out at various operating temperature and found to be good reducing gas sensor. The luminescent property of ZnO rods has been investigated extensively for their potential use as photoelectric material.

EXPERIMENTAL WORK

Hydrazine Method:

Various morphologies of ZnO were synthesised by hydrazine method. Hydrazine, a combustible agent, is used in this synthesis. All chemicals used here-in are of Loba chemie, India (AR Grade).A known quantity of zinc nitrate (ZN) was added in double distilled water of 500ml. A white precipitate was formed on the addition of hydrazine also 1% $Pdcl_2$ was added. The concentration ratios of ZN to hydrazine were varied as follows a) 1: 4 and b)1: 9. These solutions were continuously stirred for 45 min and kept for ageing for 5 days. Later these were filtered and dried at room temperature for 24 hand calcined in the furnace at 300^o C and 350^o C for 5 h to remove the organic volatiles and Pd doped ZnO powder was formed .

The structural and particle size determination was done by XRD using copper Kα line with an accelerating voltage of 40 kV. PANalytical Xpert PRO machine was used for the same. The SEM images observed using Leica Cambridge 440 microscope .The gas sensing studies are done to explore the possible application for these samples. The gas sensing study was done for Pd doped ZnO powder by making them as a thin film. For electrical measurement, silver paste contacts were used to form Ohmic contact on the Pd doped ZnO thin film. The powder sample was sonicated in ethyl alcohol to prepare thin film by drop casting method. Weights of materials as per the composition:

Table 1:

% Composition	Wt. of zinc nitrate (grams)
1	37.185
1	37.185
Wt. of PdCl2 (grams)	Wt. of Hydrazine (grams)
0.2216	25.03
0.2216	56.3175

Particle size is calculated by using Scherrer's Formula & it comes out to be around 50 to 80 nm. Particle Size calculated using Scherrer's Formula Dp = 0.9* λ/ß cosθ where λ - X-ray wavelength using Cu-Ka ß- full width at half maximum (FWHM) of the diffraction peak .-Bragg diffraction angle. The lattice parameters are calculated for hexagonal phase of ZnO using.

$$1 / d^2 = \{4/3 (h^2 + hk + k^2) / a^2\} + (l^2 / c^2)$$

RESULTS OF XRD & SEM

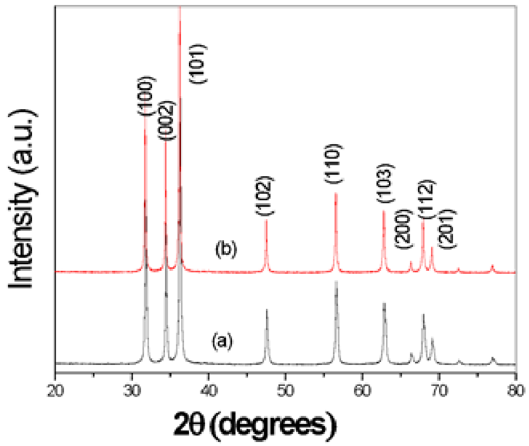

Fig.1:(a) XRD (Pd-ZnO: Hydrazine::1: 4)

(b) XRD (Pd-ZnO: Hydrazine::1: 9)

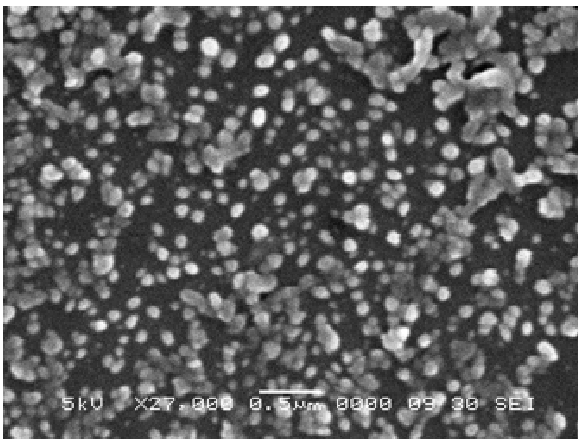

Fig-2a) Pd-ZnO: Hydrazine::1: 4 at 5 KV

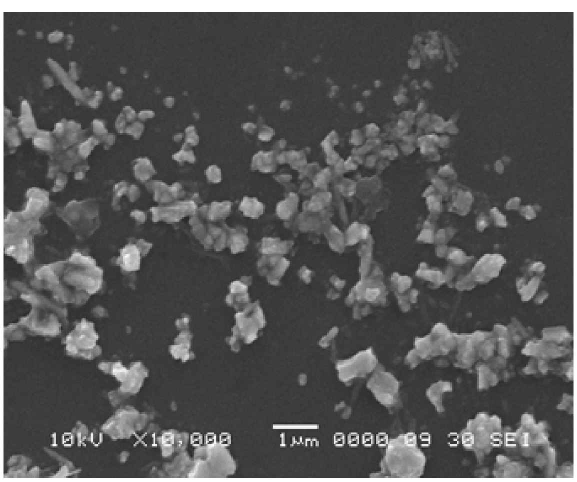

Fig-2b) Pd-ZnO: Hydrazine::1: 4 at 10 KV

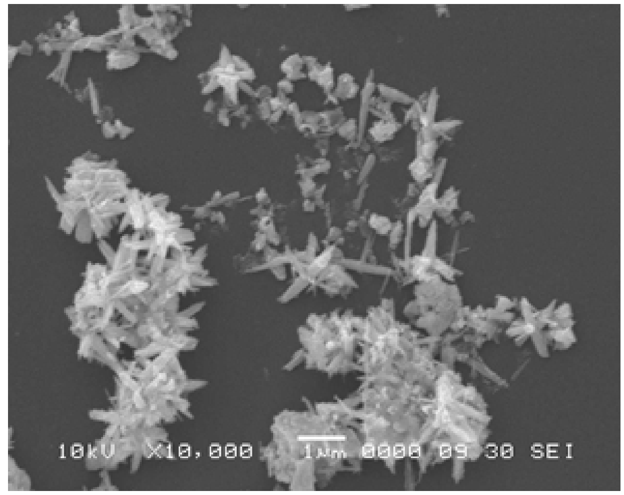

Fig-2c) Pd-ZnO: Hydrazine::1: 9 at 10K V

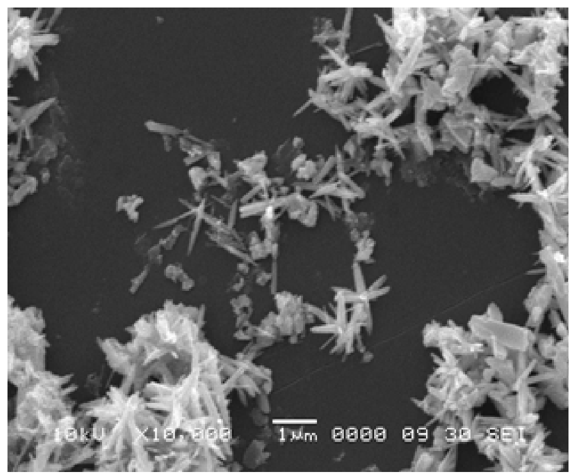

Fig-2c) Pd-ZnO: Hydrazine::1: 9 at 5 KV

GAS SENSING RESULTS

Fig: 3 Graph of Sensitivity Vs Different Gases

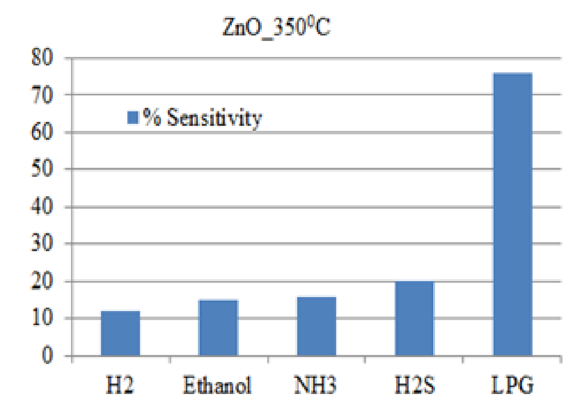

Fig 3a) ZnO_350°C

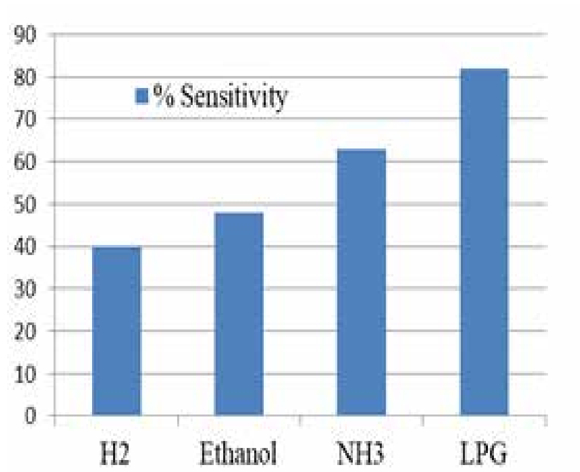

Fig 3b) Pd-ZnO:Hydrazine- 1:4 T=290°C

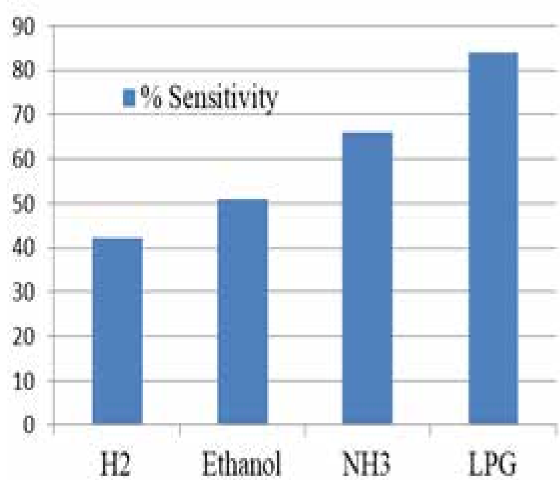

Fig 3c) Pd-ZnO:Hydrazine- 1:4 T=320°C

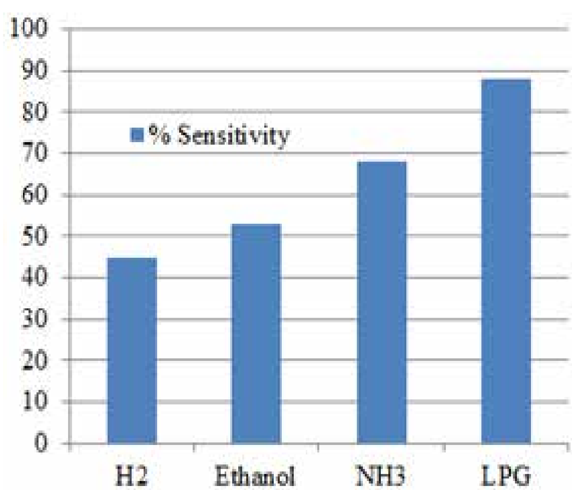

Fig 3d) Pd-ZnO:Hydrazine- 1:9 T=290°C

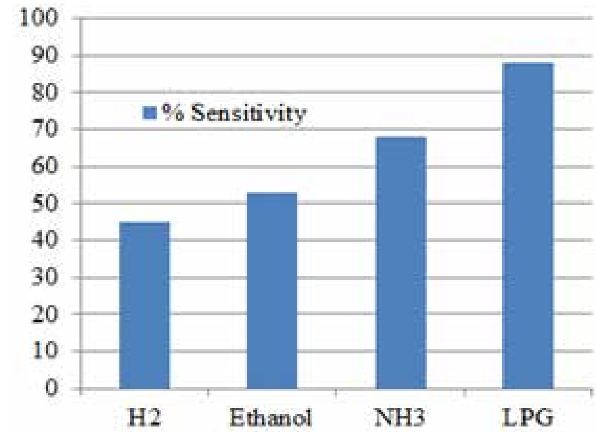

Fig 3e) Pd-ZnO:Hydrazine- 1:9 T=320°C

DISCUSSION & CONCLUSION

Fig. 1 (a) & (b) shows the XRD patterns for the samples having ratio Pd-ZnO to Hydrazine 1:4 & 1:9 after calcining at 300°C. The d line pattern matches the reported values for ZnO in JCPDS 36 -1451.The average crystallite size was calculated using Scherrer's formula, $t = 0.9\ \lambda / \beta \cos\theta$ and was found to be ~40-80 nm. The lattice parameters calculated for hexagonal phase of ZnO using

$$1/d^2 = \{4/3\ (h^2 + h\,k + k^2)\ /\ a^2\} + (l^2/c^2)$$

has been calculated to be a =3.29 A° and c = 5.209 A° which are in close agreement with the reported JCPDS 36-1451.

The possible reaction occurring in the solution is as follows:

$$Zn(NO_3)_2\,.6H_2O + N_2H_4 + PdCl_2 \longrightarrow$$

$$Pd_x\text{-}Zn_{1-x}(NH_2)_2 + NO + NO_3^- + H_2O + 2HCl$$

Fig. 2, a, b, c, d shows the SEM images of Pd doped ZnO with various morphologies. In Fig. 2a distinct spheres of average diameter ~98 nm are seen. Fig. 2b & c indicate random morphology for these powders Fig. 2d shows Star-like structure employing the influence of various ratios of Pd-ZnO to Hydrazine and flower like structure is also obtained. It is interesting to note that in Fig. 2a there is no other morphology except spheres while Fig. 2d does not show any spheroidal form. Fig.2b and c show a non uniform random shape structure of diameter ~500 nm while Fig. 2d shows flower and bud-like structures. It can be seen that for lower concentration of hydrazine the Pd-ZnO is in the nano form without any aggregation. While for high concentration of hydrazine (1:9), Pd-ZnO takes the form of micro-rods without any nanostructures. Thus we say the hydrazine plays an important role in controlling the morphology of our powders. We can say that hydrazine being combustible is also acting as a structure directing agent. It is observed that only the spindles or the typical flower-like structure with the bundles of Palladium doped zinc oxide rods emerge from a single nucleus.very systematically in the pulses giving rise to flower-like structure. This might be facilitated due to the variations in the stirring speed during synthesis. In general, it can be stated that the morphology of the Palladium doped zinc oxide can be tailor made by controlling mainly the ratio of ZN with Palladium chloride to hydrazine and stirring parameters.

The gas sensing studies done for the thin films (for sample with 1:4 and 1:9) are in the temperature range of 250^{o}C to 350^{o}C as shown in fig.3 a,b,c,d,e It was found that only reducing gases were sensed. The reducing gases used were H_2, ethanol, NH_3 and LPG. The response time is of several minutes at 290^{o}C while a large improvement was observed at higher operating temperatures. The samples show a high efficient response towards LPG (200 ppm) as compared with other gases.

The change in electrical resistance was used as a measure for gas response study at various temperatures. The gas response (%S) is calculated as follows:

$$\%S = [\ R_a - R_g \ \text{x}\ 100\ ] /\ R_a$$

where R_a = resistance of the sample in air R_g = resistance of the sample when exposed to gas.

The %S against various reducing gases is shown in Fig. 3 At lower operating temperature samples take longer time to sense the gas while for higher operating temperatures the sensing is fast. Hence we say that 290^{o}C is an optimum temperature where we found to have high sensing response

CONCLUSIONS

1D ZnO rods were synthesised using less hydrazine as a structure directing agent. Controlled ratio of Zinc nitrate to hydrazine is found to give various morphologies of Pd-ZnO. Varying this ratio is found to change the morphology. We have also reported high sensitivity towards LPG which is domestically explosive gas.

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Enhancing IoT Threat Detection through Drift-Enabled Deep CNN Classifier Utilizing Hybrid Search Optimization

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ABSTRACT

These days, the Internet and computer networks are vulnerable to a variety of security risks. It is challenging to implement adaptable and flexible security-related techniques due to the frequent emergence of new threats. An intrusion detection system (IDS) shares similarities with other security tools like firewalls, antivirus programmers, and access control models that enhance communication and information security. One essential tool for protecting computer networks and systems is the network intrusion detection system (NIDS). However, modern networks face a number of challenges regarding the viability and sustainability of current methods. Numerous methods exist for identifying and controlling different security risks within a network. In this research, we present an effective AI-based intrusion detection system (IDS) mechanism for Internet of Things (IoT) systems. We make use of the developments in deep learning algorithms, which have demonstrated their effectiveness in resolving challenging engineering issues. Convolutional neural networks (CNNs) are the tool we suggest employing for feature extraction in order to retrieve pertinent features. The suggested method extracts the precise feature representation of the data using a convolutional neural network (CNN) and then categorises it using an LSTM model. This study employs CNN-LSTM for its intrusion detection procedure. Effective intrusion detection requires a CNN feature extraction procedure. In this case, the Deep LSTM is used to detect network intrusions, and its detection performance is improved through training it with a specially created optimization technique.

KEYWORDS *: Deep learning, Intrusion detection system, Long short term memory, Recurrent neural network,convolutional neural network (CNN)*

INTRODUCTION

The advent of the Internet of Things (IoT) has introduced a contemporary period when a network of computers and gadgets capable of interacting and engaging with each other is driving the development of new business process technologies. The widespread and quick development of cyber security attacks on IoT devices has caused people and companies to face a wide range of challenges pertaining to credibility, enforcement, funding, and business operations. Cloud computing is a concept that provides various services and resources to customers as needed, with minimal involvement between providers and users. It has garnered considerable attention from users and organisations. It is a component of the Internet of Things (IoT) that is responsible for storing data generated by IoT devices. Nevertheless, the process of transitioning to cloud platforms poses a multifaceted challenge due to the presence of diverse operations and security systems. Security is a significant concern in cloud computing technology due to the vast volume of data stored in the cloud. Numerous factors have contributed to the escalation of cyberattacks. The widespread availability and convenient accessibility of hacking tools are key factors contributing to the ease of performing cyberattacks. These tools enable hackers to carry out attacks without requiring extensive knowledge or exceptional abilities.

For many years, the field of computer network security has been the subject of extensive research.

The organization has acknowledged the critical role of information and network security technology in protecting its data. An intrusion or security attack is any attempt, whether successful or unsuccessful, to undermine the integrity, confidentiality, or accessibility of an information resource or its data. Industries encounter a multitude of attacks on a daily basis. The optimal remedy for this issue is to implement an Intrusion Detection System (IDS). Due to their susceptibility to attacks, the widespread use of computer networks and the increasing reliance on web-based businesses have made network and host security a crucial concern. We can categorize attacks as either aggressive or passive. Passive attacks only retrieve confidential data, whereas active assaults manipulate or alter it. Given the inherent vulnerabilities, it is not feasible to completely avoid them and design a system that is entirely secure. Intrusion detection has become a significant challenge. The primary objective of an intrusion detection system (IDS) is to categorise and, in certain instances, analyse attacks. We have devised multiple methodologies or strategies. However, as new assaults continue to emerge, it is necessary to construct more resilient systems..

LITERATURE SURVEY

According to [1]it devised an ensemble adaptive voting technique called RF, KNN, DT, and DNN, and an ensemble MultiTree. A model that uses adaptive ensemble learning techniques. Our model's primary concept is to employ ensemble learning to harness the benefits of various methods. We employ the technique of ensemble learning to enhance the efficacy of detection. Our ensemble model has been demonstrated to significantly enhance the accuracy of detection, as compared to prior research articles.

According to [2]a machine learning system called k-means. The text discusses the clustering algorithm, an alternate way of the support vector machine classification system, and the k-means clustering algorithm. An intrusion detection system (IDS) is employed to identify and detect individuals or entities attempting to breach a network's security. The majority of existing intrusion detection systems rely on a predetermined pattern (signature) that corresponds to recognised attack functions. An inherent drawback of the signature-based technique is its inability to detect novel attacks, including minor modifications to existing vulnerabilities.

According to [3]Machine learning techniques are employed to detect intrusions. In the context of network security and machine learning applications, intrusion detection continues to be of utmost importance. It has significantly enhanced the ability to detect new types of threats. The utilisation of several classifiers, such as hybrid systems and ensemble learning approaches, in recent years has significantly enhanced the accuracy of attack detection strategies. However, it is crucial to tackle the issue of the frequency of incorrect positive and negative results.

According to [4utilises online machine learning techniques for detecting intrusions in IoT networks. Semi-supervised approaches and unsupervised approaches.An architecture designed to optimise resource usage for detecting intrusions in the Internet of Things (IoT). When dealing with a continuous data stream, there are limitations on both time and memory. These limitations then affect the resources available for IoT perception layers. Online learning facilitates effective memory allocation and promotes the utilisation of streamlined, time-saving algorithms for detecting misuse. By utilising informed change detection, models may adjust to evolving network conditions over time, allowing for adaptation to fluctuations in device and network performance as well as emerging threats.

According to [5]a feature learning environment inspired by ensemble methods has been designed to identify network intrusion, utilising multiple machine learning-based classifiers.The rapid rise of network-based applications in today's world necessitates the development of an effective intrusion detection system to safeguard sensitive information from numerous threats and attackers. A network administrator relies heavily on an effective intrusion detection system that can accurately identify and detect any unauthorised access attempts or intrusions originating from the network.

According to [6] the influence of the IoT network's characteristics and the reference dataset utilised in the detection system is taken into account. This dataset classifies the types of attacks that the IDS uses to determine whether or not an intrusion has occurred.

Utilise established and often employed reference databases, such as KDD Cup 99, NSL KDD, and attack datasets acquired from specific circumstances. The algorithmic methods that can be utilised include Support Vector Machines (SVM), Decision Trees, K-Nearest Neighbours (K-NN), Artificial Neural Networks (ANN), Recurrent Neural Networks (RNN), and other more.

According to [7] an initial inquiry into an intrusion detection system (IDS) that utilizes an extreme learning machine and an artificial immune system (AIS-ELM) to detect abnormalities in a smart home network. The Artificial Immune System (AIS) employs the clonal method to optimize the input parameters, whereas the Extreme Learning Machine (ELM) analyses the input parameters to improve the convergence in detecting abnormal activity. The main goal of this study is to apply this technology in a smart home network gateway and combine it with a push notification system.

In [8]an auto-encoding based hybrid unsupervised machine learning strategy is proposed for intrusion detection in Software-Defined Networks (SDNs). The experimental results demonstrate that the proposed module may attain a high level of accuracy while utilising a minimal number of specified flow features. The proposed module employs a hybrid approach, combining an autoencoder (AE) with a random forest (RF) algorithm within the software-defined networking (SDN) environment.

According to [9]Flow-based attributes are employed to detect abnormal behaviour on the network, which may indicate malicious activity. Using flow-based features, this study focuses on detecting hostile behaviour on the network through anomaly-based detection. Four unsupervised approaches are assessed, with two utilising a self-supervised learning approach. The suggested models are evaluated in terms of classification performance and computational complexity using a genuine modern dataset called CIC-IDS-2017, which consists of numerous diverse attack types.

In [10]created an innovative, adaptable, and long-lasting framework for handling network data and building a dependable intrusion detection model using machine learning. An analysis of network traffic spanning five years, amounting to around 20 terabytes of data, uncovered that our methodology has the potential to extend the longevity of our model by up to six weeks. Our concept sustains a consistent accuracy rate for a duration of eight weeks following the training phase, whereas standard models often only remain effective for a period of two weeks.

PROPOSED SYSTEM DETAILS

This section provides a comprehensive overview of our strategy for detecting threats both indoors and outside. The first phase involves extracting user behavior features using the Long Short-Term Memory (LSTM) model and producing feature vectors as output. Next, the feature vectors undergo a transformation to become feature extracts. We input these extracted features into the CNN in the second phase to categorize them as either normal or anomalous.

Modules

Dataset: The system utilizes widely recognized datasets, with KDDCup-99, NSL-KDD, and BoT-IoT. The obtained data is preprocessed using a variety of methods.

Preprocess: The data may contain a plethora of irrelevant information and missing elements. We conduct data preparation to effectively manage this segment. At this stage, we have employed various data pre-processing approaches such as data cleansing, data transformation, and data reduction.

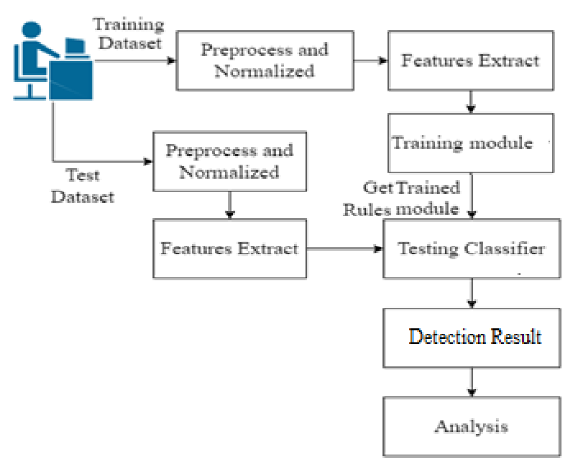

Figure 1: Proposed System architecture

Data cleaning deals with noise, missing information, and other similar issues. We have employed various approaches, such as gap filling or discarding the tuples, to address incomplete data in the information.

Data transformation: We use this technique to transform the data into a format suitable for the mining process. This technique encompasses normalisation, attribute selection, and discretization.

Feature Extraction: This approach extracts a diverse range of features from the supplied data. Afterwards, a feature selection threshold standardizes the extracted features, removing unnecessary and superfluous features for training. We use normalised data, rich in relational features, to extract a wide range of hybrid attributes. The training process entails choosing an optimization approach.

Classification: Ultimately, the system identifies each individual entry, whether it is an assault or a regular occurrence, by employing a supervised classification technique. We employ CNN and LSTM as supervised classification techniques. As a result, the classifier is trained using supervised deep learning.

Algorithm Design

Input: The train dataset contains background knowledge stored by the trained classifier TD[], the test dataset is TestDb[], and the desired threshold is used to validate the present weight.

Output: A Hash_Map is used to store objects that have a similarity weight greater than a specified threshold.

Step 1: Utilise the following function to examine each test object.

$$testFeature(j) = \sum_{j=1}^{n} \left(featureSet[A[j] \ldots \ldots \ldots . A[n] \leftarrow \text{Testing\_Data\_Lits} \right)$$

Step 2: Compute all feature as a one-hot vector or input neuron from test Feature(j) using the equation provided below.

$$\text{Feature\_Extracted\_X[At......n]} = \textstyle\sum_{m=1}^{n} (\text{t}) \leftarrow testFeature \text{ (m)}$$

The variable "Feature_Extracted_X[At]" stores the feature direction specific to the corresponding domain.

Step 3: Utilise the provided function to isolate and retrieve each individual train entity.

$$trainFeature(m) = \sum_{k=1}^{n} \left(featureSet[A[k] \ldots \ldots A[n] \leftarrow \text{Training\_Data\_List} \right)$$

Step 4: Use the function below to extract the best features for a given document object test-Feature(m) from each test set.

$$\text{Training\_Feature\_Extracted\_Y[t......n]} = \textstyle\sum_{x=1}^{n} (\text{t}) \leftarrow testFeature \text{ (m)}$$

The variable "Training_Feature_Extracted_Y[t]" stores the feature vector specific to the corresponding domain.

Step 5: Now, assess each test vector by utilising all the train features and generating a weight for each corresponding instance.

$$score = cal\_Score \text{ (FeatureSetx} \,||\, \sum_{i=1}^{n} \text{FeatureSety[y])}$$

Step 6: Return object [label] [score]

RESULTS

We assess CNN using a dataset of network intrusion detection systems (IDS) with different cross-validation techniques. Figure 1.2 depicts the outcomes. Based on this data, we can infer that fold cross validation yields the highest classification accuracy of 96.10% when utilizing CNN-LSTM.

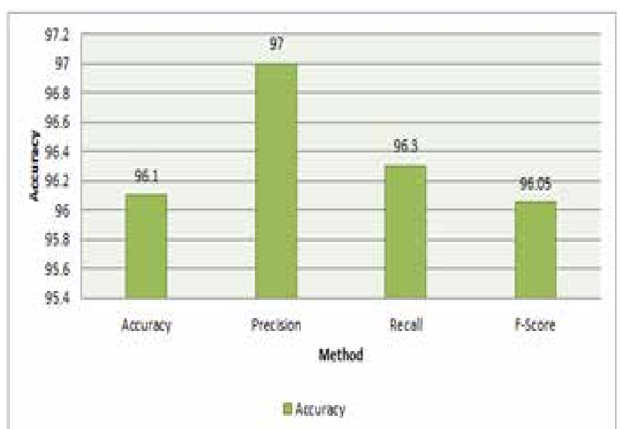

Figure 2: CNN-LSTM with fold cross validation

CONCLUSIONS

Intrusion detection plays a crucial role in enhancing information security, with its core technology being the exact identification of various network threats. This study focuses on developing an intrusion detection system using deep learning techniques. We assess the performance of the proposed CNN-LSTM model using 10-fold, 15-fold, and 20-fold cross-validation techniques. The suggested system is capable of detecting several types of attacks, including denial of service attacks, root-to-login attacks, probing attacks, active attacks, network attacks, passive attacks, and user-to-root attacks. The proposed system has the capability to autonomously generate rules, eliminating the requirement for manual effort in monitoring packets. This work proposes an intrusion detection system (IDS) for IoT devices that utilizes the benefits of deep learning and optimization methods. The implemented system utilises a convolutional neural network (CNN) as a mechanism for extracting features that are pertinent to the input data. The suggested method was put through a series of thorough tests using three datasets for IoT Intrusion Detection Systems (IDS): KDDCup-99, NSL-KDD, and BoT-IoT. This study presents a network intrusion detection method that utilises a CNN-LSTM model, which has proven to be effective. The network detection model gathers input data from the BoT-IoT and NSL-KDD databases, then normalises it to guarantee correct ordering. The process of dimension transformation leverages mutual information. Feature extraction is crucial for efficient detection. This method involves extracting the CNN feature from data that has undergone conversion into a different dimension. Ultimately, we execute intrusion detection by employing Deep LSTM, which we train using the developed CNN methodology. We present a novel deep learning technique by combining the CNN and LSTM algorithms. The Deep LSTM model categorises the data into two groups: authentic users and invaders. Furthermore, by combining an alternative deep learning methodology with an efficient deep learning strategy, we can expand the network intrusion detection model.

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Design and Optimization of Elliptical Leaf Spring Mount for Enhanced Vibration Control

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ABSTRACT

The vibrations produced by engines in agricultural machinery can result in audible noise and discomfort for operators, leading to reduced efficiency and increased fatigue. It is crucial to address these vibrations to enhance operator comfort and productivity. 'Hand-armvibration(HAV)' is a common issue transmitted from machinery into the operator's hands, particularly when using hand-held tools or equipment. Prolonged exposure to HAV can result in permanent adverse effects, which are more likely when such exposure is a significant part of a person's job. This exposure can lead to conditions like 'hand-armvibration syndrome (HAVS)', as well as specific ailments such as white finger and carpal tunnel syndrome. The adverse effects of HAV include circulatory and neural impacts in the hand, manifesting as numbness, pain, and skin discoloration. Addressing these issues is essential for the well-being and comfort of agricultural machinery operators.

KEYWORDS *: Monoleafspring, Engine vibrations, Weight optimization, Hand-armvibrationsyndrome(HAVS)*

INTRODUCTION

The engine mount is a crucial component that connects the engine bracket to the frame in engine applications. These mounts secure the engine to the body, serving key functions such as dampening engine noise and vibration, securely anchoring the engine, and limiting its movement.

Engine vibrations typically stem from irregular combustion pulses within the cylinders and inherent movements in the engine's reciprocating parts. Factors like the number of cylinders, strokes, and engine RPM influence the frequency and intensity of these vibrations. Handheld agricultural equipment, especially those powered by high-speed two-stroke petrol engines exceeding 5000 RPM, often experience pronounced vibrations. These vibrations can lead to discomfort when using hand held or shoulder-mounted machinery like farm sprinklers, hedge trimmers, rotors, and lawnmowers.

While research on damping vehicle engine vibrations is extensive, there is a research gap concerning affordable machinery like handheld agricultural equipment. Efforts are being made to develop a composite half-leaf (C-type) elliptical spring mount and compare its effectiveness with traditional spring mounts used in similar applications.

Various types of engine mounts are available, with rubber mounts, also known as elastomeric mounts, being a common choice due to their cost-effectiveness and simplicity. Rubber mounts are ideal for a wide range of applications, including handheld agricultural machinery, providing necessary vibration isolation and stability.

LITERATURE REVIEW

'Mohammed Mathenulla Sharif ,N. Sreenivasa Babu, Dr. Jaithirtha Rao'[1]

The provided information pertains to an analysis of a glass epoxy reinforced monolithic leaf spring, published in the International Journal of Modern Engineering Research(IJMER) in August 2014. The paper discusses the design and analysis of a composite‘ mono leaf spring’, highlighting its advantages over conventional steel springs, such as a substantial weight reduction, higher natural frequency, increased strain energy storage capacity, and reduced stress.

‘T. Bhanuprasad, A Purushotham’[2]

The paper introduces the concept of leaf springs, highlighting their application in the suspension of wheeled vehicles, and addresses the design and analysis aspects using advanced software tools. The study evaluates the deflection, stress, and vibration characteristics of the two materials and provides critical insights into the potential advantages and challenges associated with the use of composite leaf springs.

‘Ghodake A.P., Patil K.N’[3]

The research paper explores the use of composite leaf springs as a replacement for steel leaf springs in vehicles. It provides an in-depth comparison of the two materials using ‘Finite Element Analysis (FEA)’ and highlights the potential benefits of composite materials such as higher strain energy and significant weight reduction. The study emphasizes the lighter and more economical nature of composite leaf springs, under scoring their promising prospects in the automotive industry.

‘Vijaya Lakshmi, I. Satyanarayana’[4]

The cited study explores the potential of composite leaf springs as a viable alternative to traditional steel leaf springs in vehicles. The research delves into a comparison between the load-carrying capacity, stiffness, and weight savings of composite leaf springs and steel leaf springs. It emphasizes the use of ‘Finite Element Analysis (FEA)’ to understand the behavior of the materials and provides evidence of the benefits of composite materials, including their lightweight nature and cost effectiveness. The study’s findings strongly advocate for the use of composite leaf springs in the automotive industry.

‘Ram Krishna Rathore, Edward Nikhil Karlus, Rakesh L. Himte’[5]

The research study investigates the potential of using composite leaf springs instead of steel leaf springs in vehicles. It compares the load-carrying capacity, stiffness, and weight savings of both types of leaf springs, employing ‘Finite Element Analysis (FEA)’ to assess their behavior. The study advocates for the use of composite materials due to their light weight and cost-effective nature. It also presents a detailed comparison of different types of composite leaf springs, emphasizing their performance under various conditions. This research provides valuable insights into the potential advantages of composite leaf springs in the automotive industry.

‘S. Rajesh, G. B. Bhaskar’[6]

The studies focus on the optimization of ‘mono parabolic leaf springs’ using shape parameters to reduce mass while controlling stress and deflection. The research explores the use of ‘ANSYS’ 15.0 for optimization and employs the “Adaptive Single Objective” algorithm. By utilizing this approach, there search successfully achieved a significant reduction in mass, stress, and deflection, showcasing the benefits of shape optimization. Additionally, the study includes references to various industry sources and prior research on similar topics.

‘R D V Prasad, P. Venkatarao’ [7]

The study thoroughly explores the weight optimization of ‘mono leaf springs’, encompassing material investigations, fabrication processes, analysis, and comparative assessments. The research entails structural analyses, feasibility testing, and validation, highlighting the potential of composite materials in automotive suspension applications. By effectively reducing deformation and weight, there search suggests the suitability of composite materials for automotive suspension.

VIBRATION ANALYSIS RESULTS

Table. 1: Testing Result of Conventional Rubber Mount using Vibration Analysis

Sr	Weight (gm.)	Engine Speed (rpm)	Acceler-ation. (mm/s^2)	Freq (Hz)	Amplitude or Displ. (mm)
1	1500	1315	315	415	0.47
2	2000	1275	356	408	0.99

3	2500	1245	372	417	0.93
4	3000	1205	394	426	1.77
5	3500	1185	410	434	1.33
6	4000	1155	427	444	1.55

Table. 2: Testing Results of Elliptical Leaf Spring without Centroidal Leaf(C-type)spring ('SS-314')using Vibration Analysis.

Sr	Weight (gm.)	Engine Speed (rpm)	Acceler-ation. (mm/s^2)	Freq (Hz)	Amplitude or Displ. (mm)
1	1500	1315	256	367	0.46
2	2000	1275	264	372	0.98
3	2500	1245	276	380	0.92
4	3000	1205	281	376	1.16
5	3500	1185	288	384	1.32
6	4000	1155	291	389	1.54

Table. 3: Testing Results of Elliptical Leaf Spring with Centroidal Leaf(C-type)spring (SS-314)using Vibration Analysis.

Sr	Weight (gm.)	Engine Speed (rpm)	Acceler-ation. (mm/s^2)	Freq (Hz)	Amplitude or Displ. (mm)
1	1500	1315	231	330	0.44
2	2000	1275	238	335	0.96
3	2500	1245	249	342	0.90
4	3000	1205	253	339	1.14
5	3500	1185	259	346	1.30
6	4000	1155	262	351	1.52

Table. 4: Testing Results of Elliptical Leaf Spring without Centroidal Leaf(C-type)spring(EN-48 D)using Vibration Analysis.

Sr	Weight (gm.)	Engine Speed (rpm)	Acceler-ation. (mm/s^2)	Freq (Hz)	Amplitude or Displ. (mm)
1	1500	1315	208	297	0.42
2	2000	1275	215	302	0.94
3	2500	1245	225	308	0.88
4	3000	1205	228	306	1.12
5	3500	1185	234	312	1.28
6	4000	1155	236	316	1.50

Table. 5: Testing Results of Elliptical Leaf(C-type) spring with Centroidal Leaf Spring(EN-48D) Vibration Analysis.

Sr	Weight (gm.)	Engine Speed (rpm)	Acceler-ation. (mm/s^2)	Freq (Hz)	Amplitude or Displ. (mm)
1	1500	1315	187	268	0.40
2	2000	1275	194	272	0.92
3	2500	1245	201	278	0.86
4	3000	1205	206	276	1.03
5	3500	1185	211	281	1.26
6	4000	1155	213	285	1.48

CONCLUSION

The system's efficiency is assessed by comparing an elliptical spring mount made of 'EN48D' and 'SS-314' components. The evaluation will combine hypothetical predictions with real-world observations to draw conclusions.

Further assessments will be carried out to analyze the vibration characteristics using rubber mounts and leaf springs. Comparative observations show that vibrations are less pronounced in the leaf spring than in the vibration mount. Additionally, the presence of a centroidal axis in the leaf spring leads to reduced vibrations compared to a leaf spring that lacks a centroidal axis.

ACKNOWLEDGMENT

I extend my heartfelt gratitude to my esteemed professors, mentors, and industry experts in the field of mechanical engineering, particularly in the domain of 'Design, Development & Analysis of Elliptical Leaf Spring Mount Vibration Isolation.' Their guidance, knowledge sharing, and support have been in valuable in shaping this research endeavor. Their dedication and expertise have been instrumental in enhancing my understanding and contributing to the advancements in this specialized area of study.

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Design, Analysis & Optimization of Relation Gauge for Handle Holder

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ABSTRACT

Gauges are tools that measure the size and form of numerous pieces. Gauges are interchangeable and serve a crucial part in any volume manufacturing system. Various types of inspection techniques make use of a CMM (coordinate measuring machine) and gauges. A gauge is a used to measure different components. Gauges are single-size, fixed-type measuring instruments. This effort concentrates on item inspection. A relationship gauge is a gauge with an inner measuring surface used to determine the male portion's size and counter. The gauge is developed in compliance with standards that ensure the dimensions are precise. Gauge is mostly used in the industry to inspect dimensions during mass production. It greatly decreases the time required validating product authenticity within defined dimensional tolerances. The gauges are designed to replace the frequent use of expensive measurement devices. In this study CATIA software is used for the design. The distribution of stress intensity has been found using the Von- mises yield principle. The proposed model outperforms the existing gauges in the term of result.

KEYWORDS *: Design, CATIA , Gauge, Inspection, Manufacture, Relation gauge.*

INTRODUCTION

Every company's fundamental requirement is the inspection after manufactured any part or product. A gauge or gage is a tool in technology and engineering that measures or displays positive data, such as time. A gauge, depending on its application, might be conceived of as a tool for measuring a physical quantity such as thickness, hole area, or material diameter. The dimensions of a manufactured part must be checked after processing to ensure that they are within the tolerances specified in the part design .Universal measuring equipment, such as micrometers, vernier calipers may measure parameters for less production, and gauges for mass production . Gauges represent the size as well as shape of the feature to be confirmed. Gauges can also be used to locate two workpiece features in relation to one another. This project's design is carried out using CATIA V5 software. Hyper mesh is utilized for pre-processing chores like as meshing and determining static loading conditions, while Ansys is used for finite element analysis to perform static analysis on the trolley. The Von-Mises yield concept was utilized to estimate the distribution of intensity of stress. We may then encourage our industry to adopt a better one and validate it once the theoretical and CAD software data have been verified. As a result, given our stated goal, further optimization is preferable.

LITERATURE REVIEWS

Santosh Hiremath et.al(2016) has research on the paper of "Design and FEA Analysis of Fixture for Multitasking operations". The approach improved the efficiency and dependability of fixture design, making the outcome more reasonable. This strategy can help to minimize the cycle time required for part loading and unloading. To meet the multi-functional and high performance fixturing requirements.

Deshmukh Santosh et.al(2019) has research on the paper of "Design and Detailing of Inspection Fixture" . The reception gauge was specifically designed and built for inspection purposes. It measures the job very accurately and exactly according to the job norms and specifications. It can be utilized both in the metrology area and on the manufacturing floor.

OBJECTIVES

The project aims to find out problems solutions regarding more cost, low accuracy, more inspection time, low productivity etc.

- To study & find out theoretically as well as analyze the result of stress & deflection of handle holder as per our requirement.
- According to existing results find out which factors or which points we must consider for the new redesign gauge, to meet our optimization factors.
- Hence the main purpose is to minimize the overall cost of gauge, more reliable, easy-to-be handling purposes as well as optimize inspection time.

METHODOLOGY

The following process has been to optimize the inspection time while checking the handle holder. Significant literature research is required before applying the finite element approach to the design of relation gauge ; therefore, the primary area of concentration after reading the literature is the current design that needs to be concentrated.

The concept is executed using a few literary allusions. First, the current gauges which is stable under the current loading conditions, is examined for its safety factor. It turns out that the safety factor is significantly higher. Therefore, the primary goal is to optimize the time while checking the handle holder and increase accuracy.

EXISTING GAUGES USED IN INDUSTRY

The various gauges like plug, pin, snap, caliper gauges used in industry for checking or inspecting handle holders dimensions such inner diameter , outer diameter .height , center distance between two holes as well width of the holder

NEW RELATION GAUGE DESIGN DATA

Material Selection-

- H13 Tool Steel
- C40 Carbon Steel

Design Calculations

Weight of one piece of handle holder = 600 gm ,

Material of handle holder = Aluminum LM24

The below figure show that side view of TVS handle holder.

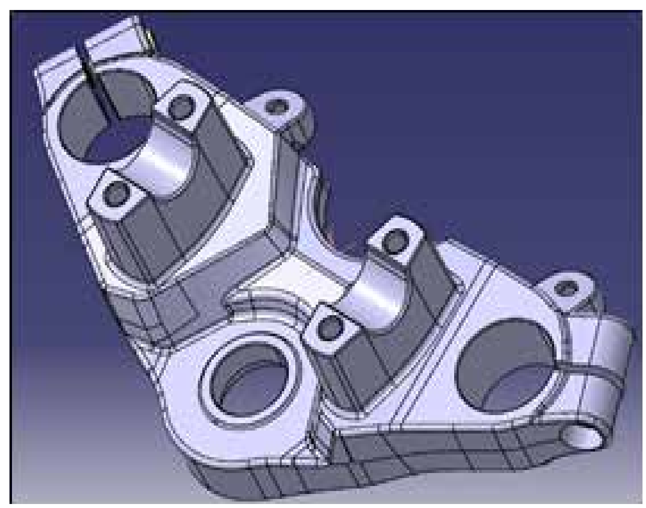

Fig 1 Side view of TVS handle holder

A total number of handle holder checked in single day

= 1000

The time taken checked one handle holder = 2 minutes

A total number of Handle holder checking time

= 1000 X 2 min.

= 2000 min = 33.33 hours

Required person for checking handle holder = 4 Person

Holes checked with the help of GO gauges and center distance checked with the help of caliper gauges same as traditional gauges.

We need to all gauges in one setup. So we design a relation gauge in that GO gauges are mounted on certain distance which is required to checked Diameters of handle holder.

Center Distance = 91 mm from center (left & right side) For large two holes and 49 mm from center (left & right side) for small four holes.

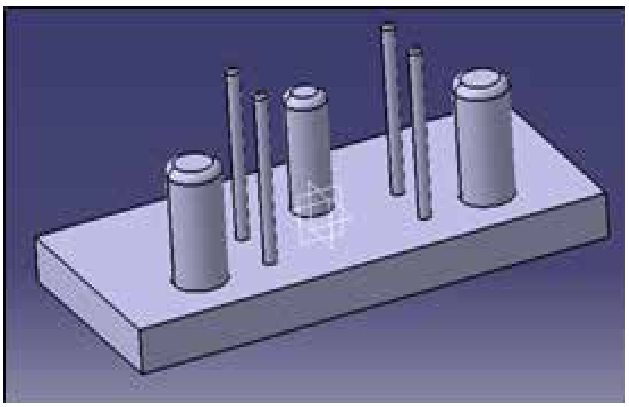

Fig 2. Isometric view of Relation Gauge

The above figure shows that the seven GO gauges are mounted in certain diameters as we required while checking the handle holder.

Diameters A,B,C,D,E,F,G,H,I,J,K,L,M,N are 33,29,25.5,21.5,33,29,8,6,8,6,8,6,8,6 mm respectively.

External manual mass up to 40 kg.

Force = Mass X Acceleration

= 40 X 9.81 = 392.4 N

Consider 400 N force applied while checking handle holder.

Consider ,

External applied force up to 400 N.

Factor of Safety = 2.5

So External applied force = 1000 N while checking the handle holder with relation gauge.

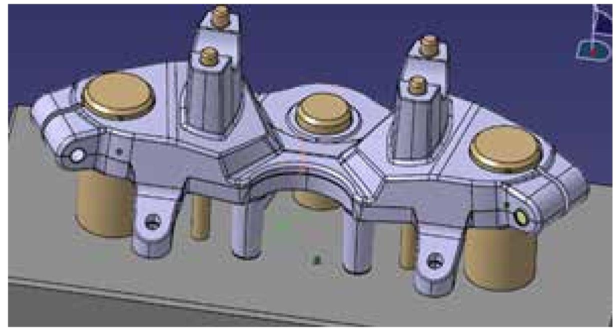

Fig 3 Assembly view of handle holder with relation gauge

The above figure shows that the assembly view of handle holder with relation gauge when fitment us done.

Analysis of relation gauge

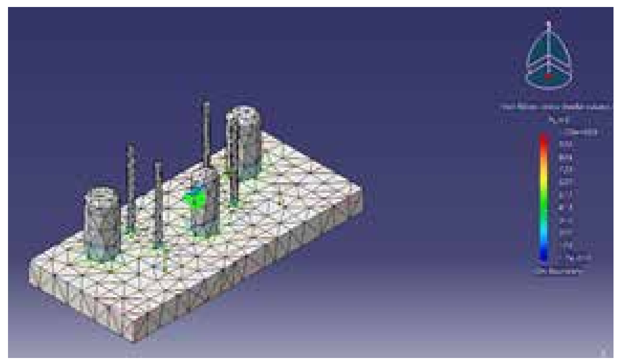

Fig 4 Octree tetrahedron mesh

After that we applied 1000 N force on our relation gauge in software and check our design is safe or not as per our factor of safety. Considering all parameter regarding to design relation gauge like FOS ,material selection etc. our design is safe is shown in below figure. This figure shows the analysis result of relation gauge when we applied 1000N load on it.

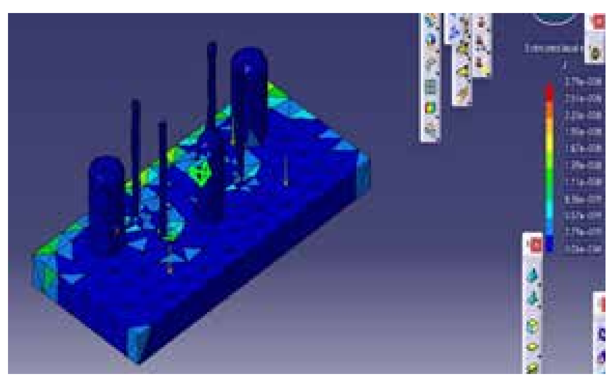

Fig 5 Analysis result of relation gauge

Fig 6 Manufactured Relation gauge

The above figure shows that the relation gauge is after manufacturing process. After that it is ready to checked handle holder in single pass.

RESULTS AND DISCUSSION

As per our methodology, we have firstly studied on existing gauges used in industry. After that find out the theoretically force as per our require load. After that studied on the meshing of relation gauge in software. Studied loading conditions, usable material as well as boundary conditions.

Hence we can say that accuracy is increases while fitment is done. There is no chances to scrap any single handle holder or there is no error while checking the handle holder while assembly line. cost is reduced as compared with the existing gauges, which is near about INR 30000 per year. In that gauges are wear and tear after used. Then after some time we need to calibrate the gauges. The cost of relation gauge INR 18000 which is less. This design will benefit the existing use, and based on the requirements of TVS handle holder, it provides an additional benefit.

CONCLUSION

Theoretical and analytical design optimization is performed. This study, design and optimization methodology are used to get better results with the provided design in less time .Looking at the results, it is evident that the new design outperforms the current model. The main purpose of minimizing the overall cost of relation gauge in single setup, the new relation gauge cost is 60% reduces from existing gauges also easy-to-be used for skilled as well as unskilled worker, Also accuracy increases between center distance & their diameters.

The use of relation gauge all parameters checked within 20 second . Therefore for checking one job time reduces is 1min 40 seconds so indirectly productivity also increases, manpower reduces, achieve exact dimensions, zero error so that there is no scrap.

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Night Shift Management on Construction Site

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ABSTRACT

Managing night shifts on construction sites presents unique challenges and requires a specialized approach to maintain productivity and ensure the safety of workers. This abstract explores the key aspects of effective night shift management in the construction industry. The focus is on prioritizing safety measures, efficient task planning, effective communication, and compliance with regulations. The abstract delves into the critical considerations required for a successful night shift operation. It discusses the necessity of adequate lighting to ensure visibility and safety, the significance of meticulous planning to schedule tasks optimally during night hours, and the essentiality of clear communication and coordination between night shift workers and daytime management. Furthermore, the abstract highlights the importance of workforce well- being and compliance with regulatory requirements. It addresses security challenges and the adoption of technological advancements to enhance safety and efficiency during night shifts. The culmination of these elements contributes to a comprehensive understanding of the multifaceted approach required for effective night shift management on construction sites, ensuring a seamless and safe operation, optimal productivity, and worker well-being.

INTRODUCTION

Night shift management on a construction site involves a comprehensive approach to ensure the effective and safe continuation of construction activities during non-traditional working hours. The theory behind managing night shifts in construction encompasses various critical aspects. It involves meticulous planning, adequate resource allocation, and the implementation of robust safety measures to optimize productivity and maintain a secure working environment. One key aspect of this theory is strategic scheduling and logistics. It involves careful planning of tasks, equipment usage, and manpower allocation to maximize productivity during the night shift. Efficient scheduling ensures that critical and less disruptive tasks are appropriately as- signed during these hours, enabling continuous progress without hampering the project's timeline. Moreover, the theory emphasizes the importance of adequate illumination and visibility on the construction site during the night shift. Effective lighting is crucial for maintaining safe working conditions and reducing the potential for accidents or errors. Utilizing high-quality lighting systems, reflective materials, and properly lit work areas is paramount in ensuring worker safety and quality workmanship. Addition- ally, night shift management theory emphasizes the need for effective communication and coordination. Ensuring clear lines of communication between night shift workers, supervisors, and day shift teams is essential for maintaining workflow continuity, addressing issues promptly, and ensuring a seamless transition between shifts. Further- more, implementing stringent safety protocols and procedures is integral to the theory of night shift management on construction sites. Emphasizing the adherence to safety regulations, providing adequate training, and regularly inspecting and maintaining equipment promotes a safe working environment during non-standard working hours. Ultimately, the theory of night shift management on construction sites revolves around strategic planning, efficient resource utilization, emphasis on safety, and effective communication. By incorporating these elements, construction projects can run smoothly and productively during night shifts, ensuring the project progresses without compromising safety or quality.

LITERATURE REVIEW

I. "Accelerated Project Timelines: Many researchers have pointed out that night shift construction can significantly speed up project timelines. This can be especially beneficial for projects with tight deadlines or when there are financial incentives for early completion (e.g., Alsih and Alwan, 2016).

II. " Safety Benefits": Night shift construction can enhance worker safety by avoiding extreme daytime temperatures and reducing the risk of heat-related illnesses. Addition- ally, fewer pedestrians and vehicles on the construction site during the night can contribute to a safer working environ- ment (e.g., Liu et al., 2020).

III. "Quality Control and Productivity": Some studies have indicated that night shift workers may be more focused and attentive to detail due to reduced distractions. This im- proved focus can lead to better quality construction work (e.g., Gu et al., 2017).

IV. Compliance with Noise Regulations: Researchers have highlighted the significance of night shift management in adhering to noise regulations. Many urban areas have re- strictions on daytime construction noise, and nighttime construction can help companies comply with these regulations (e.g., Arslan et al., 2019)

V. "Environmental Considerations": In ecologically sensitive areas, night shift construction can help minimize the environmental impact of construction activities. This is especially important for preserving nocturnal wildlife and ecosystems (e.g., Palk et al., 2020)."

VI. "Cost Savings": Some studies have found that night shift management can lead to cost savings. These savings may result from reduced labor and equipment costs, increased project efficiency, and faster completion (e.g., Abdi et al., 2018)

VII. "Challenges and Concerns": Several authors have pointed out challenges associated with night shift construction, such as increased labor costs, light and noise pollution, worker fatigue, and limited support services during nighttime hours (e.g., Harrell and Erickson, 2014).

METHODOLOGY AND IMPLEMENTATION PROCESS

The methodology for implementing night shift construction involves careful planning, coordination, and adherence to safety and regulatory guidelines. Below is a general outline of the key steps and considerations for effective night shift construction:

1. Project Planning and Scheduling: Establish clear project objectives, including the reasons for choosing night shift construction. Create a detailed project schedule that includes tasks to be performed during the night shift and aligns with project milestones. Identify critical activities that can benefit from night shift work, considering factors like noise restrictions and community impact.

2. Regulatory Compliance: Review local regulations and ordinances related to nighttime construction work, including noise and lighting restrictions. Obtain the necessary permits and approvals from local authorities, if required. Ensure compliance with labor laws and regulations related to night shift work, including rest breaks and overtime pay.

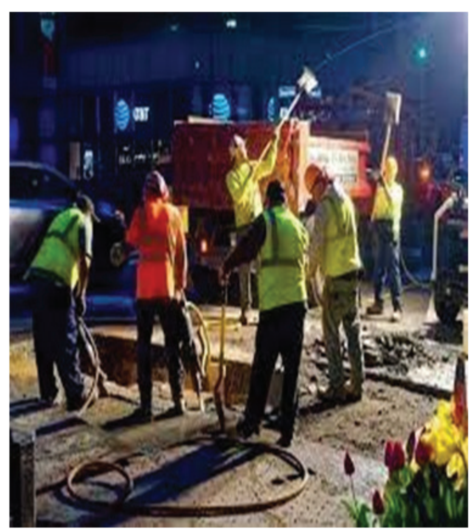

Figure 1. Night Shift Work

3. Stakeholder Communication: Communicate with project stakeholders, including the client, subcontractors, and the local community, about the decision to implement night shift construction. Address concerns and expectations from the community and nearby businesses. Establish a point of contact for addressing any complaints or issues during the night shift.
4. Lighting and Visibility: Implement adequate and appropriate lighting for the construction site to ensure worker safety and visibility. Use energy-efficient lighting options to reduce light pollution and minimize the impact on the surrounding area. Consider using portable lighting towers to illuminate specific work areas.
5. Noise Control: Employ noise control measures to minimize disruptions to nearby residents and businesses. Use quieter equipment and machinery, and implement noise barriers or enclosures where possible. Schedule noisy activities during the day when permissible.
6. Safety Measures: Conduct a safety assessment for night shift work and identify potential risks associated with reduced visibility. Provide adequate safety training to night shift workers, emphasizing the importance of vigilance. Ensure that all safety equipment and procedures are in place and followed diligently.
7. Labor Management: Recruit and retain a skilled work- force for the night shift, considering the availability and preferences of workers. Offer appropriate compensation, such as shift differentials, to attract and retain night shift personnel. Establish clear work schedules and rotations to manage worker fatigue.
8. Quality Control and Supervision: Maintain strong supervision and quality control throughout the night shift construction. Implement regular inspections to ensure work meets quality standards. Address any issues or deviations promptly to avoid project delays.
9. Logistics and Support Services: Ensure the availability of support services, such as material suppliers and equipment maintenance, during nighttime hours. Coordinate logistics for the transportation of materials and equipment to the construction site.

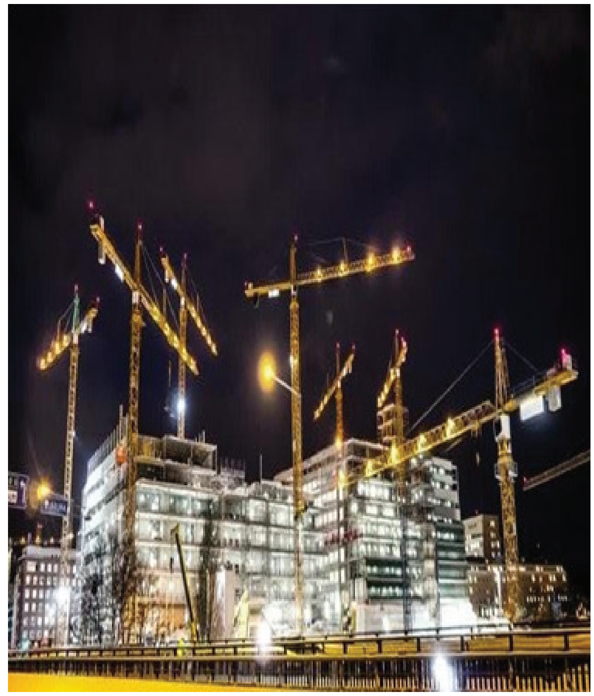

Figure 2. Working tower and Cranes

CONCLUSION

In conclusion, night shift management in the construction industry offers a valuable solution to various challenges and project requirements. When executed effectively, it can lead to several advantages, including reduced disruption to the surrounding community, accelerated project time- lines, enhanced safety, and improved quality control. How- ever, it is essential to acknowledge and address the as- sociated disadvantages and challenges, such as increased labour costs, potential fatigue and safety concerns, and regulatory compliance. Successful night shift management hinges on meticulous planning, clear communication with stakeholders, adherence to regulatory requirements, and a commitment to safety, quality, and community relations. It is not a one-size-fits-all approach and must be carefully tailored to the specific project and its context. As construction projects continue to evolve and diversify, night shift management will remain a valuable tool for meeting the demands of complex projects in urban areas, meeting tight deadlines, and mitigating disruptions to the community.

Ultimately, its success lies in its ability to balance productivity, safety, and environmental responsibility while maintaining positive relationships with all project stakeholders.

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2. Journal of Construction Engineering and Management: This journal covers a wide range of construction-related topics, and you can find articles on night shift management and its effects on construction projects.
3. International Journal of Project Management: This journal frequently features research on construction project management, scheduling, and work methods, including night shift construction.
4. Construction Industry Institute (CII): The CII often con- ducts research on best practices in the construction industry, including construction scheduling and shift management
5. Local government websites: Many cities and regions have guidelines and regulations related to night shift construction. These can provide insights into the practical aspects of implementing night shift management in construction.
6. Academic databases: You can search academic databases like Google Scholar, JSTOR, or Proust for specific research papers, articles, and case studies related to night shift management in construction.

Convolutional Neural Networks for Accurate Brain Tumor Classification

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ABSTRACT

The accurate categorization of brain tumors is necessary for neurologists in order to diagnose and treat these conditions. It is proposed in this study that a deep learning strategy might be utilized to categorize brain malignancies as Glioma, Meningioma, or No Tumor based on the data obtained from medical imaging. Convolutional neural networks (CNNs) were utilized to develop a reliable classification model to distinguish between different types of cancers and determine the absence of malignancies. The method begins with the preprocessing of MRI images, followed by the extraction of features through the utilization of CNN architectures, and finally, the training of a classifier to recognize various diseases. Through exhaustive testing and assessment of a wide variety of datasets, it can demonstrate the remarkable classification accuracy and resilience of this method. This method has the potential to improve clinical decision-making in brain tumor analysis as well as patient results.

KEYWORDS *: Brain tumor, Deep learning, CNN, Neurology, Glioma, Meningioma.*

INTRODUCTION

Neurologists have several diagnostic and therapeutic issues with brain tumors, which impact millions of people globally. Treating brain cancers accurately into Glioma, Meningioma, and No Tumor is essential for prognostication, treatment planning, and patient care. Medical imaging test interpretation is primarily done by hand in conventional diagnosis. Automated and precise pathological condition classification has revolutionized medical image analysis due to deep learning developments, particularly Convolutional Neural Networks (CNNs). CNNs may help create robust and efficient algorithms for brain tumor classification that can discriminate tumor kinds and non-tumor areas.

This study classifies brain cancers as Glioma, Meningioma, and No Tumor using MRI imaging data and deep learning. MRI images are preprocessed, CNN architectures extract features, and a classifier predicts tumor kinds. We use deep learning to overcome the constraints of existing diagnostic techniques and deliver a reliable and automated brain tumor categorization solution. We want to add to the literature on deep learning algorithms in medical image analysis and healthcare with our study. The suggested method may improve clinical decision-making, diagnostic accuracy, and tailored and effective patient treatment for neuro-oncology.

LITERATURE REVIEWS

Brain MRI images were utilized to determine brain tumor malignancy using the hybrid method. An automated brain cancer detection system eliminates human labelers and their inaccuracies. Future improvements can enhance accuracy and minimize root-mean-square error [1]. A unique deep-learning technique is used to classify tumors in MR images. Extracting robust characteristics from magnetic resonance imaging datasets and learning MRI convolutional layer structure. Exchanging fully connected layers trains the deep network to recognize three cancer types. The six-layer deep neural network classifier comprises about 1.7 million weight parameters and other approaches. All patients average 13 photographs and undergo this process (930 images). 5-fold cross-validation exceeds state-of-the-art methods in accuracy for design performance evaluation. [2]

The proposed study utilizes transfer learning to address limitations in training data samples of DCNN structures, enhancing classification accuracy. Utilize the output GAP layer to prevent overfitting and vanishing gradients. The leading learning-based systems on the Figshare dataset attain a classification accuracy of 98.93% with the proposed technique. This study may help doctors identify brain cancers more accurately. Even though the suggested transfer learning-based DCNN architecture has performed well, it needs refinement. Future training can use a larger dataset. Feature dimensionality issues can be addressed during parameter and weight transfers [3]. Effective brain tumor treatment requires precise and timely identification. Early diagnosis can save lives and improve medication development. Biomedical informatics and computer-aided diagnostics benefit neuro-oncologists. Machine learning algorithms are employed to assess medical images and data instead of manually detecting tumors, which is time-consuming and prone to errors. Computer-aided processes enhance traditional diagnostic procedures. After a CNN harvests data, the usual technique is classifying it using a fully connected network. [4]

Detecting and segmenting are difficult. This is not easy and repeated, requiring radiologists or clinical experts. Human organ anatomy may be conceptualized via image processing. Detecting brain abnormalities with basic imaging is difficult. This innovative, independent technique based on anatomical, morphological, and relaxometry data supports separating the cerebral venous system in MRI. Anatomical and brain area homogeneity characterizes the segmenting function. One learning method, ELM, employs hidden nodes in layers. These networks have various uses beyond regression and classification. The suggested method successfully identified normal and diseased tissue from brain MRI data with 98.51% accuracy [5]. Brain tumors cause serious problems with the human nervous system and are currently considered the most serious illness affecting humans. A tumor is an abnormal, uncontrolled proliferation of brain cells. Its segmentation-based identification ranks high among the most difficult medical tasks. Image recognition by hand is labor-intensive and fraught with the possibility of human mistakes. With its ability to provide precise pictures of the brain and skull, MRI technology is one of the most helpful diagnostic techniques for brain tumors. The time-saving and highly effective automatic segmentation and classification method is ideal. The study recommends classifying tumors as benign or malignant based on MRI imaging. This work proposes a hybrid classifier strategy combining SVM and KNN classifiers to enhance efficiency.[6]

SYSTEM DESIGN

Fig.1 shows the suggested system block diagram. The input dataset, preprocessing, splitting, training, and classification are included.

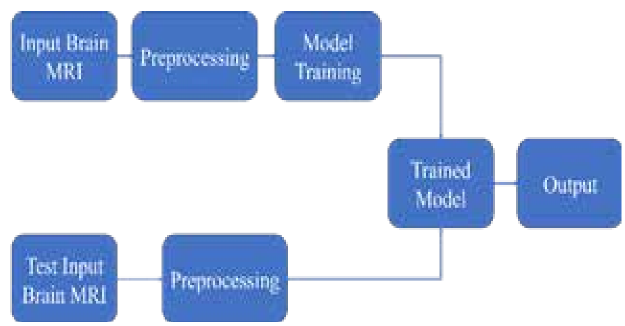


Fig. 1. Proposed system block diagram

Dataset Preparation

SARTAJ includes MRI scans of Glioma, meningioma, pituitary malignancies, and healthy brain tissue without tumors. The collection has 3264 RGB JPGs. Uneven class distribution and unexpected splitting ratios plague the dataset. The frequency of “no tumor” photos is far lower than those with tumors: There are 500 tumor-free photos, 937 meningioma images, 901 pituitary images, and 926 glioma images.

This difference creates classification imbalances that may bias the classifier toward tumor images. The “Pituitary Tumor” photographs have a different train-test splitting ratio.

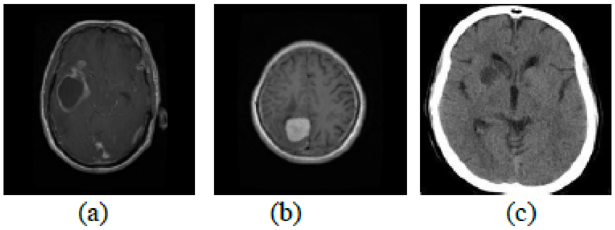


Fig. 2. Sartaj dataset samples (a) Glioma, (b) Meningioma, (c) No tumor

The dataset has 80% training data and 20% validation data.

Data preprocessing

We require filters for preprocessing. Median filters remove noise and enhance images using a non-linear approach. Its ubiquitous usage stems from its capability to diminish noise and maintain sharp edges. It effectively suppresses noise, similar to how salt and pepper enhance flavor. The median filter replaces each pixel's value with the median of its neighborhood in an image. Arrange the pixels of the window in numerical order, then replace the center pixel with the median.

Glioma, Meningioma, and No Tumor Classifiers

The Sartaj dataset MRI and image analysis pipeline needs Glioma, Meningioma, and No Tumor brain tumor classifiers. These classifiers use extracted characteristics to classify MRI images into three categories. MRI images of malignant brain tumors originating from glial cells are used to train a glioma classifier. The classifier is trained using MRI scans to identify Glioma tumor patterns. Uneven shapes, intensities, and augmentation are examples. The trained Glioma classifier can predict Glioma in the Sartaj dataset MRI images using learned attributes. The Meningioma classifier detects benign brain or spinal cord meningeal tumors in MRI data. The classifier trains on MRI images to detect Meningioma tumor features. Examples include well-defined borders, uniform intensities, and dural tail signals. Multiple machine-learning algorithms can teach the Glioma and Meningioma classifiers to relate input MRI images to labels. After training, the Meningioma classifier predicts malignancies in fresh MRI images using extracted attributes. Classifiers automate MRI brain tumor categorization, facilitating diagnosis and treatment. To ensure real-world dependability, these classifiers are tested for accuracy, sensitivity, specificity, and ROC curve area.

1) CNN: The architecture diagram of the CNN algorithm for classifying brain MRI is present in Fig.1.

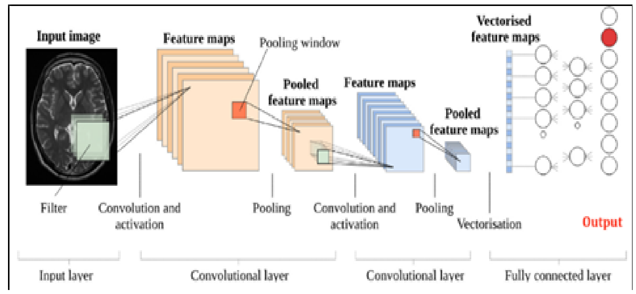


Fig. 3. CNN Architecture

MRI images and extracts significant information using deep learning algorithms to classify brain malignancies as Glioma, Meningioma, or No Tumor. A CNN architecture for this is summarized here:

- The input layer receives MRI pictures. Photos of brain slices are frequently three-dimensional.
- The CNN convolutional layers retrieve spatial information from MRI pictures. Many filters in each convolutional layer extract edges, textures, and shapes from input images. Every convolutional layer helps the network represent input images more intricately and conceptually.
- Pooling Layers: Pooling convolutional layers reduces feature map spatial dimensions, improving computing efficiency and reducing overfitting. Max pooling typically downsamples feature maps by retaining the maximum value in each frame.
- Flattening Layer: This layer converts convolutional layer output into a one-dimensional vector for fully connected layers.
- Fully Connected Layers: Weighted connections map flattened feature vectors to output classes. These layers perform high-level feature abstraction and global picture integration. Dropout regularization can prevent overfitting in fully connected layers by randomly deleting connections during training.
- Softmax activation functions in the output layer calculate the probability distribution across output classes.

This CNN architecture may be trained using the Sartaj dataset of brain tumor MRI images annotated by category. Using backpropagation and gradient descent, the CNN learns to properly categorize brain cancers into Glioma and meningioma and no tumor categories based on input MRI scans.

2) Xception Architecture: It is an extension of the Inception architecture, which introduced the concept of "factorized convolution" to capture spatial hierarchies of features while reducing computational complexity efficiently. Xception takes this idea further by replacing the standard Inception modules with depthwise separable convolutions, resulting in a more efficient and effective network architecture.

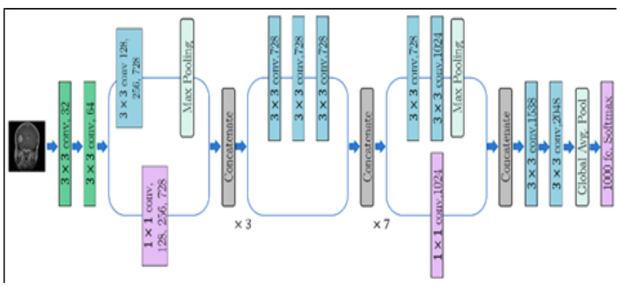


Fig. 4. Xception Architecture

- Entry Flow: The network receives MRI images via the entrance flow. The network starts with batch normalization, ReLU activation, and convolutional layers. In contrast to CNN designs, Xception employs depthwise separable and pointwise convolutions. Factorizing spatial and channel-wise operations reduces computing costs and preserves expressive power.
- Middle Flow: The middle flow processes characteristics extracted in the entering flow with a stack of repeating modules. Many depthwise separable convolution layers make up each module. These modules record increasingly complicated MRI picture patterns and structures.
- Exit Flow: Exit flow is the last network component that predicts. A global average pooling layer combines middle flow feature map spatial data. Fully connected layers that learn to map attributes to output classes get global average pooling layer output. Softmax activation functions create the output class probability distribution and predict the final classification with the greatest probability.

With the Xception architecture and Sartaj dataset, the network can classify brain cancers using MRI image features. Xception's depthwise separable convolutions capture rich spatial patterns and structures in images while reducing computational complexity, making it a powerful and quick medical image classification tool.

3) Inception Architecture: 2014 Szegedy et al. unveiled the deep convolutional neural network (CNN) Inception architecture to record and analyze picture feature spatial hierarchies effectively. The network can collect fine-grained and global characteristics, improving picture classification performance.

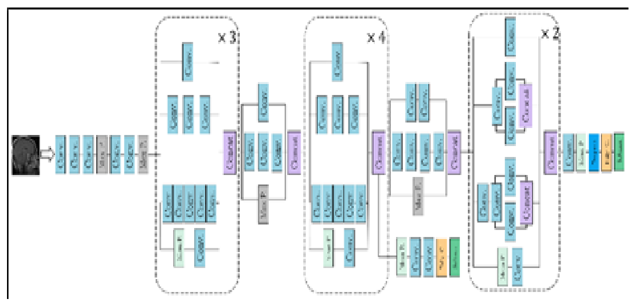


Fig. 5. Inception Architecture

MRI scans from the Sartaj dataset are supplied to the input layer. These photos usually show brain slices in three dimensions.

- Inception Modules: All modules have many convolutional branches with different kernel sizes. Parallel convolutions with different kernel sizes let the network learn fine-grained and global features at several spatial scales.
- Pooling Layers: Inception modules improve computing performance and reduce overfitting by reducing the spatial dimensionality of feature maps. A commonly used approach called max pooling causes the feature maps to shrink because it retains the greatest value in each pooling window.
- Flattening Layer: The flattening layer converts the Inception module's output into a one-dimensional vector for the fully connected layers.
- Fully Connected Layers: After processing the flattened feature vectors, fully connected layers

use the sequence of weighted connections to learn how to map them to the output classes (Glioma, meningioma, and no tumor). These layers integrate global information from the entire input image and perform high-level feature abstraction.

- Output Layer: The probability distribution across the output classes is calculated by the softmax activation functions that make up the output layer. The final classification is expected to be the class with the highest probability.

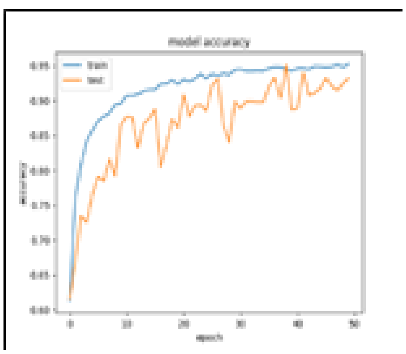
The network can classify brain tumors into desired categories on the Sartaj dataset using MRI image characteristics and the Inception architecture.

RESULT

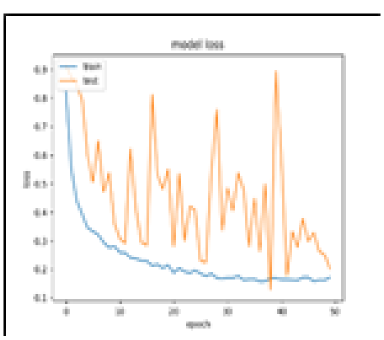
This section displays the outcomes of the suggested approach for categorizing brain MRIs using the CNN, Inception, and Xception algorithms.

Results of CNN Algorithm

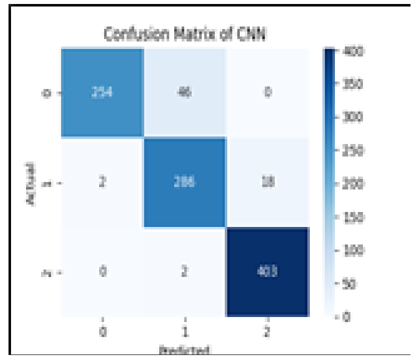
Fig. 6 shows the CNN algorithm's performance in classifying Glioma, Meningioma, and No Tumor on the Sartaj dataset.



(a)



(b)



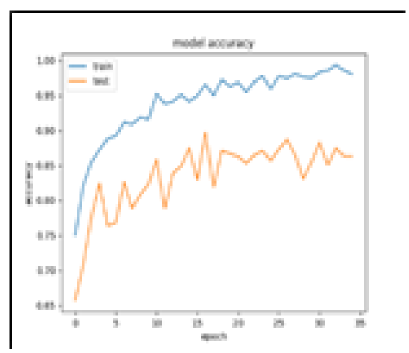
(c)

Fig. 6. CNN training accuracy, loss, and confusion matrix.

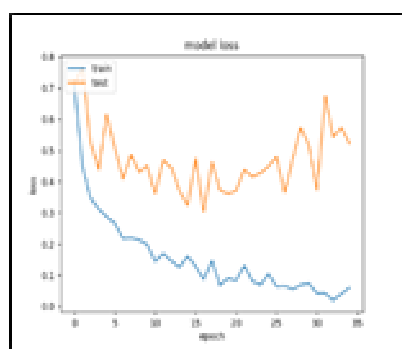
The CNN trains for 50 epochs using the RMSprop optimizer and a 0.001 learning rate.

Results of the Xception Algorithm

Fig. 7 displays the results of the Xception method for detecting Glioma, Meningioma, and No Tumor on the Sartaj dataset.



(a)



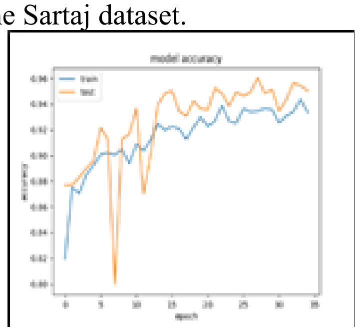
(b)

(c)

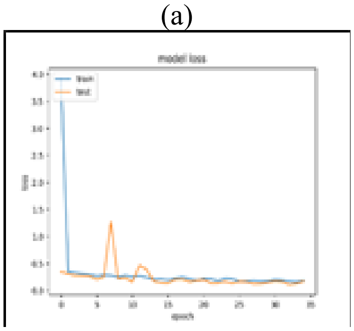
Fig. 7. Training performance of Inception (a) Accuracy (b) Loss (c) Confusion Matrix

Results of the Xception Algorithm

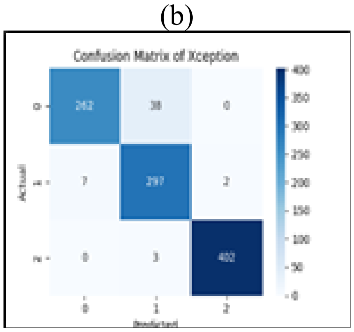
Fig. 8 demonstrates the performance of the Inception technique in classifying Glioma, Meningioma, and No Tumor on the Sartaj dataset.



(a)



(b)



(c)

Fig. 8. Training performance of Xception (a) Accuracy (b) Loss (c) Confusion Matrix

Table I compares the CNN, Xception, and Inception algorithms for categorizing brain MRI images into meningioma, Glioma, and no tumor.

Table 1. Comparative Analysis Of The Proposed System

Algorithm	Precision	Recall	F1 Score	Accuracy
CNN	0.93	0.94	0.94	0.94
InceptionV3	0.92	0.92	0.92	0.92
Xception	0.95	0.95	0.95	0.95

Table 1 compares classifiers from the Sartaj Dataset based on Precision, Recall, F1 Score, and Accuracy. Accuracy measures the proportion of valid positive predictions, memory evaluates the capacity to remember all relevant instances, and the F1 Score balances accuracy and recall. Accuracy assesses the exactness of a model. Xception had the highest categorization performance with a precision, recall, F1 Score, and accuracy of 0.95. CNN outperformed InceptionV3 in every category, but Xception surpassed both. Xception surpasses CNN and InceptionV3 as a classifier for the Sartaj Dataset. Figure 9 illustrates the system's ability to classify brain MRI data into Glioma, meningioma, or no tumor categories.

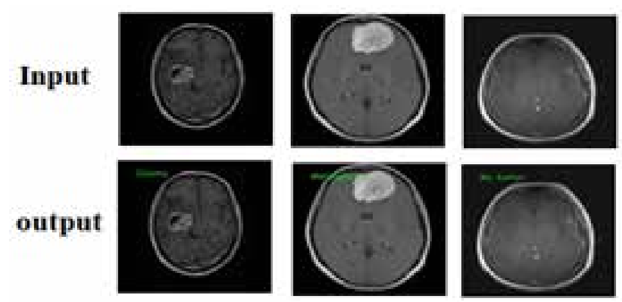


Fig. 9. Testing results of the proposed system on the Sartaj dataset

CNN, InceptionV3, and Xception algorithms accurately categorized brain MRI images into brain cancer categories. The outcomes show the accuracy and reliability of the brain MRI multiclass classification technique. Healthcare personnel require this to diagnose, treat, and monitor brain malignancies. Deep learning, optimization, and larger datasets may enhance MRI-based brain tumor classification. We employ CNN, InceptionV3, and Xception to detect brain cancer kinds. Xception improves categorization with both networks. The developed model serves two functions. It can immediately identify brain MRI images in numerous categories with minimal processing.

CONCLUSION

This study utilizes MRI data to propose a deep-learning approach for classifying brain tumors into Glioma, Meningioma, and No-Tumor groups. We utilized Convolutional Neural Networks (CNNs) and conducted thorough experimentation. We demonstrated the effectiveness of our proposed methodology in accurately identifying and classifying brain tumors with high precision and recall rates. Our findings underscore the potential of deep learning algorithms in facilitating automated tumor classification, thereby streamlining the diagnostic workflow and enabling timely and informed clinical decisions.

Furthermore, our research contributes to the growing literature on leveraging machine learning techniques for medical image analysis and healthcare applications. By providing a scalable and efficient solution for brain tumor classification, our work offers a valuable tool for radiologists and oncologists in diagnosing and treating patients with brain tumors. Future research directions may explore integrating multimodal imaging data and advanced deep learning architectures to enhance brain tumor classification systems' performance and generalization capabilities, ultimately advancing the state-of-the-art in neuro-oncology diagnostics and treatment planning.

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