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Due to the technological advancement in the fields of communication systems and information technology subsequently the evolution of Internet of Things (IoT), a great transformation has been happened across the world in every domain and in everyone's life. In simple language the Internet of Things (IoT) is the network of smart electronic devices embedded with sensors and software via internet for the purpose of data exchange. Some of the important applications of IoT in various sectors include industrial, agriculture, banking, healthcare, retail, supply-chain, transport and logistics, hospitality and tourism air quality monitoring, traffic management, self-driving cars, smart homes, smart cities, smart grids, and so on. The recent evolution based on IoT platform is unmanned aerial vehicles (UAVs) also called as drones.

Very important development in health care sector using IoT is Smart Health Sensing System (SHSS) which comprises of smart intelligent equipment and devices to assist/monitor one's health. Smart health devices can be used indoors as well as outdoors to monitor various health issues of patients. One can travel to the required destination using google map without the help from anyone or roadside information boards. They can hire a vehicle or order food/ products to deliver at doorstep using various apps available, and can do financial transactions without visiting a bank. All these facilities works based on IoT.

Devices with sensors are either ingestible like pills or implanted in patient or wearable. These sensors will help the patient or a family member or healthcare professional to monitor blood sugar levels, blood pressure, fitness levels, condition after discharge from hospital, etc. Healthcare centres and pathological laboratories are equipped with IoT based wireless control sensors to maintain the temperature and other conditions to the required levels for the purpose of preserving blood samples, medicines, tissues, biomedical materials, etc. IoT has the potential to transform India into a Smart India.

This edition of IJTE contains articles on "Comparison of the performance evaluation criterion of a rectangular plate with or without delta winglet in a channel flow", "Brain tumour detection from MRI images using Machine and Deep Learning Techniques: A Review", "Coordinated Control of DFIG and STATCOM for Mitigating Power Quality Issues", "An Application of the 'Horizontal Y' Queuing Model in Hospital", "IOT Based Wearable Tracking cum Health Care Device for Industrial Workers" etc.", "A Critical Analysis of Outcome Based Education" and "A review paper on Experimental Investigation on Liquefaction Mitigation using Pumice Aggregate and Geosynthetics" etc.

We take this opportunity to thank all those contributors, reviewers in making this issue an unforgettable one. Suggestions and feedback from our readers are welcome for the overall improvement of quality.

New Delhi
30th June, 2022

Editorial Board

COMPARISON OF THE PERFORMANCE EVALUATION CRITERION OF A RECTANGULAR PLATE WITH OR WITHOUT DELTA WINGLET IN A CHANNEL FLOW

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ABSTRACT

This study examined the enhancement of heat transfer inside a channel flow employing a modified delta winglet. In this study, a comparison of a rectangular fin plate with or without the modified delta winglet in a channel flow. The experimental set of wind tunnel is designed so that the thermo hydraulic efficiency/performance evaluation criterion is calculated with various air velocity and locations. The colburn factor, friction factor and performance evaluation criterion are also calculated with winglet and without winglet of a rectangular fin plate. The overall result shows that the performance evaluation criterion increased up to 6% while using the modified delta winglet on the rectangular fin plate.

Keywords : Channel flow, Performance Evaluation Criterion (PEC), Response surface method

1. INTRODUCTION

In applications where heat exchanger medium is a gas, tube-fin, plate-fin, tube bundles with small diameters and regenerative have exchangers are ordinarily used. Some of the applications are refrigeration, HVAC systems, air-cooled condensers, dry cooling towers, oil heaters, and transportation equipment. Also, in-car radiators, cryogenics process industries, chemicals, electronics and several other areas of industries, compact heat exchangers are used. . A number of research were carried out on traditional methods,

the Heat Exchangers are designed using vortex Generators/winglets in recent years. The various types of winglets are used nowadays for getting the high performance of heat transfer & Reduction of pressure while as much as the pressure reduces, the heat transfer performance increases. Whereas [1] Studied and concluded that the Delta winglet type vortex generator possesses more heat transfer performance than the modified delta winglet type vortex generator. So to get more heat transfer performance, further investigation is done by this Delta winglet vortex generator after a modified form;

Conclude a hole in the centre in the delta winglet type vortex generator. This modified Delta winglet is now ready to get more heat transfer performance while the heat transfer performance depends on the Reduction of pressure drop. So this modified Delta winglet type vortex generator will work towards the pressure reduction. Although many researchers [2-6] work on the pressure drop for different shapes, vortex generators experimentally found the pressure loss in fin-tube Heat Exchangers. Whereas [7-8] solve the vortex generators problem numerically. And [9-12] performed heat transfer performance of winglets experimentally. [13-17] works on the Delta winglet type vortex generator, whereas in our research, we use a modified delta type winglet vortex generator to obtain more pressure reduction. Variation of drop in pressure of fluid with various values of Reynolds numbers has been examined by [18-20].

This research focuses on optimizing the maximum Thermo hydraulic efficiency/ performance evaluation criterion (PEC) in a channel flow with the help of a modified delta winglet. The experiments were performed on a rectangular flat fin plate on the wind tunnel test rig. The PEC is calculated after fitting the modified delta winglets on the rectangular flat fin plate and compare the thermo hydraulic efficiency/ performance evaluation criterion (PEC) without winglet. A comparison also focused on this research for finding the PEC on a rectangular plate on between with and without winglet.

2. EXPERIMENTATION

2.1 Wind Tunnel

Wind tunnel is generally used to measure air effects on any object. The experiment setup is divided into three types.

- 2.1.1 Air inlet section
- 2.1.2 Throat
- 2.1.3 Air outlet

All three types of wind tunnel dimensions is given below:

2.1.1 Air inlet section

The air inlet section is looks like a rectangular shape in front view. It consists of the honeycomb.

Honeycomb is used for produced air in the laminar flow. The size of the honeycomb is 132 cm * 84 cm. This air inlet section consists to throat section. The distance between the honeycomb to throat section is 105 cm.

2.1.2 Throat

The throat section is very important part of the wind tunnel section. Basically it is the test section. The test plate is fitted in this throat section. The dimension of the throat section is 56 cm in length, 25 cm in breadth and 46 cm in depth. The throat connects to the air inlet section from one side and the air outlet section from the other side.

2.1.3 Air outlet section

The air outlet section consists of the exhaust fan, which is used for exhausting the air from wind tunnel experiments. It shows the force type convection. The shape of the exhaust fan or the end of the air outlet section is circular type. The distance between the throat and the end circular is 156 cm. Figure.1 shows the wind tunnel test rig.



Fig. 1: Wind Tunnel Test Rig.

2.2 Rectangular fin plate

The rectangular fin plate is the main part of our experimental research. All the experiments are performed on the experimental plate. We consist of the rectangular type experimental plate. The dimension of the plate is 300mm * 200mm * 4mm. In our research, we used the 13 rectangular fin plates in which only one of the plates is considered for the final experiment work, which is fitted in the

mid of the other plate. All other 12 plates are used for converting the laminar flow of air. However, the laminar flow is created by the honeycomb, whereas these 12 plates are also used for creating more laminar flow because as much as the laminar flow creates, the experimental gives an accurate reading. Here we use 13 plates in our experiments and the distance between each plate (Pitch of the Plate) is 28 mm. Figure 2 shows the test section with experimental plate.

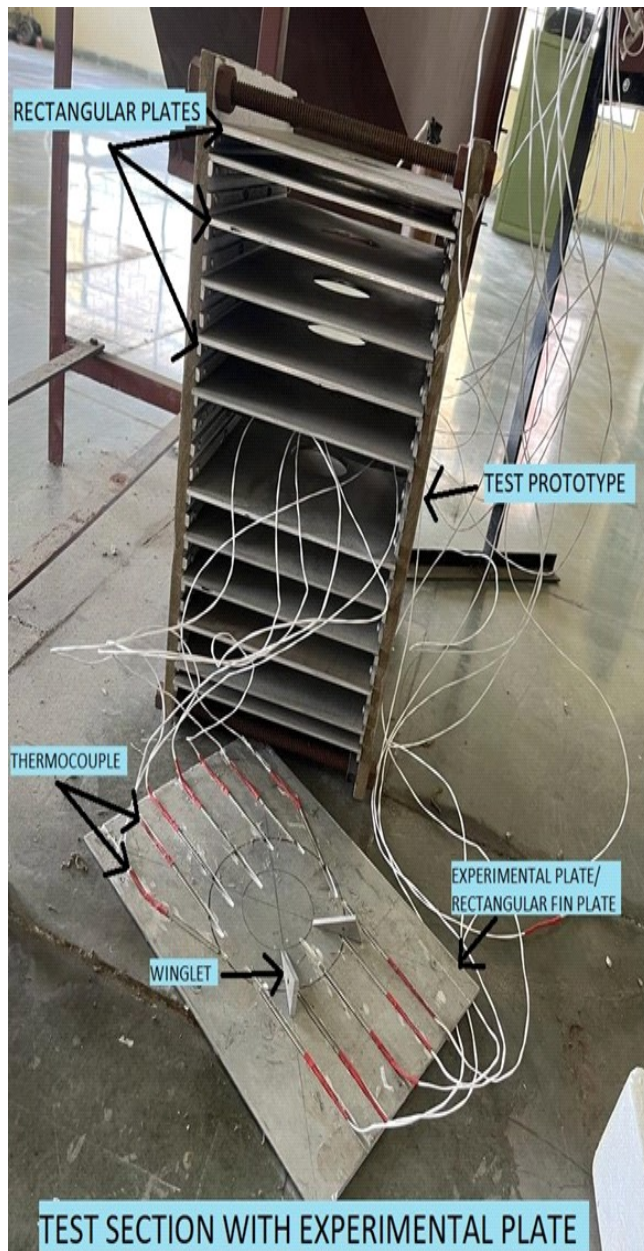


Fig. 2: Test Section with Experimental Plate

3. PROCEDURE FOR FINDING THE VALUE OF PEC OF RECTANGULAR PLATE WITH OR WITHOUT WINGLET

In the plate test setup, all 13 plates are arranged in parallel, and this setup fits on the throat. The 7th number mid-plate is considered for measuring the heat transfer rate or finding the value of PEC. To obtain the value of PEC from this experiment following steps are used:

1. Connect the electric supply to the instrument.
2. Start the heater and set it on a fixed temperature.
3. Start the fan and set the speed of the fan according to the requirement of air velocity.
4. Wait for the steady state, i.e. waits till that the changes in temperature reach up to a fixed level.
5. Install the pen drive in the data logger for record the data of temperature and pressure automatically according to at a fixed interval of time.
6. This is the first step for taking the reading on wind tunnel experiments.
7. Now change the air velocity and heat power from the heater according to requirement and record the second reading again.
8. Perform the experiment continuously till collect all readings according to requirement one by one with or without the winglet.
9. From these values of temperature and pressure find the value of PEC with help of following mathematical formulas.

2. MATHEMATICAL FORMULATION

For the calculation purpose we have to determine the PEC which means performance evaluation criterion which is also used for estimating the performance of thermal and the performance of pressure drop.

$$PEC = j/f$$

Here j denotes Colburn's factor which is defined as:-

Here j denotes Colburn's factor which is defined as:-

$$j = \frac{Nu}{Re \cdot Pr^{1/3}}$$

And f denotes Darcy friction factor and this is used to determine the friction characteristics and is defined as:

$$f = \frac{\Delta P_m \cdot D_h}{2L \cdot \rho \cdot u^2}$$

Here for the Colburn's factor (j) Nu stands for Nusselt number, Re stands for Reynolds number and Pr stand for Prandtl number and these are defined below:

$$Nu = \frac{h \cdot D_h}{k}$$

$$Re = \frac{u \cdot D_h}{\nu}$$

$$Pr = \frac{\mu \cdot c_p}{k}$$

Here in the above equations h denotes the heat transfer coefficient due to convection which is defined as:

$$h = \frac{Q}{A_s \cdot \Delta T_m}$$

Where Q denotes the total heat transfer rate and ΔT_m denotes temperature difference and Q and Δ are defined below:

$$Q = \dot{m} \cdot C_p \cdot (T_{m,out} - T_{m,in})$$

$$\Delta T_m = \frac{(T_{m,wall} - T_{m,in}) - (T_{m,wall} - T_{m,out})}{\ln \frac{(T_{m,wall} - T_{m,in})}{(T_{m,wall} - T_{m,out})}}$$

And is the total heat transfer surface area which is defined as below:

$$A_s = 2 \times \{(\text{Length of fin plate} \times \text{Width of fin plate}) + (\text{Length of fin plate} \times \text{fin thickness}) + (\text{Width of fin plate} \times \text{fin thickness})\}$$

And is the hydraulic diameter and is given by

$$D_h = \frac{4 \cdot A_c}{P_w}$$

Here means the cross-sectional area for fluid flow and means the wetted surface perimeter

So,

$$D_h = \frac{4 \times (\text{width of fin plate} \times \text{fin pitch})}{2 \times (\text{width of fin plate} + \text{fin pitch})}$$

Here, stands for thermal conductivity of the fluid, Stand for the specific heat capacity of the working fluid, is the air velocity, is the dynamic viscosity, $5\theta\beta$ is the density of the air, and is the kinematic viscosity which is defined as :

$$\nu = \mu / \rho.$$

Also, for the friction factor (f) Δ Represents the pressure drop between the inlet and outlet of the test section, and represents the length of the plate along the direction of flow.

5. RESULTS

The results are shown in below figures with and without using winglet. First the results are calculated without winglet in figure 3 to 5. Figure 3 shows the colburn factor with Reynolds number. It relates the turbulent momentum and heat transfer. Figure 4 shows the friction factor with Reynolds number. It relates the pressure drop. Figure 5 shows the Performance Evaluation Criterion (PEC) with Reynolds number. The PEC relates the overall thermo hydraulic efficiency.

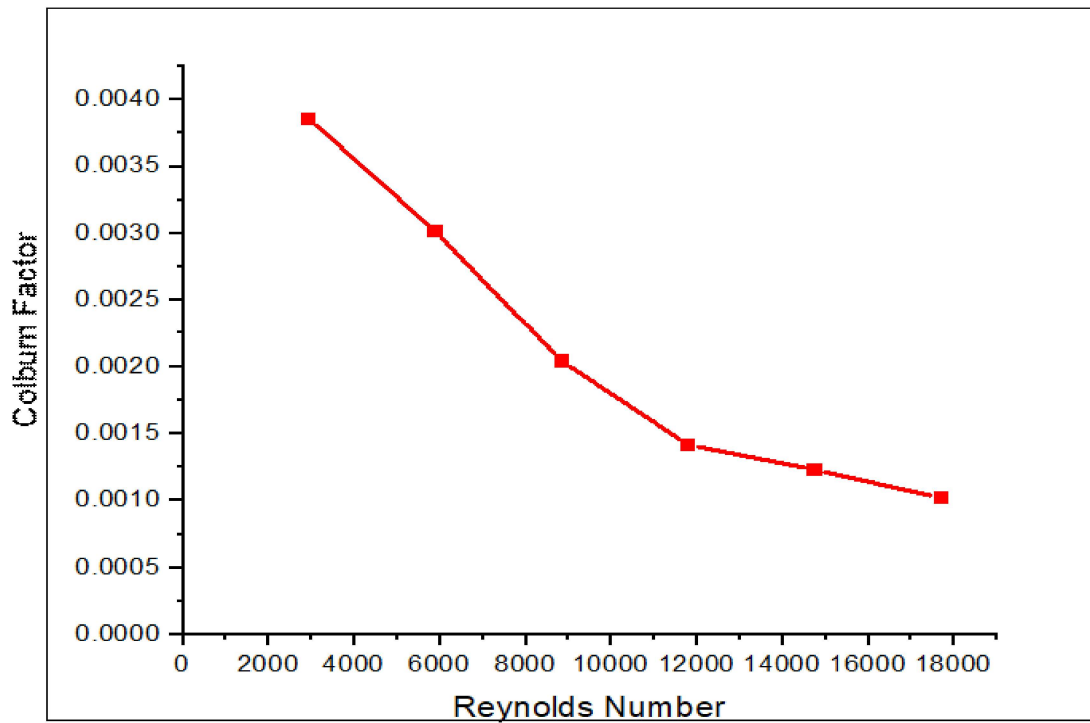


Fig.3 : Colburn factor with Reynolds number

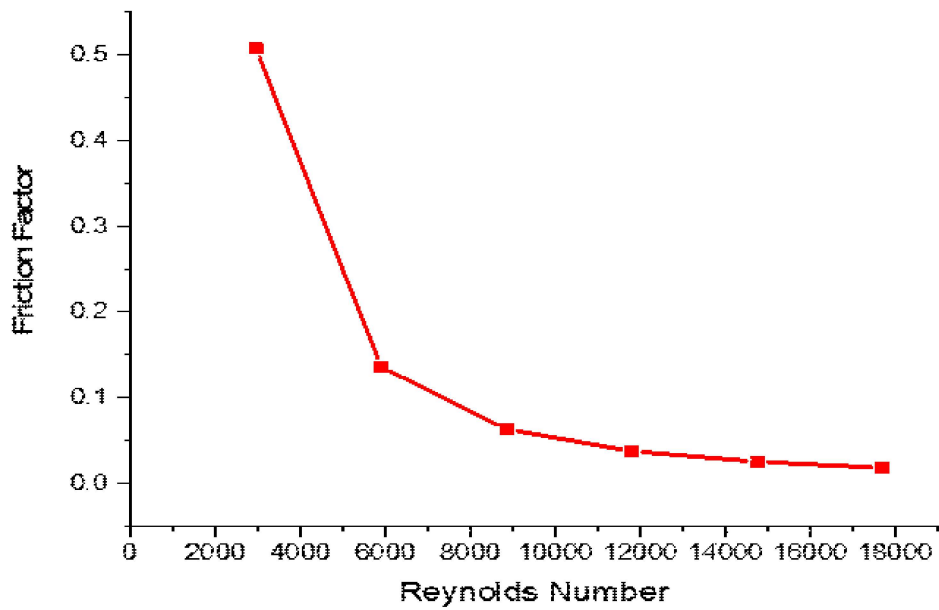


Fig. 4: Friction factor with Reynolds number

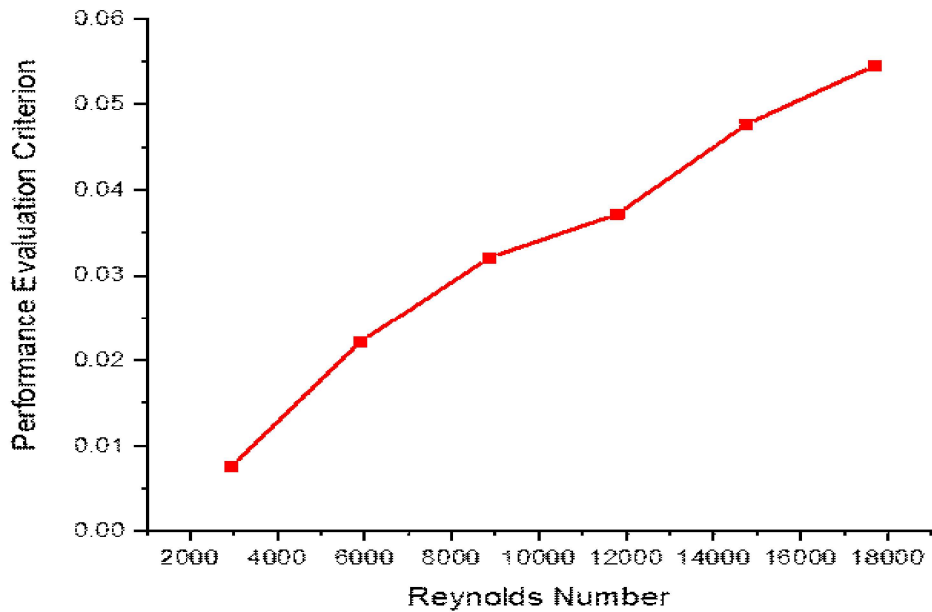


Fig. 5: Performance Evaluation Criterion (PEC) with Reynolds number

The results are shown in below figures with using modified delta winglet from figure 6 to 9. Figure 6 shows the colburn factor with Reynolds number. Figure 6 shows the friction factor with Reynolds number. Figure 7 shows the Performance Evaluation Criterion (PEC) with Reynolds number.

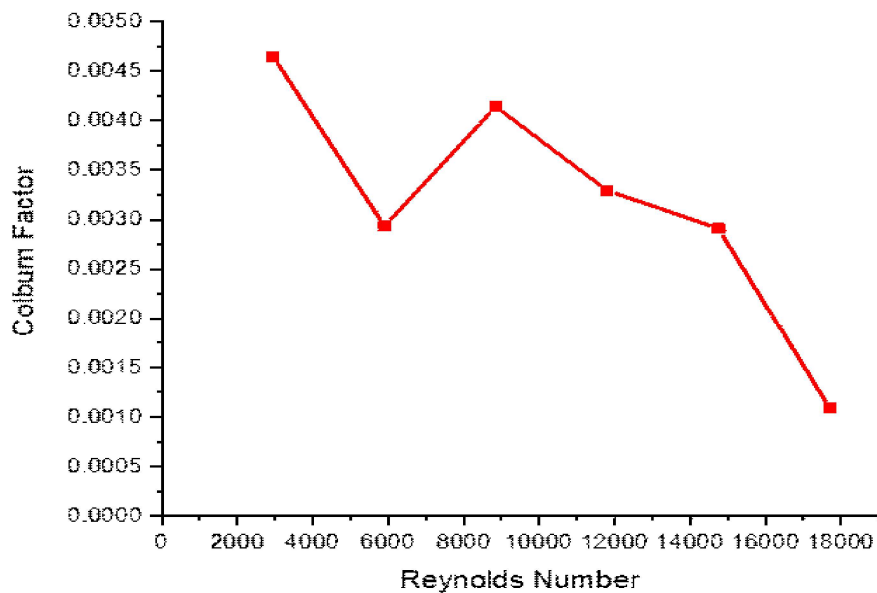


Fig.6: Colburn factor with Reynolds number

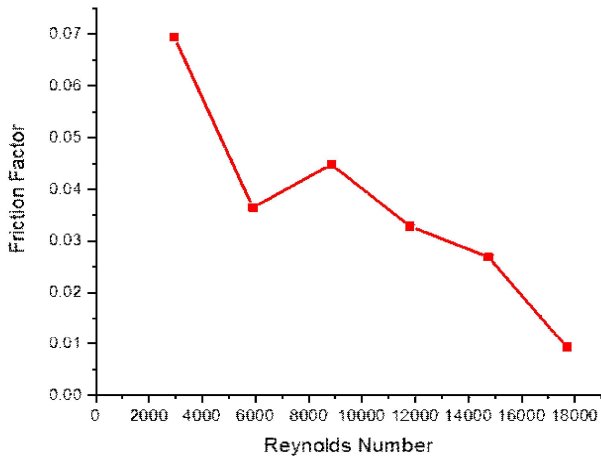


Fig. 7: Friction factor with Reynolds number

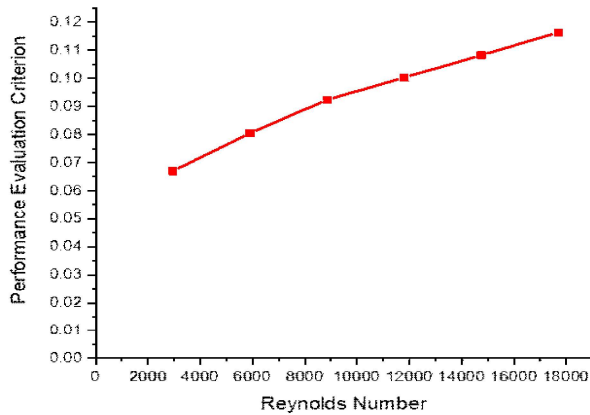


Fig. 8: Performance Evaluation Criterion (PEC) with Reynolds number

6. COMPARISON OF THE THERMO HYDRAULIC EFFICIENCY/ PERFORMANCE EVALUATION CRITERION (PEC) WITH AND WITHOUT WINGLET

Table 1 and figure 9 show the Comparison of the Performance Evaluation Criterion (PEC) with or without Modified delta Winglet. From the results, it is clearly indicates that when the winglet is used; the PEC is increased at every points. Here the PEC is calculated at six points each, i.e.; with or without the modified delta winglet on the air velocity from 1 to 6 m/s. The results clearly indicate that at every points of air velocity, the PEC is increased up to the 6%.

Table 1: Comparison of the Performance Evaluation Criterion (PEC) with or without Modified delta Winglet

Sr. No.	Air Velocity (m/s)	PEC (%) without Winglet	PEC (%) with Winglet
1	6	5.452634	11.63769
2	5	4.765634	10.82345
3	4	3.720615	10.02865
4	3	3.207066	9.234974
5	2	2.217107	8.047966
6	1	0.759135	6.69479

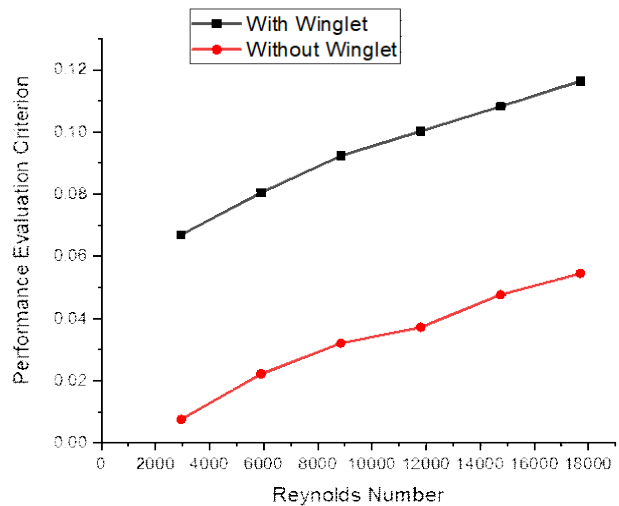


Fig. 9: Comparison of the Performance Evaluation Criterion (PEC) with or without Modified Winglet

7. CONCLUSIONS

In this research, the Thermo hydraulic efficiency/ performance evolution criterion (PEC) of a modified delta fin plate in a channel flow are augmented by using modified delta type winglet. This research indicates that the overall thermo hydraulic efficiency/PEC is increased up to 6 percent while using the modified delta winglet.

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★★★★★

AN INVESTIGATIVE STUDY OF SYNTHETIC DATA FOR ENHANCING DATA PRIVACY

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ABSTRACT

This paper brings out the benefits and properties of synthetic data and how ML, AI models will become robust by involving synthetic data instead of real data during deployment. Privacy issues arise when using the real data of users. The malicious users may misuse the real data in applications which are crucial for modern-day lives. So, the notion of synthetic data fabricated by AI will substitute the real-world data and the data models will be replicated to use in a controlled environment. This will help in increasing the efficiency of multiple AI and ML systems.

Keywords: Synthetic Data, Privacy, AI (Artificial Intelligence)

1. INTRODUCTION

Data, even though just facts and figures, is the lifeblood of today's rapidly evolving world. With vast volumes of data being generated every day as a result of continuous procuring of new information and advancements in storage technology, the need for the security of databases due to persistent cyberattacks is becoming more critical by the day and the safety of individuals is at stake. Various existing technologies such as data anonymization, data masking, data generalization, data swapping, data perturbation, and so on can be employed to fortify the data, augmenting the privacy of individuals. We can desiccate or encrypt identifiers, which are sensitive data pieces directly associated with the individual, using anonymization of data, which is a widely employed strategy for shielding

confidential information [1]. We can further improvise the security of the data by using data masking approaches, which alter the tuple values while preserving the format thus masking the data from intruders. Several types and techniques of data masking can be employed depending on our requirements and the datasets, some of which include Static, Dynamic, On-the-Fly, and Deterministic data masking [2]. It can be accomplished by substituting words or characters of the data with alternative fake values fetched from other references, shuffling the data values within the same dataset, or even nulling out the values when an unauthorized user gains access to the database. Data generalization, a form of dynamic data masking and value variance use functions and algorithms to generate less precise values to

prevent accurate predictions about the data. Encryption of data is the most secure form as the user needs a decryption key but is complicated to implement, furthermore, Pseudonymization is a three-step procedure that includes data masking, encryption, and hashing. Through data perturbation methods, we can induce noise to safeguard sensitive information and foster confidentiality. Contemplating these most employed techniques, we can transmit and utilize data for training datasets in machine learning (ML) procedures, testing purposes in software development, model validation, etc., without any restrictions imposed on it [7]. But what concerns the most is, how private the data is in regard to the user and how secure it is when it is associated with the individual. There are several de-anonymization procedures like cross-referencing various sources of information to reveal data in relation to data subjects or identifiers, that attackers can maneuver to disclose the private and obscure data, even after it has been stripped of identifiers. Data masking techniques like the substitution of data become convoluted in larger dimensional datasets because finding relevant data becomes more intricate, shuffling is impotent in the case of nominal-sized datasets, value variance, and data generalization work only on numerical data, and encryption is not an explicit solution for different organizations as it includes a lot of expense and ought to be adequately deployed [3].

Recent studies show that the privacy paradox exists even though individuals have concern over their privacy, their behavior and continuous usage of the services do not seem to relate as there is not much they can do regarding this [10]. This discrepancy has led to imprudent usage of users' confidential information by various organizations due to which immense amounts of data breaches occur. Regarding this, several standards have been developed and regulations have been enforced by various countries to control data contraventions and preserve the intimacy of the data. Some of the most prevalent standards include General Data Protection Regulation (GDPR) in Europe which aims to safeguard the data from security concerns by regulating the enterprises to secure and prevent data from misuse and exploitation [5]. Personal

Information Protection Law (PIPL) imposed by China, is similar in fashion to GDPR but with the government having more control over the data transfers. United States Innovation and Competition Act (USICA) and California Consumer Privacy Act (CCPA) employed in the US focuses on protecting data from data leaks and maintaining privacy. Original data is still retained within it, regardless of the data preservation strategy used, even if the data complies with the standards imposed, giving intruders access to actual data that they can extract using any tactic. A better solution is to produce fake data which can resemble the original data in terms of statistical measures. Such data generated has minimal privacy concerns and is devoid of usage limits as it does not relate to any individual instigating into the spotlight, the concept of AI-generated synthetic data. Synthetic data, as the term indicates, is synthesized by scrutinizing authentic datasets for utilization as a stand-in for specific needs [4].

It can reproduce all the required properties of the data as it emphasizes the maintenance of multivariate relationships and statistical distributions rather than merely explicit statistics whereas data masking and anonymization could mimic only specific attributes of the datasets. Misconceptions might arise about generating limitless synthetic data, but this is not the case as it simulates general trends. It overcomes the complications of standard data retention and has the added benefit of being able to generate data for unforeseen situations while also being resistant to statistical problems. Contrived by algorithms, AI-generated synthetic data could harness the potential of actual datasets by analyzing and replicating them with the least amount of privacy concerns. It curtails the risks of identity disclosure and linkage attacks whereby an intruder can anticipate the individual's identity from a record in a dataset, inferential disclosure which associates the risks of extracting sensitive information from disclosed sources even though devoid of the actual statistic and attribute disclosure which signifies attribution envisaged without associating the individuals. Synthetic data, in addition to having minimal vexations around confidentiality, also proffers the effectiveness in performance analogous to that of actual datasets.

Synthetic data generation through AI is a simple task with robust commercial potential as it is highly automated, provides generative models for simulation and requires less workforce and skills, and can also be yielded on an extensive scale [6]. Moreover, it is an economical means to generate synthetic data rather than traditionally extracting the essential information from the datasets, pre-processing it, and anonymizing or masking the data, as it proves expensive for massive and non-traditional datasets, even though in compliance with the laws. Synthetic data is superior to traditional anonymization and masking approaches in that it obscures the user's data despite its structural resemblance to genuine data.

2. BATTLE BETWEEN DATA PRIVACY VERSUS DATA UTILITY

By increased application of data for innovation, we are trying to accumulate as much relevant data as attainable for machine learning in business sectors for tasks such as recommendation systems, customer-data analysis, fraud detection, etc., in healthcare sectors for efficient identification of disease patterns in patients, in science for pre-identification of calamities, for software testing and deployment, and in many other activities [7]. The utility of data, which signifies the properties and the amount of useful information extracted, has tremendously grown which led to privacy scandals and exploitation of personal data. Currently, two opposing forces are at odds: one is concerned with sharing as much data as possible as part of machine learning, smart services, behavioral analytics, customer insights, data monetization, and so on.

The other end of polarity involves difficulties like data security, privacy constraints, consumer consent, and so on. Because of the curse of dimensionality in big data, there is a lot of concern about privacy, because people can be easily identified due to the sparse dataspace. Unfortunately, many of the datasets we compile have a vast number of dimensions that are extremely beneficial to businesses but at the expense of the user's privacy [9]. Differential privacy, homomorphic encryption, and other

privacy-enhancing technologies (PETs) diminish personal data identifiers by safeguarding users' Personally identifiable information (PII), hence strengthening data security. The objective of PETs is to secure data and privatize sensitive information, yet most hard privacy technologies seek to control and minimize data, resulting in decreased data utility. As a preventive step against cybercrime, PETs jeopardize data quality and create a false sense of security, they are also complex and expensive to implement, making them unreliable [13]. The methods such as data masking, include nulling out the values that appear useless as it replaces values with empty values, destroying the utility of the data; data perturbation techniques also appear unreliable due to noise induction, which may result in useless data; and K-anonymity causes omitting of values to a degree, resulting in an aggregate forfeiture of information.

Despite the data security and privacy technologies utilized, it is specious and drastically reduce the data's utility. Existing technologies like classic anonymization, data masking, etc., can be employed but it is hard to conceal data without demolishing its utility. As a result, there is a trade-off between the usefulness and privacy of the data, with the least privacy issues having the least utility. The privacy-utility curve is a J-curve, and we may infer an approximate inverse proportionality between privacy and utility from it, i.e., as privacy improves, utility declines [5]. Regardless of the technique employed, it fails to preserve both the utility and confidentiality of the data as they do not appeal to align with each other. With the increased frequency of cybercrimes, a novel approach is vital to safeguard the privacy and utility of data, leading to the conclusion of artificially generating synthetic data.

3. AI-GENERATED SYNTHETIC DATA

With real datasets, acquiring adequate data, pre-processing it according to the applied algorithm, and feeding it into prototypes for training and validation could consume a lot of time. In real datasets, there may be imbalances and biases that must be sampled cautiously. Synthetic data is typically used in the development of machine

learning prototypes since it enables us to quickly build training and testing datasets that meet our requirements. Synthetic data can be divided into three kinds, each of which can be generated to satisfy our needs. The first is fully synthetic data, which has no traces of the original information, enhancing privacy at the expense of credibility. Partially synthetic data replace particular feature values while still maintaining some genuine data, compromising privacy. And hybrid data is a mix of the two, offering the benefits of both full and partial synthetic data while sacrificing memory and processing time [4]. To produce synthetic data, bi-proportional fitting, agent-based modeling, decision trees, and other Deep Learning (DL) approaches such as Variational Auto Encoders (VAE),

Neural Radiance Field (NeRF), and Generative Adversarial Networks (GAN) can be employed [8]. By training on actual datasets, decision trees enable enterprises to construct multi-modal and non-classical data distributions, resulting in data that is strongly correlated with the original data. This method involves a lot of time and expense, is ineffective at predicting continuous values, and becomes complicated when dealing with varying data sets. VAE is an unsupervised DL technique that uses the encoding-decoding technique to reduce the dimensions of the data space, avoid over-fitting, convert it into latent space, and then decoded it back to the original space [11]. It is an iterative-optimization process that proves useful for continuous data but seems less efficient for categorical datasets.

NeRF can create new views from partially known datasets, however, it takes a long time to train and is only good for developing realistic images. GANs recognize feature patterns and generate random input in accordance which can be used to produce synthetic data. This is a widely accustomed method for generating synthetic data since it includes a discriminator that compares real data with created data and attempts to identify fakes. If the determination is successful, the generator is notified, modifications are made, or a new batch is created. The generator and discriminator compete, and more realistic datasets are synthetically generated over time [12]. Even

though GANs outperform other methods, they are difficult to regulate due to inconsistent training and the lack of an intrinsic criterion for predicting performance, making the approach appear opaque. To compare and contrast the distributions, general-purpose comparisons can be done, and work-load aware utility assessments can be utilized to enhance the output.

4. FUTURE DIRECTIONS

Synthetic data production is less expensive and superficially simpler but is complex and time-consuming with the existing technology and requires little but cutting-edge expertise. Incredibly useful in automation, it requires precise standards to be placed such that innovation is not on the other end of the pendulum and startups are not burdened. Policymakers are currently struggling to justify stricter data privacy legislation. Enforced laws should be in a manner that ensures accuracy, maintains reliance, and bridges the gap between inventions and security facets. The privacy frameworks extended to the entire life cycle of the data, restrict innovation and performance, and makes uncalled trade-offs. The standard measures taken against data spills must be transparent and user-centric so that assurance can be made with objectives maintained. Frequent checks must be carried out, including feedback on the data generated so that the process improves over time. With a greater advantage over current technologies that suppress or conceal sensitive data, the privacy risks incurred with synthetic data are below acceptable thresholds.

The main drawbacks of generating this kind of data include missing outliers that could effectively define the data. To overcome this situation, control over the output is essential. On top of that, the quality of the output depends on the source, if biases are present in the real data sets, they could be reflected in the generated data sets. Choosing the right datasets and formulating proper strategies is the key to overcoming these limitations. Mistrust among different sectors also inhibits the progress and must therefore be addressed by cryptographic solutions and synthetic data to provide valuable insights from the data. In the prospect of escalating Synthetic

data, it could be assessed through a set of simulations and evaluation systems, and for advanced applications, further research studies are expected to be carried out. There are plenty of future research opportunities around synthetic data for devising better algorithms for the aforementioned restraints and satisfactory analytics. At present, there is a lot of hype over synthetic data generation and is an emerging trend as it has a lot of potential for future growth.

With appropriate frameworks in place and policies intact, it can build a future filled with diverse possibilities. As generating synthetic data also need actual datasets, Privacy impact assessment (PIA) must be made to alleviate privacy threats by equipping the user with the information on fetched PII, the way it is stored, protected against attacks, secured from privacy risks, transmitted, and utilized. Production of synthetic data, although advantageous over other methods, possess difficulties and limitations and, therefore, average information leakage could be calculated in advance to determine the appropriate strategy. Relevant skills, metrics, and evolving strategies in the right direction would lead to breakthroughs in synthetic data and is promising.

5. CONCLUSION

This paper paves way for researchers making use of synthetic data to feed ML models to gain higher accuracy without leakage of sensitive private data. More than ever the importance of such synthetic data has been discussed in our paper taking into consideration the privacy preservation property. We have represented the facilities provided by AI for the generation of synthetic data. We can easily infer that by 2030 synthetic data will overshadow real data. Although there are -few research challenges related to the usage of synthetic data the popularity of synthetic data is increasing day by day. Our paper provides a sincere attempt towards the same.

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BRAIN TUMOR DETECTION FROM MRI IMAGES USING MACHINE AND DEEP LEARNING TECHNIQUES : A REVIEW

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ABSTRACT

Detection of brain tumor is a difficult task that entails identifying malignant tissues from different and diffuse brain medical imaging. This is a crucial stage in computer-aided diagnostic (CAD) systems, as cancerous areas must be identified for viewing and analysis. Image segmentation and classification of brain tumors have to be automated. The principle of this work is to provide an overview of the Magnetic Resonance Imaging (MRI)-based approach for brain tumors detection. Deep learning-based techniques, which automatically create multilevel and separated from unprocessed data, have made significant progress in brain tumor detection recently. These techniques outperformed traditional machine learning techniques that employed handmade characteristics to explain the distinctions between sick and healthy tissues. We provide a complete summary of modern advances in deep learning-based approaches for brain tumor detection (BTD) from MRI in this study. Furthermore, we address the most typical issues and provide potential remedies.

Keywords : Brain tumor detection, deep learning, classification segmentation.

1. INTRODUCTION

Brain tumor is an uncontrolled proliferation of abnormal cells in the body. A brain tumor is a lump in the brain that is made up of a cluster of these aberrant cells. Tumors are classified as malignant or benign. Tumors are classified as primary, secondary, or metastatic depending on their origin. The term “type of tumor” refers to cancer that originates in the brain. Brain cells, meninges, nerve cells, and glands can all produce them. The metastatic tumor can spread cancer cells to different parts of the body. Glioma and meningioma are the most prevalent kinds of malignant tumors. Adult gliomas are the most common malignant tumor. It begins in glial cells and spreads throughout the body [1]. Gliomas affect children aged 5 to 10

years, as well as adults aged 40 to 65 years, according to the World Health Organization (WHO) [2]. Furthermore, these tumors report for 81% of the total malignant brain tumors and 45% of the total primary brain tumors [4]. WHO has classified and rated over 120 tumor types (World Health Organization). According to the WHO, brain tumors are graded from grade I through grade IV. The tumor’s classification and grading system aid in predicting the tumor’s nature and stage, which may aid in diagnosis. Complex cell structure, diverse distribution of strength, tumor dynamic position, and tumor artifacts, for example, can all impact diagnosis. Heterogeneity in cancer cell proliferation provides significant hurdles in the development of cost-effective and efficient behavior strategies.

Positron emission tomography (PET), X-ray, and computed tomography (CT) are examples of biomedical imaging modalities. MRI is a most important technique for brain construction study because it provides high-contrast images of soft muscles as well as great spatial resolution. The MRI image pre-diagnosis method involves frequent image sequences T1, T2, T1ce, and FLAIR. Fig. 1 shows the images of dissimilar sequences.

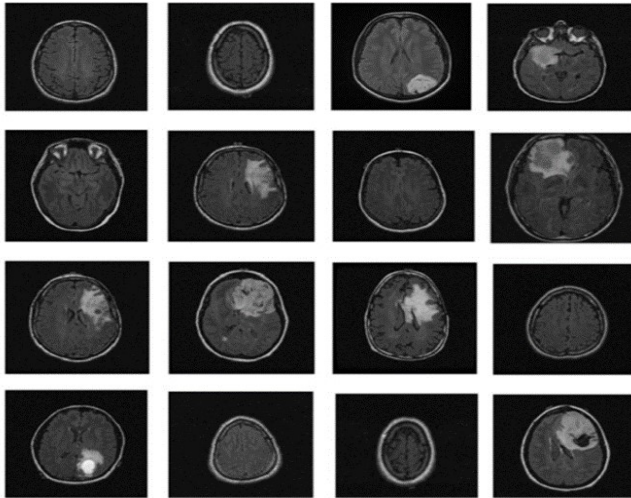


Fig.1 : Sequences of MRI images

2. LITERATURE SURVEY

In the last two decades, several approaches for brain tumor detection have been planned to identify the position of tumors at a prior stage for a greater survival probability. The most important goal is to distinguish and emphasize the various aberrant brain images using the distinct feature set. Many researchers use a machine and deep learning approaches to detect brain tumors, as follows:

When compared to further machine learning techniques, the KNN, or K nearest neighbor method, finds Euclidean distance the label-based, resulting in excellent accuracy. However, it falls short in terms of runtime performance. To accomplish classification, an ANN, or artificial neural network, employs numerous nodes and hidden layers, as well as weights. When comparing the desired output to the weights, the error factor is reduced [6].

In [7], a novel SVM method was proposed that extracts flexible decision edges based on region processing. This method makes it simple to comprehend nonlinear data. When compared to fuzzy clustering, the final findings reveal a better output. The distinction between different types of cancers was studied using a probabilistic neural networks (PNNs) paired through least-squares features transformation (LSFT) in [8]. The model had achieved a level of accuracy of over 95%. For categorizing normal and Alzheimer's brains, orthogonal DWT paired with intensity histograms [9] achieved a high accuracy of around 100%. [10] proposed an adaptive neuro-fuzzy interface system (ANFIS) for brain tumors recognition using a neural network (NN) and a fuzzy filter. This was tested on 80 normal photos and 40 aberrant images. The auto seed selection technique showed promising accuracy of 81.7% in the experiment. [11] proposed SVM for dimensionality reduction, and this experimental resulted 98% accuracy with extremely selective features. This also emphasizes the significance of selecting the right features. The author of [12] addresses the use of unsupervised machine learning to cluster comparable MRI images. This work was based on detecting important classes by plotting similar pixel vectors. Some of the most widely studied unsupervised algorithms is fuzzy c-means algorithm, k-Means clustering algorithm, SOM (self-organized map), and PCNN algorithm. [13] describes advances in the classification phase of Brian tumors identification. The Feed-Forward neural network (FFNNs) with K-Nearest Neighbors (KNNs) classification methods is discussed by the author.

Concentrating on these categorization algorithms resulted from inaccuracy of 97 and 98%, respectively. It was also suggested that this technology be applied to a variety of MR pictures. In [14] the widespread approval of Deep Learning (DL) in this diligence is discussed. Deep Learning (DL) is used in a variety of fields, including breast cancer, tuberculosis, and brain tumors studies. CNNs (Convolution Neural Networks) the deep learning techniques that have been developed for recognizing and classify brain tumors. When Deep Learning approach is backed up by additional

techniques, their accuracy soars to new heights. In [15] they proposed a Deep Convolution Neural Network (DCNN)-based solution to tackle the problem of over-fitting. The author suggests max-out with drop-out layers and tests the method using the BRATS_2013 dataset. The model was trained with an 80:20 train with test ratio and sensitivity, specificity, and dice similarity coefficients (DSC). In [16], proposed Fuzzy c-means for segmentations T2-W MRI images were classified using a combination of discrete wavelet transform (DWT) and a DNN (Deep Neural Network). Normal, glioblastoma, sarcoma, with metastatic-bronchogenic-carcinoma tumors, were all included in the classification. The algorithm's performance in a classification rate of 96.97%.

Within a year, [17] [18] discussed an enhanced version of DCNN. Tumor multiplicity adds to the complexity and necessitates greater precision. [19] multimodal-based segmentation with Random forest classification was discussed. Gabor characteristics are taken from each supermodel and used to train Random Forest. Using multimodal images from the BraTS datasets, each supermodel is classified as healthy or tumor. The results are presented in terms of sensitivity and dice score, which are 86% and 0.84%, respectively. Mohsen et al. [20] proposed using a Deep Neural Network to divide brain MRIs into four categories: normal, sarcoma, metastatic bronchogenic carcinoma tumors, and glioblastoma. The discrete wavelet transform (DWT) with principal component analysis (PCA), an effective feature extraction method, were used with the classifier. When the suggested model was compared to other classifiers, such as KNN when $k = 1$, $k = 3$, LDA, and SVM, it got the highest AUC score of 98.4% when DWT was employed on CNN. Chang et al. [21] introduced a Fully Convolutional Residual Neural Networks (FCRNNs) based on linear identity mappings, a basic medical picture segmentation approach. The FCR-NN system uses a fully convolutional image segmentation architecture that effectively caters to low-level and high-level picture information. For tumor segmentation, the

machine employs two distinct networks: one to segment the entire tumor and the other to segment subregion tissues. The FCR-NN sequencing architecture goes beyond state-of-the-art approaches with validation, and both have been trained for the proposed model. Complete tumor 0.87, core tumors 0.81, and enhanced tumors 0.72 are DSC.

Raja et al. [22] presented a brain tumor classification model hybrid deep autoencoder uses through a Bayesian fuzzy clustering technique for brain tumor segmentation. Initially, during the preprocessing stage, non-local mean filtering is used for denoising purposes. The BFC(block-based fast compression) method is employed in the segmentation brain tumors. They use information-theoretic measurements such as the Wavelet Packet Tsallis Entropy (WPTE) from each brain image with Scattering Transform (ST) approaches after segmentation. The brain tumor classification, a hybrid system comprising the DAE (Deep autoencoder)-based JOA (Jaya optimization algorithm) and softmax regression is applied. According to the results of the BraTS_2015 database, the proposed technique provided high classification accuracy (98.5%).

Kumar et al. [23] proposed employing a Deep Wavelet Autoencoder Neural Networks (DWADNNs) strategy for picture segmentation, which was evaluated and compared to a variety of different classification methods, including the DNN, AEDNN, and others. In broad data distribution, an autoencoder can be thought of as an optimal strategy for extracting and learning principal components. DWA-DNN has been proven to be more accurate than the other exit approaches. It also enables the use of an image classification method for cancer detection that is both reliable and simple. The original encoded image is treated using a Daubechies wavelet of order two via a Discrete Wavelet Transformation (DWT), which bypasses low-pass and high-pass filters to generate estimate and detail coefficients. Sensitivity, specificity, and F1-Score, as well as accuracy results of 93, 94, 92, and 93%, respectively.

3. METHODOLOGY

Computer-aided diagnostic (CAD) for brain tumor detection steps various machine and deep learning techniques uses, the block diagram illustration in shown in fig.2.

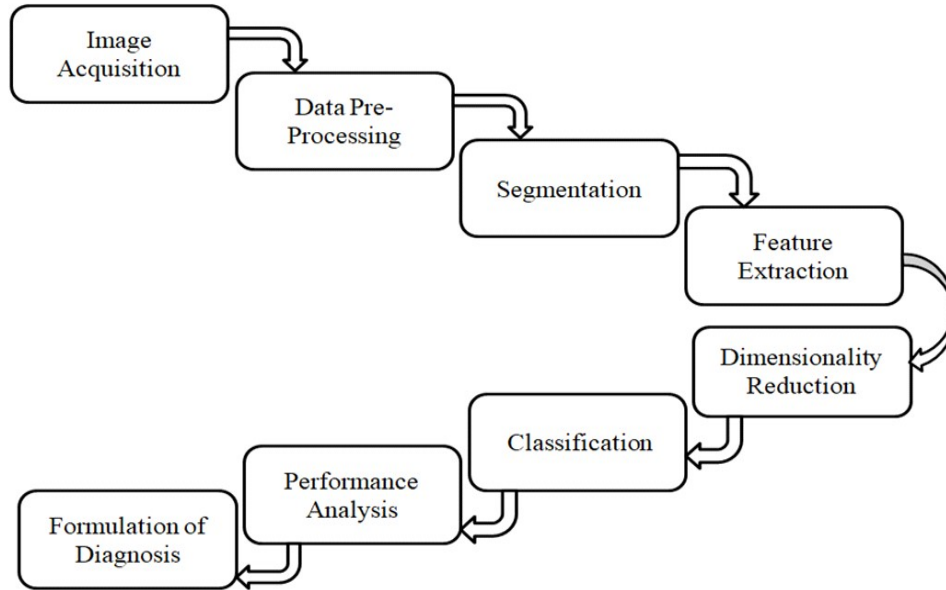


Fig.2 : Computer-aided diagnostic (CAD) systems for brain tumor detection

Collect historical images for training the algorithm. This is the first phase of the Brain Tumor recognition system. The dice coefficient of Internet Brain Segmentation of Repository (IBSR) segmented dataset, and Brain Web with Medical School Harvard Some of the most usually used datasets for brain tumors detection are BraTS [5]. Researchers encountered numerous limitations as a result of a requirement of data for precautions reasons. Data cleaning and data improvisation occur after the data has been collected during the data preprocessing step. The amount of noise in images makes it difficult to distinguish between normal and diseased cells. The segmentation

phase is a crucial step in determining the analytical region of interest. Following segmentation, feature extraction extracts features such as texture and intensity with edges. Reduction of dimensionality: PCA (Principal Component Analysis) aids in the reduction or elimination of non-classifiable features. Later, utilizing the collected features, classification models are employed to classify the types of brain tumors.

4. DATASETS

Brain Tumor Detection (BTD) uses Machine and Deep Learning Techniques are brain tumor datasets publically available as shown in Table 1.

Table 1: Publically Brain tumor Datasets

Sl. No.	URL Address	Datasets Name
1	https://www.cancerimagingarchive.net/	TCIA
2	https://www.smir.ch/BRATS/Start2012	BRATS
3	https://brainweb.bic.mni.mcgill.ca/	Brain Web
4	http://www.oasis-brains.org	OASIS
5	http://www.med.harvard.edu/AANLIB/	Harvard Medical School
6	https://imaging.nci.nih.gov/ncia/	NBIA
7	https://www.cancerimagingarchive.net/	TCIA
8	https://www.smir.ch/	ISLES

5. EVALUATION PERFORMANCE

The evaluation performance is precision, recall, accuracy, and F1-score are used to measure the real and expected classes that have previously been expressed in equations 1, 2, 3, and 4, individually, to validate the proposed model. Different metrics may be constructed from a confusion matrix to reflect the performance of classifiers, unique to each tumor type, using each performance metric's mathematical notation. The important measures of accuracy, precision, recall, and F1-score are computed using the following equations.

$$AUC = \frac{TP + TN}{TP + TN + FP + FN} \quad (1)$$

$$PRE = \frac{TP}{TP + FP} \quad (2)$$

$$REC = \frac{TP}{TP + FN} \quad (3)$$

$$F1\ SCORE = 2 \times \frac{Precision \times Recall}{Precision + Recall} \quad (4)$$

Where,

TP used for True Positives, TN used for True Negatives, FP used for False Positives, and FN used for False Negatives

6. DISCUSSION AND FUTURE DIRECTION

Deep Learning algorithms are gaining traction as the demand for AI and automation grows. Automatic systems are currently a prominent focus of research. This review focuses on the various deep learning algorithms that are currently in use, as well as a discussion of the approaches for segmentation of brain tumor utilized. Deep learning-based segmentation of brain tumors are detection in this paper. We examine it from two perspective. The deep learning is a first of the perspective technology and the second is from the perception of tumor types. From a technical aspect, we seem at network building, post-processing, pre-processing, loss function, multimodality, and post-processing. The tumor segmentation approach

deep learning-based is concise from two perspective: types of the tumor and procedural architecture. The modern methods are mostly utilized to correctly segment tumors and compensate for the lack of training data. When given adequate training data, deep learning can efficiently segment tumors, and all three approaches are based on the following three perspectives: Remove infrared portions from the image and segment with set limits to provide additional data for pixel categorization. As a result, a large number of networks have been proposed, and the article includes detailed comparison introductions. However, because neural networks require large amounts of data by their very nature, the current methods for compensating for a lack of data are partial, and the most popular ones rely on modify the training technique. Based on the aforesaid situation, we have identified four potential research areas for future: Some of the techniques used include 3D image compression model, segmentation, classification, and transfer learning an overfitting solution.

Although the deep learning-based tumor segmentation method has yielded promising results so far, there are few relevant research approaches and development points. Based on the method's reasoning, this study evaluates the methodology from the perspective of tumors kind and network architecture. This review contains some important information for researchers and others interested in learning more about this topic quickly.

7. CONCLUSION

This research looks at a variety of methodologies and tools for developing automatic brain tumor detection algorithms. Despite major advancements in the discipline, deep learning methodologies are still in their infancy. Tumor segmentation techniques based on deep learning are gaining popularity. This article looks at the state-of-the-art technique from two perspectives: tumors type and network building, and technical considerations. The majority of the strategies are based on supervised learning, which necessitates manual ground truth labeling. Because there aren't enough datasets, different strategies for dealing with

data or class imbalance issues should be investigated. 3D image transfer learning, model compression, segmentation, classification and an overfitting solution are all areas that will be investigated in the future.

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COORDINATED CONTROL OF DFIG AND STATCOM FOR MITIGATING POWER QUALITY ISSUES

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ABSTRACT

Day by day there is an increase in electrical load demand and hence generation capacity is also increasing. During power transmission from plant to load center, voltage drops are high and there are high power losses as the distance between the power plant and load center is more. Power plants are generally located far away from load centers. To resolve this issue, distributed generation (DG) units can be installed near load centers. The addition of distribution generation makes the existing power system more secure, efficient, and reliable but at the same time, it put different challenges. Due to the introduction of distributed generation, there is a change in the magnitude of current and direction of fault current affecting the overcurrent protection system taking into account protection coordination. This paper presents the coordinated control action between double field induction generator and STATCOM for different conditions such as variation in wind velocity and variation in load at the point of common coupling. Simulation results show that to maintain the voltage level at the point of common coupling of the wind system and grid, the STATCOM maintain the sufficient reactive power at the terminal

Key Words: PLL, DFIG, LVRT, islanding, STATCOM

1. INTRODUCTION

In recent times, Generation of the electricity from renewable energy sources such as hydro, solar, wind, geothermal, tidal, has come under increasing attention. However, Wind power generation, economically and environmentally, has numerous benefits and is extensively installed in power systems worldwide. The installation cost of DFIG based wind turbine is less as compared to

other types of the wind turbine. It can transfer energy at various wind speeds efficiently and the converter used is of small capacity. Due to active and reactive power control and variable speed constant frequency operating characteristics, it is used extensively in the wind farm. Many reviews on DFIG based wind turbines are available. [3-7].

The DFIG Induction Generator has stator windings and rotor windings. Stator windings are

directly connected to the grid and the rotor windings are fed through the rotor side converter (RSC) and the grid side converter (GSC). These two converters are connected back-to-back as shown in Fig.1. During normal operation, the RSC controls stator active power and reactive power. DC link voltage is kept constant by GSC and is not dependent on the magnitude and direction of rotor power. The voltage stability of the system can be improved by using DFIG WT with voltage control capability. DFIG based WT system has reactive power output control that helps in voltage profile improvement in normal conditions and during grid faults, there is the enhancement of FRT capability [8].

During grid disturbances generator rotor current and DC-link voltage increases. Protection circuits are used to limit this over current and overvoltage. For improving the transient performance of the DFIG WT system, the reactive power injecting-devices will nullify any shortage of the reactive power and hence limit the rotor current and the dc-link voltage.

During grid fault, protection circuits enhance the DFIG system efficiently but grid-code requirements are not fulfilled easily and change in the objective of power control is applied. With the aim of the safe grid-connected operation, a flexible FRT plan with a coordinated control strategy can assure the supply of the reactive current as per the grid-code requirement [9,10]. Due to the limited power capacity of the DFIG based WT system, it cannot provide the required reactive power and voltage support during grid disturbances. Hence to

reduce effects for grid-side faults such as 3-phase fault, the sudden change in load, under voltage, and overvoltage in DFIG-wind farm, reactive power compensation is required during and after fault [11].

DC distribution system has high reliability and less power loss at a low cost. But due to a lack of standardization, it is difficult to plot the architecture of the DC distribution system. DC standards will put an outline for design and installation methods. Standardization for generation, transmission, distribution, DC voltage level needs to be defined. CPL (constant power load) tends to maintain load power constant under the fast change in current and voltage (disturbances) i.e. nonlinear behavior.

The introduction part as discussed above can be summarized as that there are several operational challenges in the conventional power system. All these challenges are due to the interconnection of a large number of Wind generators to the traditional grid system. This requires a detailed investigation of protection coordination, distribution of fault current, and voltage profile across different loads. Again the most critical issues in coordination of these systems require robust control in terms of communication, Time variance, and stability changes based on the insertion of new components. So in this paper, the authors have addressed the coordinated control of DFIG and STATCOM in mitigating the power quality issues in terms of protection coordination and voltage profile using secondary control.

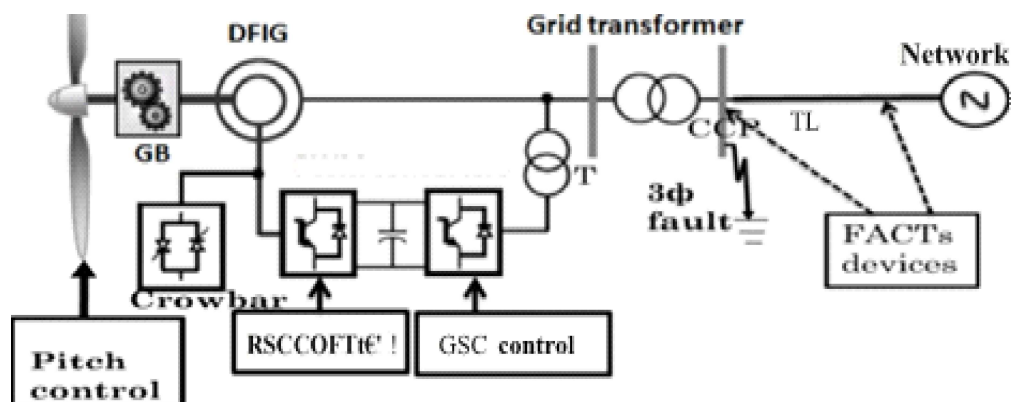


Fig.1: Structure of a DFIG based wind turbine

2. STATCOM

The creation of power from wind generators are getting to be distinctly increasing. Wind energy has been faced with various problems like voltage dips, frequency variation, etc. To maintain the voltage stability, it is required to keep DFIG-based WT connected to the grid during the disturbances also. To regulate the real and reactive power output and for improvement of power quality of the system, FACTS devices can be used [12,13]. For the improvement of the dynamic performance of wind farms using FACTS devices, many research papers are available [14, 15]. The advantage of using STATCOM over a thyristor-based SVC is that the maximum reactive current of STATCOM is independent of the voltage at the point of PCC. So the compensating current is not lowered as the voltage drops due to grid disturbances [16].

FACTS devices can be categorized as a shunt type and series type depending on how they are connected in the power system. For voltage stability enhancement Shunt type controllers are used. Series type controllers or multi-type controllers are used for Power flow control and reducing losses [17]. Power system parameters such as loadability and voltage profile at different buses can be improved using FACTS devices [18]. For reducing grid side disturbances, reactive power compensating devices such as STATCOM can be connected at the point of common coupling. A STATCOM is a device connected in shunt with a power system. It is used for reactive power compensation. It can generate and/or absorb reactive power and the output of this device can be changed as per the requirement of control of a particular parameter of the electrical power system.[19]

Static Synchronous Compensator (STATCOM) is a device from the FACTs family. It has the components VSC, DC capacitor, and a coupling transformer. By changing the magnitude of converter voltage concerning the system line voltage, this device can generate or absorb reactive power and controlled output current in reactance between the device and the system. This helps the STATCOM to reduce voltage fluctuations and provide good voltage regulation.

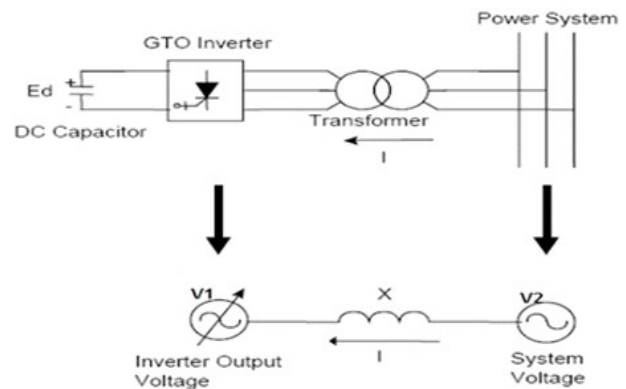


Fig.2: Static Synchronous Compensator (STATCOM)

The calculation of the rating of the STATCOM depends on various parameters and reactive power required by the power system to recover from grid faults so that there are no chances of losing synchronism with the grid. Cost analysis of the system can also be the factor for the final decision of the STATCOM rating [20].

3. PROPOSED MODEL

The experimental set up for the investigation of coordinated control action between DFIG and STATCOM for the proposed work is shown in fig.3. From left to right the system consists of a three-phase source of 220kV, 50 Hz acts as a swing Bus followed by a transformer, and 25 Km Transmission lines. Again at a distance of 23Krn from the centralized power center, there is another Wind power plant connected by TFR- I. The wind generator consists of 3 turbines having a capacity of 26KVA each.

The control structure of the DFIG wind turbine consists of two converters i.e. grid side converter control system and rotor side converter control system. The main purpose of the grid side converter is to control and set the capacitor voltage. Apart from the voltage setup, it is also used to control the d-axis and q-axis current and its alignment.

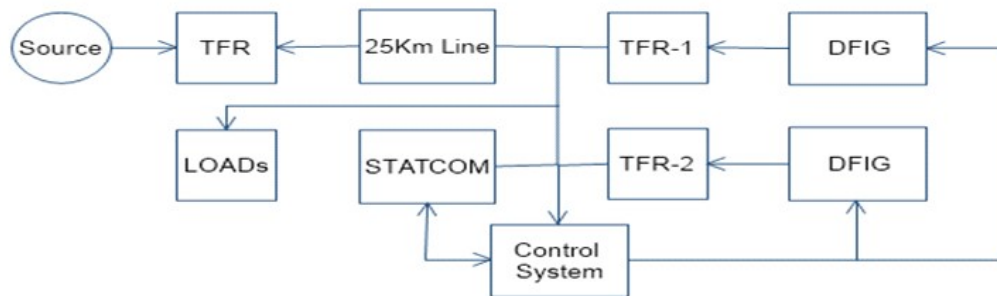


Fig.3 Block diagram of Experimental setup in MATLAB

Here the q-axis component of the control structure is set to zero to generate unity power factor across the output. Again the reference voltage i.e. V_{dc} in figure 4 is also set to a higher voltage like 800V, 1200V for a grid side voltage level of 400V ac based on the relationship of $\sqrt{\frac{2}{3}} V_s$. Here in this model two PI-Controller has been used instead of one PI-controller to increase the performance of the controller. The detail parameter for the grid side converter is shown in table.2. It can be seen that here the actual dc voltage is around 528V and that of the reference is fixed at 1150V with a modulation index of 0.92. The Optimum result for the controller can be obtained bt setting the Modulation index in between 0.9 to 1.0 and hence in this paper, it has been considered as 0.92.

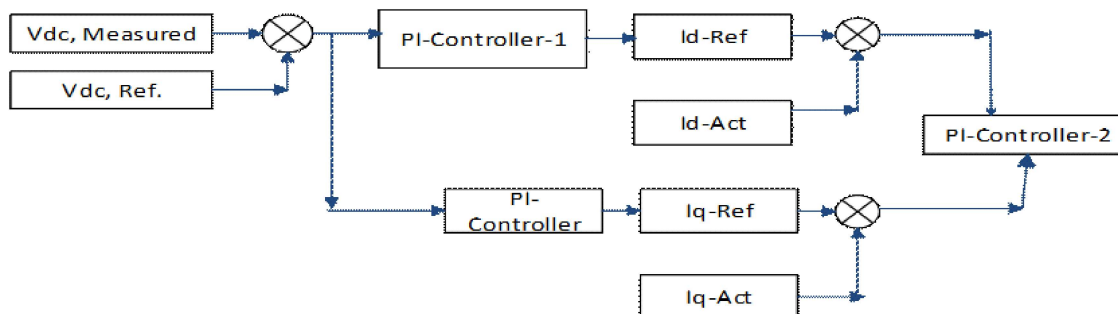


Fig.4 : Grid Side Converter Topology based on PI-Controller

4. RESULT AND DISCUSSION

4.1.1 Variation in Wind Velocity

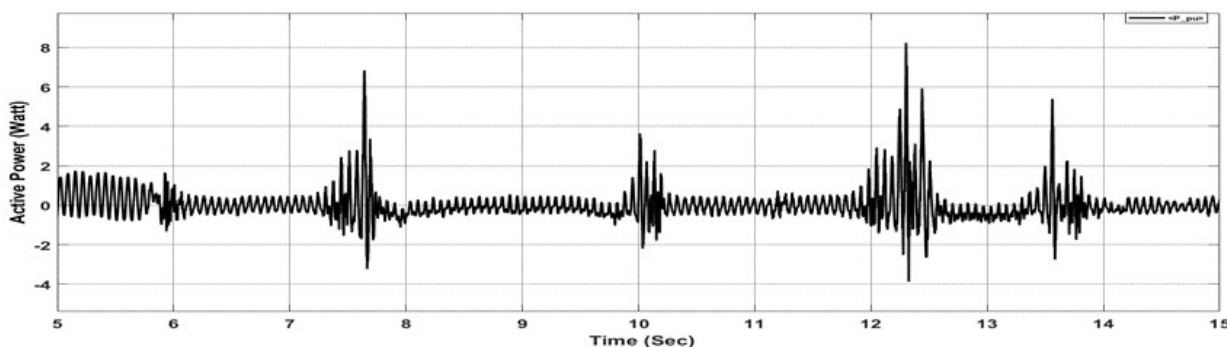


Fig.5 : Active power Generated by DFIG under different Wind Velocity

The result analysis under this section includes the effect of wind velocity on active power generation at the output of DFIG. From figure 5 which shows the active power generated by DFIG on the different wind speed it can be found that it variation of 5

different wind speed can be marked on the active power fluctuation. An increase in active power up to a level of 8.2 megawatts at a time interval of 12.3 seconds can be marked.

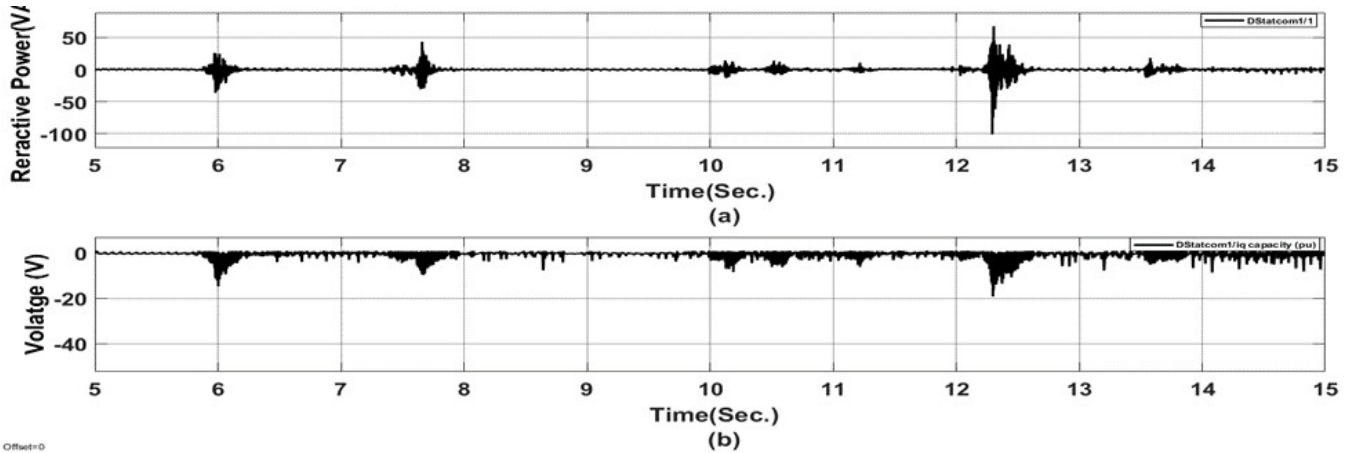


Fig. 6 (a) : Reactive power generated by STATCOM (b) : Voltage across capacitor

To support the voltage demand at the point of common coupling of the wind system, the STATCOM has operated in 5 major instances for maintaining sufficient reactive power at the terminal. Figure 6b shows the variation of voltage across the capacitor which is nothing but the linking capacitor between the STATCOM and that of the grid to which it is connected. It can be found that the STATCOM observes the maximum amount of reactive power at 12.3 seconds that is the instant of wind gust by changing the voltage across it.

4.1.2 Variation in Load

The effect of variation of load in the wind power plant has been investigated through figure number

8 to figure number 10. Here a 250-kilowatt load is connected at PCC with circuit breaker having switching instances from 11 to 15 seconds. During the instance of overloading that is 25% overloaded concerning the size of the system when the STATCOM has not operated, the wind farm gets into an islanding mode of operation. And again system synchronizes at 15second with that of the grid. From figure 9, it can be found that the real power demand of the load has been maintained by DFIG after the instances of the fault and that of reactive power is also increased in the same proportion. Figure 10 shows the gain and frequency maintained by STATCOM.

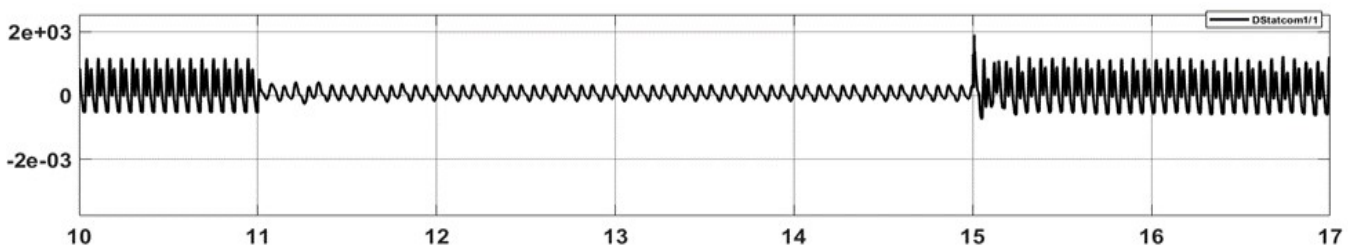


Fig.8 : Reactive Power exchanged by STATCOM with Grid

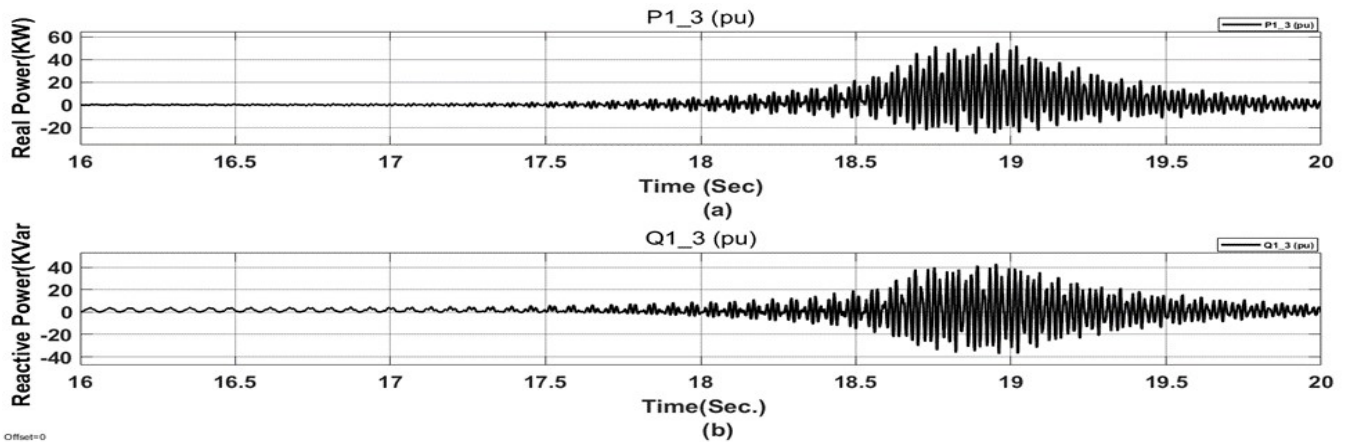


Fig.9 : Active Power exchanged by DFIG-1 with Grid

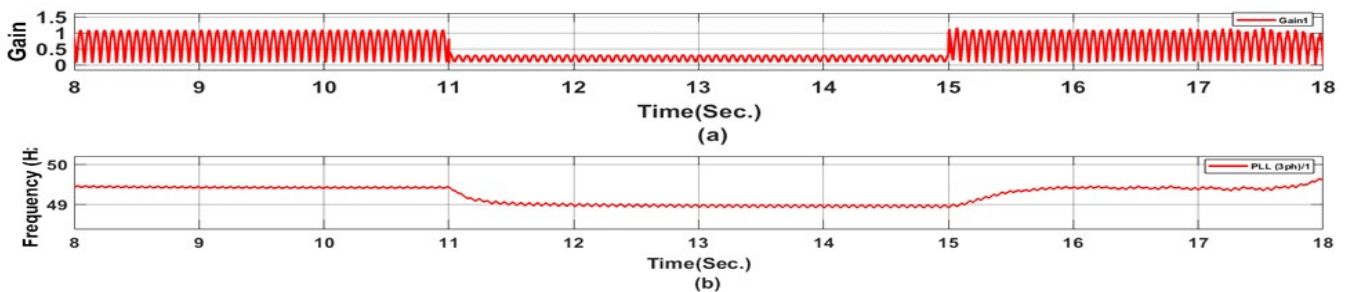


Fig.10 (a) Gain maintained by STATCOM (b) Frequency at PCC

5. CONCLUSION

In this paper, the coordinated control action between double field induction generator and STATCOM has been discussed for different conditions such as a change in wind velocity and change in load at the point of common coupling. Matlab simulation on a 200-kilowatt system has been investigated and the performance has been validated through the control strategy as mentioned. To reduce the power quality problem in the grid, a different controlling strategy based on the PI controller has been implemented. The coupling capacitor used in the STATCOM matches the input voltage with that of the grid and mitigate the oscillation on the DC link voltage.

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EQUIVALENCY OF ENGINEERING DIPLOMA - AN ANALYTICAL VIEW

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ABSTRACT

Since the diploma in engineering has been three year duration after the high school and two year after intermediate or ITI, and these diploma holders pursue the four year engineering degree course under lateral entry by three year, also the simple graduate pursue the same as three year engineering degree. So the engineering diploma holders be treated as analogous to simple graduation rather than intermediate as prescribed by state government order as equivalent to intermediate. Also seeing the next point of view of subjects studied by engineering diploma holders during three year span, are much more than intermediate or simple graduation. Also having industrial training of four weeks, diploma holders have some extra exposure of operation of equipments, production work process, storage / supply of product, manual gesture and tacking with industrial resources. So the emphasis is for the diploma holders be treated as analogous to simple graduation, which is the need of hour.

Key words : SCVT/NCVT-State /National Council of Vocational Training, Simple graduation-Bachelor of humanities/commerce/science, 10-High School, 10+2=High School+ Intermediate, 10+3=High School+Diploma, 12+2=Inter+Diploma, 12+3=Inter+Simple graduation, 12+4=Inter+Degree in engineering, (10+3)+3=Diploma+Engg.Degree, (10+2+2)+3=Diploma+Engg.Degree, (10+2+3)+3=Simple graduation+Engg.Degree.

1. INTRODUCTION

Equivalent or analogous of certificates/ diplomas/degrees are most commonly used term in education, which means the at par status of conferred attainments by any board, institutions or universities, so as in any job someone could apply accordingly in respective concern. At par indicates alike similar, however not equal. Sometime it may better or lesser valued. When original qualification bearers are insufficient, then weightage is given to equivalent qualification bearers. However in existing scenario, as open competitions are going on, hence

every, one bearing the same, is given opportunity to face open written exam and get selection.

Generally the intermediate certification is made available through state board/national board, diploma from state technical board-covering all districts of the state, ITI from SCVT/NCVT and simple graduation from zonal university like CCS University, Lucknow University, Kanpur University, Agra University, Rohilkhand University etc covering 4 to 5 district of the state.

So far the title is concern, wherein on the basis of duration, in pasts and in present as well as

number of subjects and on industrial demand basis, data have been put up before readers on individual way, to highlight diploma in engineering vis-a vis intermediate versus simple graduation. The author has been indulged in technical education and working since long pasts and after having experience in technical teaching, fairly and judiciously inclined towards the promotion of technical education and justified his pros to make the engineering diploma to the viable attainments. Since the examination procedure is in semester wise in intermediate, diploma and in simple graduation, hence no any matter exist with equivalent. So far the subjects are concerned, it has been observed that intermediate has 5 subjects plus respective practical in physics, chemistry and biology. In diploma in engineering there are more than 30 subjects and almost all subjects have practical. In simple graduation it has been observed that there are approximately 28 subjects including practical. Seeing this difference it may be noticed that engineering diploma may be treated at par with simple graduation. Also the subjects in diploma are of diversified in nature, while in intermediate and simple graduation, little diversification is there. Diploma being technical is more liking in demand, because of job opportunities are much more than intermediate as well as simple graduation. Also industrial requirement for job wise and operation of equipment wise as well for diploma holders seem much more for diploma holders. Because diploma holders have four weeks industrial training, where they learn different aspects during internship, like punctuality, operation of machinery, handling of equipment, liason with concern staff, working condition, production process, supplying chain, financial things and over all culture within industry etc. So they have good exposure of surroundings.

However only on duration base justification has been made through illustration to cover the title of paper.

2. JUSTIFICATION

Diploma in engineering of three years duration is the lower course than graduation in engineering like B.E./B. Tech./B.sc.(engineering) of four year duration after intermediate as base

qualification for engineering and above level course than ITI where basic qualification has been pre-metric or metric for ITI.

For diploma basic qualification has been made as high school for three year duration course and intermediate/ITI as entry qualification for lateral entry to 2nd year for three year duration diploma course.

Means the diploma has $10(\text{metric}) + 3(\text{duration})=13$, or $12(\text{inter/ITI})+2(\text{duration})=14$, while ITI has $10(\text{metric})+2(\text{duration})=12$, and graduation in engineering has $12(\text{inter})+4(\text{duration}) = 16$ and through its lateral entry to B.Tech. is $10(\text{metric}) + 3(\text{diploma}) + 3(\text{duration}) = 16$, or $12(\text{inter/ITI}) + 2(\text{lateral entry diploma})+3(\text{duration lateral entry B.Tech.}) = 17$ or $12(\text{inter}) + 3(\text{B.Sc.}) + 3(\text{duration lateral entry B.Tech.})=18$

In past say up-to 1990, the simple graduation was for 2 years like B.A., B.Com and B.Sc. at that time the duration include $10(\text{metric})+ 2(\text{inter}) + 2(\text{graduation})=14$, but diploma has been three years since its begining and include duration $10(\text{metric})+3(\text{diploma})=13$.

So the diploma seems equal to graduation because in State University of U.P. merges diploma holders or B.Sc. holders in lateral entry to B.Tech. and for them their B.Tech becomes 3 years duration.

3. JUSTIFICATION IN TABULATION FORM

The details of course duration represents in following manner.

$10 + 3 = 13$ means metric plus diploma

or

$12 + 2 = 14$ means inter plus Lateral Entry diploma

Here $13=14$ as both duration serves DIPLOMA.

Also $13 + 3 = 16$ means diploma plus Lateral Entry B.Tech is equal to $12+3+3=18$, means Inter plus B.Sc plus Lateral Entry B.Tech.

Here the term can be under stood easily in following manner.

10= Metric
 10 +2=12=Inter=ITI
 (10+2)+3=15=Intermediate +simple graduation.
 (10+2)+4=16= intermediate + Engineering Graduate
 10+3=13=Diploma in engineering
 (10+2)+2=14=Intermediate /ITI +Diploma in engineering
 (10+3)+3=16=diploma +B.tech.
 (12+2)+3=17=diploma +B.tech.
 (12+3)+3=18=simple graduation +B.Tech.

Here as cited above through duration of course, it is clear that

13=14=diploma in engineering (10+3=13=Diploma in engineering, (10+2)+2=14= Intermediate /ITI + Diploma in engineering)

16(13+3)=16(12+4)= 17(12+2+3)=18(12+3+3)= B.Tech.

Or 16=18 or 17=18 or 16=17=B.Tech.

Also 12+3=15=Simple graduation.

- (1) Here 13=14 as happening for diploma course.
- (2) 16=16=17=18 as happening for B.Tech.
- (3) Then why not 13=14=15=diploma in engineering =B.Sc.

As 15=16=17, respectively stands duration for simple graduation =B.Tech.= graduation in medical. As any graduation is equivalent whether it is in humanities, commerce, science, engineering, medical, fine arts, law, computers, management, education, pharmacy and music too even, and all above courses have same status at Post graduate level and doctoral level as well, whether Ph.D. in any field.

Though a general tendency exists with society that humanities have post graduation in the same trade, while commerce have in its trade and humanities too, while Science has P.G. in humanities, commerce and science itself too. Similarly engineering and medical have vast horizons and may go in any field. However it is better for all to have competency in open competitions held for everyone for any graduates. Those having versatility may crack the competition and get the post. Their modus operandi may something different, however their decision making should be clear and dependent on presence of mind.

4. CONCLUSION

Considering the duration of course and seeing the course content as well as number of subjects of diploma in engineering, it seems relevant to equivalent the diploma in engineering to simple graduation rather than intermediate, as it being technical qualification which includes the science and mathematical concept and engineering concepts too, be given the status of simple graduation. On cited grounds, no doubt diploma holders to be given the analogous status of simple graduation. In existing scenario it is the need of hour to justify their knowledge and skills. Also to balance the educational system, it is a matter of again looking over this, to authenticate it parallel to simple graduation.

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★★★★★

AN APPLICATION OF THE 'HORIZONTAL Y' QUEUING MODEL IN HOSPITAL

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ABSTRACT

The 'Horizontal Y' queuing model in which there is bulk infinite arrival of patient's, but available M services are limited. The discrete flow of patients in the system is reduced in continuous flow and a diffusion equation is used. In terms of means and variances of inter arrival time distribution, this process of number of patients and number of servers is used, impose reflecting boundaries. The motivation of this paper due to Aradhye & Kallurkar(2014) and Armony et al. (2005). In which explained that hospitals are complex system and will be solved using queuing theory. The present paper deals with it double ended queue in which patients wait in a queue for services. The discrete distribution equations for queue size with various cases have been derived. Finally, the mean for bulk arrival of patients i.e. L_c and mean for finite server L_s have been derived.

Keywords: Horizontal Y shaped model, Hospital Sector, model $G/G_M/1$, Bulk Arrival

Mathematics Subject Classification: 90B22, 60K25, 60K30

1. INTRODUCTION

Queuing theory is a broad discipline with roots dating back to the early twentieth century. The basic goal of queuing theory research is to figure out how to provide patients with high-quality and fast service. Erlang (1909) did the groundwork in the subject of queuing theory. The many other researchers namely Molina (1927), Fry (1928), Kasturi and Lakshmi (2003) and Morse (1958), Gumbel (1960), Lakshmi and Iyar (2013), Pandey and Gangeshwer (2018), have worked on queuing theory. According to Aradhye and Kallurkar (2014),

waiting is a global problem that affects almost everyone, and it consumes a lot of time and money. Armony et al. (2005), stated "Hospitals are extremely challenging systems with critical societal advantages". A physical perspective of patient flow in hospitals using a queuing model is useful for assessing and improving overall execution. The importance of quality and service work in health care is something that they should consider when planning and executing their operations or actual timetable. In terms of layout, capabilities, and control, queuing models are especially beneficial.

Therefore, in this investigation major attention has been paid to the development of queuing models with its application in medical science.

Queuing models are extremely important for all of us because we frequently encounter waiting lines or lineups. For example, double-ended queue describes a situation in which a demand process is arriving at the queue, as well as a supply process that is arriving to match the demand process. The double-ended queue application settings range from organ transplants where patients waiting for organs would be matched with donors or organs already obtained. In the traditional model both demand and supply process has arrivals in single units and demand will need only a single unit to be served. At the time of arrival for both sides, if there is a queue of attendants waiting for the arrival of the unit under consideration, then, the demand and supply is matched instantaneously and leave the system together. It is also assumed that as long as a demand unit and a supply unit come across each other, the match will happen without failure. The arrival processes were initially assumed to be exponential as well. A depiction of this system could also be found in figure-1 below.

Using the generating function method, Sasieni (1961) constructed a double ended queue model with impatient clients. The diffusion approximation, according to Reiser and Kobayashi (1974), is an attempt to overcome the limits of exponential server queuing models by considering the mean and variance of the service time distribution. Whit (1982) talked on how to improve queue diffusion approximations. In the case of the

double ended queue model, Srivastava and Kashyap (1982) derived the generating function method and utilized it to analyze additional models. Hlynka and Sheahan (1986) investigated the optimal management of one Poisson process over another. Due to mathematical complexity, the exact answer for a double-ended queue with a generic arrival distribution cannot be found. Diffusion approximation is used to solve complex queuing systems. Using the diffusion approximation technique, Jain (1986) investigated a double-ended queue with generic arrival. For state-dependent queues, Kimura (1987) proposed a unifying diffusion approximation model. Garg et al. (1993) used diffusion approximation to investigate the $G/G^Y/m$ queuing model with discouragement. Jain (1994) later explained a diffusion approximation for the $G/G/1$ double-ended queue. Whit (2004) showed a diffusion Approximation for the $G/GI/n/m$ Queue. If any big crowded program is organized, some time that causing many people to be harmed. Now that the pilgrims require quick medical attention, just a few doctors or servers are available, which is limited in in real situation. On the other side private hospitals has to wait for customers.

In this paper, " $G/G_M/1$ horizontal Y shaped model" have been considered in which there is bulk arrival patients but available services are limited by effective reflecting boundaries at M and N. Finally develop the discrete distribution equation for queue size with various cases. Finally find out the mean for bulk arrival patients i.e L_C and mean for finite server L_S . In section (1) explain about introduction, motivation and about literature. In Section (2)

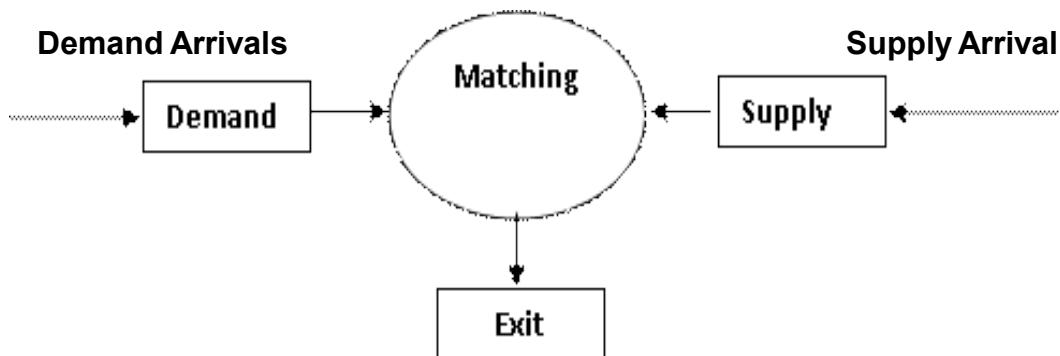


Fig.: 1 Generalized Double Ended Queue System

explained about the proposed double ended Horizontal Y queue model, in which first Approximate Solution, Second approximate Solution and normalizing condition have been derived. Section (3) deals discrete distribution for queue size. Last section (4) discussed about the result.

2. DEVELOPMENT OF THE PROPOSED $G_a/M/1$ MODEL

Assumed double ended queue model with no limit of arrival patients in the system but occupying

area for arrival patients are enclosed in which on N patients stay for M - services and remaining are outside of this enclosed area and they will wait for service. When this first N Patients will take services then remaining patients will come in enclosed area, reference to figure. In inter arrival times suppose patients/services are identically and independently distributed with mean arrival rate $\lambda(\mu)$ and square coefficient of variation P_a^2/P_s^2 .

The Arrival patients balks with probability $p=n/N$ where $n= 0, 1, 2, 3, \dots, N$

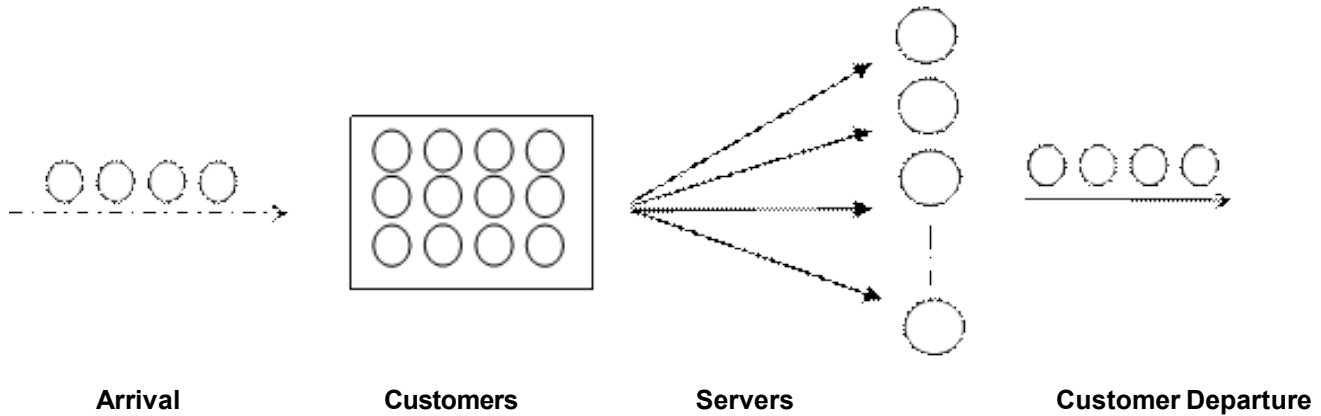


Fig.2 : A Systematic views proposed queue model

If $N(t)$ is number of units present in the system at a time $t \geq 0$ then the diffusion approximation methodology dictates that we replace the discrete valued variable $\{N(t), t \geq 0\}$

$$P_n(t) = \begin{cases} \text{Prob \{patients waiting in outside and inside of the enclosed area at time t\}} \\ \text{Prob \{-M Services waiting for patients at time t\}} \end{cases}$$

If $N(t)$ is number of units present in the system at a time $t \geq 0$ then the diffusion approximation methodology dictates that we replace the discrete valued variable $\{N(t), t \geq 0\}$ by the continuous valued variable $\{X(t), t \geq 0\}$. Pandey and Gangeshwer (2018) derived $\alpha(x)$ and $\beta(x)$ be the infinitesimal mean and variance of the process. After integrating and using exponential and logarithmic property

by the continuous valued variable $\{X(t), t \geq 0\}$. Pandey and Gangeshwer (2018) derived $\alpha(x)$ and $\beta(x)$ be the infinitesimal mean and variance of the process. After integrating and using exponential and logarithmic property

$$P(x) = \frac{k}{\beta(x)} \sum_{n=0}^{\infty} \frac{1}{n!} \left(2 \int_0^x \frac{\alpha(x)}{\beta(x)} dx \right)^n \quad (1)$$

2.1 First Approximate Solution

The solution $P_1(x)$ of equation (1) when $x \hat{=} 0$ become

$$P_1(x) = \frac{k}{\lambda P_{a^2} + \mu P_{c^2}} \sum_{n=0}^{\infty} \frac{1}{n!} \left\{ 2 \int_0^x \frac{\lambda - \mu}{\lambda P_{a^2} + \mu P_{c^2}} dx \right\}^n$$

$$P_1(x) = \frac{k}{R} \sum_{n=0}^{\infty} \frac{1}{n!} \left\{ 2D \int_0^x dx \right\}^n \quad P_1(x) = (-1)^n K g_1(x) \quad (2)$$

Where

$$D = \frac{(\lambda - \mu)}{\lambda P_{a^2} + \mu P_{c^2}} \text{ and } R = \lambda P_{a^2} + \mu P_{c^2}$$

$$\text{Here } g_1(x) = \frac{1}{R} \sum_{n=0}^{\infty} \frac{1}{n!} (2Dx)^n$$

Where $g_1(x)$ is continuous at $x=0$ and continuity value of $g_1(x)$ is $\frac{1}{R}$.

2.2 Second Approximate Solution

Now, the Solution $P_2(x)$ of equation (1) when $x \geq 0$ become

$$P_2(x) = \frac{K}{\lambda P_{a^2} (1 - x/N) + \mu P_{c^2}} \sum_{n=0}^{\infty} \frac{1}{n!} \left\{ 2 \int_0^x \frac{\lambda (1 - \frac{x}{N}) - \mu}{\lambda P_{a^2} (1 - \frac{x}{N}) + \mu P_{c^2}} dx \right\}^n$$

Changing improper fraction to proper fraction then integrate:

$$\begin{aligned} &= \frac{NK}{N\lambda P_{a^2} - x\lambda P_{a^2} + \mu N P_{s^2}} \sum_{n=0}^{\infty} \frac{1}{n!} \left[\frac{2x}{P_{a^2}} \right. \\ &\quad \left. + \frac{2\mu N}{\lambda P_{a^2}} \left(1 + \frac{P_{s^2}}{P_{a^2}} \right) \left\{ \log \left(1 - \frac{x\lambda P_{a^2}}{\mu N P_{s^2} + \lambda N P_{a^2}} \right) \right\} \right]^n \\ &= \frac{NK}{N\lambda P_{a^2} - x\lambda P_{a^2} + \mu N P_{s^2}} \sum_{n=0}^{\infty} \frac{1}{n!} \left[\frac{2x}{P_{a^2}} \left\{ \frac{N\mu P_{s^2} + \lambda N P_{a^2} - x\lambda P_{a^2}}{N\mu P_{s^2} + \lambda N P_{a^2}} \right\}^{\frac{2\mu N}{\lambda P_{a^2}}} \right]^n \\ &= \frac{K}{\lambda P_{a^2} + \mu P_{c^2}} \left\{ 1 - \frac{x}{N \left(1 + \frac{\mu P_{s^2}}{\lambda P_{a^2}} \right)} \right\}^{\frac{2\mu N}{\lambda P_{a^2}} \left(1 + \frac{P_{s^2}}{P_{a^2}} \right) - 1} \sum_{n=0}^{\infty} \frac{1}{n!} \left(\frac{2x}{P_{a^2}} \right)^n \\ P_2(x) &= \frac{K}{R} \left\{ 1 - \frac{x}{A} \right\}^{B-1} \sum_{n=0}^{\infty} \frac{1}{n!} \left(\frac{2x}{P_{a^2}} \right)^n \end{aligned}$$

$$\text{Where } A = N \left(1 + \frac{\mu P_{s^2}}{\lambda P_{a^2}} \right) \text{ and } B = \frac{2\mu N}{\lambda P_{a^2}} \left(1 + \frac{P_{s^2}}{P_{a^2}} \right)$$

$$P_2(x) = \frac{K}{R} g_2(x) \quad (3)$$

Where

$$g_2(x) = \left\{1 - \frac{x}{A}\right\}^{B-1} \sum_{n=0}^{\infty} \frac{1}{n!} \left(\frac{2x}{P_{a^2}}\right)^n$$

Here $g_2(x)$ is continuous at $x=0$ and continuity value of is 1.

Since both are continue at a point.

Therefore

$$\frac{g_1(0)}{g_2(0)} = \frac{1}{R}$$

2.3 Normalizing Condition

Using impose reflecting boundaries $-M$ to N

$$\int_{-M}^0 P_1(x) dx + \int_0^N P_2(x) dx = 1$$

$$\int_{-M}^0 \frac{k}{R} \sum_{n=0}^{\infty} \frac{1}{n!} \left\{2D \int_0^x dx\right\}^n dx + \int_0^N \frac{K}{R} \left\{1 - \frac{x}{A}\right\}^{B-1} \sum_{n=0}^{\infty} \frac{1}{n!} \left(\frac{2x}{P_{a^2}}\right)^n dx = 1$$

$$K = \frac{2D(\lambda P_{a^2} + \mu P_{c^2})}{\left\{\sum_{n=0}^{\infty} \frac{1}{n!} (2DM)^n - 1\right\} + 2DI_1} \quad (4)$$

Where

$$I_1 = \int_0^N \left\{1 - \frac{x}{A}\right\}^{B-1} \sum_{n=0}^{\infty} \frac{1}{n!} \left(\frac{2x}{P_{a^2}}\right)^n dx$$

Solving this I_1 using relation "incomplete gamma function"

$$\gamma(z, \alpha) = \int_0^{\alpha} t^{z-1} e^{-t} dt$$

$$I_1 = L \left[\gamma\left(B, \frac{2a}{P_{a^2}}\right) - \gamma\left(B, \frac{2(A-N)}{P_{a^2}}\right) \right]$$

Finally

$$= \frac{K}{2D \left\{ \sum_{n=0}^{\infty} \frac{1}{n!} (2DM)^n - 1 \right\} + L \left[\gamma\left(B, \frac{2a}{P_{a^2}}\right) - \gamma\left(B, \frac{2(A-N)}{P_{a^2}}\right) \right]}$$

3. RESULTS OF THE PROPOSED MODEL

The discrete distribution for queue size is derived in following manner

$$P(n) = \begin{cases} \frac{(-1)^n K}{R} \sum_{n=0}^{\infty} \frac{1}{n!} (2Dx)^n & n < 0 \\ \left\{1 - \frac{x}{A}\right\}^{B-1} \sum_{n=0}^{\infty} \frac{1}{n!} \left(\frac{2x}{P_{a^2}}\right)^n & n \geq 0 \end{cases}$$

$$P(n) = \int_{n-\frac{1}{4}}^{n+\frac{1}{4}} P(x) dx \quad \text{when } n < 0 \text{ then } P(n) =$$

$$\frac{K}{2D} \left(\sum_{n=0}^{\infty} \frac{D^n}{n!} - 1 \right) \sum_{n=0}^{\infty} \frac{\{-2D(n+\frac{1}{4})\}^n}{n!}$$

$$\text{When } n \geq 0 \text{ then } P(n) = KL \left[\gamma\left(B, \frac{2(A-n+\frac{1}{4})}{P_{a^2}}\right) - \gamma\left(B, \frac{2(A-n-\frac{1}{4})}{P_{a^2}}\right) \right]$$

Now for another value:

$$P(n) = \int_{n-\frac{3}{4}}^{n+\frac{3}{4}} P(x) dx \quad \text{When } n < 0 \text{ then}$$

$$P(n) = \frac{K}{2DR} \left(\sum_{n=0}^{\infty} \frac{(3D)^n}{n!} - 1 \right) \sum_{n=0}^{\infty} \frac{\{-2D(n+\frac{3}{4})\}^n}{n!}$$

$$\text{When } n \geq 0 \text{ then } p_n = KL \left[\gamma\left(B, \frac{2(A-n+\frac{3}{4})}{P_{a^2}}\right) - \gamma\left(B, \frac{2(A-n-\frac{3}{4})}{P_{a^2}}\right) \right]$$

And for the no limit of arrival patients then mean is denoted by L_c and evaluated by

$$L_c = \int_0^{\infty} x \left\{1 - \frac{x}{A}\right\}^{B-1} \sum_{n=0}^{\infty} \frac{1}{n!} \left(\frac{2x}{P_{a^2}}\right)^n dx$$

Solving the above equation using "Gamma Function" and relation of "incomplete Gamma Function" $\Upsilon(z+1, \alpha) = z \Upsilon(z, \alpha) - \alpha^z e^{-\alpha}$

Then the mean for patient is

$$L_c = \left[\left(\frac{BP_{a^2}}{2A} - 1 \right) \left\{ \Gamma B - \gamma \left(B, \frac{2A}{P_{a^2}} \right) \right\} + \left(\frac{2A}{P_{a^2}} \right)^{B-1} \sum_{n=0}^{\infty} \frac{(-1)^n}{n!} \left(\frac{2A}{P_{a^2}} \right)^n \right]$$

And mean for finite server is denoted by L_s and calculated by

$$L_s = \int_{-M}^{-1} x \frac{(-1)^n K}{R} \sum_{n=0}^{\infty} \frac{1}{n!} (2Dx)^n dx$$

Then finally we get

$$L_s = \frac{K}{4RD^2} \left[(2D-1) \sum_{n=0}^{\infty} \frac{1}{n!} (2D)^n + (1-2DM) \sum_{n=0}^{\infty} \frac{1}{n!} (2DM)^n \right]$$

4. CONCLUSION

The diffusion approximation is very helpful for discrete distribution for queue size with various cases. In these systems, the diffusion approximation can be used to predict performance characteristics such as queue length and waiting time distributions. In this paper the 'horizontal Y' queuing model discussed. The mean L_c for arrival patients and mean L_s for finite server have been derived. Finally, we present real-world applications in health-care models created to assist patients' service systems. The approach developed in this paper is powerful and can be used to analyze more complex queuing system. Jain (2013) also supports the application of double ended queue such that clients are arriving in groups of varying sizes or idle servers serving in batches. Arriving clients form a service queue, while an idle server that is taxis, and wait for consumers which are passengers.

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STOCK PRICE PREDICTION AND VISUALISATION USING MACHINE LEARNING APPROACH

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ABSTRACT

Stock trading is a very crucial activity in the world of Finance and is a supporting structure for many companies. Predicting the future value of a stock is the main goal of stock price prediction project. In this paper, we have used machine learning algorithms to predict future stock prices of a company. Stock prediction by the stock brokers is mainly done using the time series or the technical and fundamental analysis but as these techniques are very unreliable and limited, we propose making use of intelligent techniques such as machine learning. Python is a programming language which can be used to implement machine learning algorithms with its numerous inbuilt libraries. We propose an approach that uses machine learning algorithms and will be trained on the historical stock data that is available and gain intelligence, later it uses the knowledge acquired for predicting the stock prices accurately. LSTM is one of the machine learning techniques that is used for stock price prediction for small and large capitalizations also in different markets employing both up-to-minute and daily frequencies.

Keywords : Stock market, Machine Learning, LSTM (Long Short-Term Memory).

1. INTRODUCTION

The share market is a place where the shares of a public company are traded. As discussed in [7] the volatile nature of the stock market makes it an area which needs an abundance of analysis with the old data predicated. The previous stock trend prediction algorithms use the historic time series stock data. the typical scientific stock price forecasting procedures are focused on the statistical analysis of stock data. In the paper will develop a stock data predictor program that uses previous stock prices and data will be treated as training sets for the program to predict the stock

prices of a particular share this program develops a procedure.

This model considers the historical equity share price of a company price and applies RNN (Recurrent) technique called Long Short-Term Memory (LSTM). The proposed approach considers available historic data of a share and it provides prediction on a particular feature. The features of shares are Opening price, day High, day Low, previous day o price, Close price, Date of trading, Total Trade Quantity and Turnover. The proposed model uses the time series analysis in order to predict a share price for a required time span.

The proposed will be considering Indian stock exchange Company named as The National Stock Exchange of India Limited (NSE). The National Stock Exchange (NSE) is the Indian stock exchange entity, the NSE was the first exchange in India to provide a modern, provides latest facility to the investors spread across the length and breadth of the country. It has thoroughly modern with all latest facilities, which provides investors with the facility to trade from anywhere in India. This has a decisive role in reforming the Indian equity market to add increased transparency, convergence and efficiency to the capital market. NSE's Common Index, The CNX NIFTY, is used prodigiously by the investor across India as well as globally.

It provides accommodation for the exchange, settlement and clearing in equity and debt market and additionally in derivatives. This is one of India's most astronomically enormous mazuma, currency and index options trading exchanges worldwide. There are numerous domestic and ecumenical companies which have an interest in the exchange. Several regional companies include TATA, WIPRO, HDFC and YES BANK Ltd. Among pilgrim investors, few are strategic holdings of the city party, Mauritius limited, Tiger Ecumenical five holdings.

As suggested by [3] The Long Short-Term Memory (LSTM) networks are a type of recurrent neural network (RNN) capable of addressing linear problems. LSTM is a deep learning technique. Long-term Memory (LSTM) Units are enforced to learn very long sequences. This is a more general version of the gated recurrent system. LSTM is more benign than other deep learning methods like RNN or traditional feed forward because LSTMs tackle the evanescent gradient issue possessed by [10].

2. RELATED WORK

While doing the literature survey, the data about Stock market prediction systems that are as of now being utilized are considered.

Over the most recent two decades determining of stock returns has become a significant field of research. In the majority of the cases the scientists had endeavored to build up a straight connection between the information

macroeconomic factors what's more, the stock returns, be that as it may, with the revelation of nonlinear slants in the financial exchange record returns, there has been an incredible move in the focal point of the scientists towards the nonlinear expectation of the stock returns. Despite the fact that, there after numerous writings have come up in nonlinear measurable displaying of the stock returns, the majority of them required that the nonlinear model be indicated before the estimation is done. in any case, for the explanation that the financial exchange returns being boisterous, unsure, confused and nonlinear in nature. There are various functions used to forecast the parameters. Mainly include, binary threshold, linear threshold, hyperbolic sigmoid, and brown.

The Investigation of Stock Market Prediction Using Machine Learning Approach has been mentioned. The stock exchange forecast has become a sharp area of interest. Particular assessment is one of them, yet it does not reliably deliver specific results, so it is essential to develop strategies for progressively accurate gauge. All the procedures recorded under the backslide have their own ideal conditions and obstacles over their various accomplices. The way in which straight backslide models act is that they are consistently fitted using the least squares approach, however they may be fitted in different habits, for example by reducing the "non-appearance of fit" in some other standard, or by diminishing a disabled variation of the least square's setback work. Again, the least squares approach can be used to fit nonlinear models.

The impact of the financial ratios and technical analysis on stock price forecasting using random forests, the use of AI and human-made awareness frameworks to predict stock costs is a growing example. A constantly increasing number of experts spend their time every day considering ways to deal with techniques that can further improve the precision of the stock conjecture model. As a result of the galactic number of decisions available, there can be n number of ways on the most capable strategy to envision the expense of the stock, anyway all techniques don't work a comparable way. The yield changes for each methodology

whether or not comparative educational file is being applied. In the alluded to paper the stock worth gauge has been finished by utilizing the self-confident timberland figuring is being used to betoken the expense of the stock utilizing fiscal extent's structure the perspective quarter.

This is just a single technique for optically crusading the circumstance by advancing toward it utilizing an insightful model, utilizing the capricious boondocks to anticipate the future expense of the stock from recorded data. However, there are continuously different components that influence the cost of the stock, such as the suspicions of the money- related authority, the general assessment of the association, news from sundry outlets, and even events that cause the entire trade protection to change, by using the cash related size in the vicinity of a model that can strongly separate assumptions, the accuracy of the stock value forecast model can be extended.

It is also mentioned in [1] that stock value Prediction by methods for Multi-Source multiple instance learning unequivocally foreseeing the protections trade is a troublesome task, anyway the web has wind up being a useful gadget in making this task less difficult, due to the related course of action of the data, it is certainly not difficult to evacuate certain inclinations right now, it is less difficult to establish associations between different variables and, for the most part, a case of adventure The way in which budgetary trade information can be adequately predicted is through the use of some different options from specific legitimate data and the use of different strategies, such as the use of a feeling analyzer, to suggest a remarkable relationship between the emotions of individuals and how they are influenced by the enthusiasm for express stocks.

One of the progressively noteworthy areas of the desire strategy was to extract huge events from web news to see how they had an impact on stock costs. It is also mentioned that trade prediction protection: using historic data analysis. The stock or offer expense can be foreseen using chronicled data and its example in all actuality there is need to apply counts to anticipate the expenses. The

customary frameworks are just worried about variety of an element that is selected for forecast. The latter is usually achieved with the benefit of the Genetic Algorithms (GA) or the Artificial Neural Networks (ANN's) [5], but they neglect to establish a relationship between their stock costs as long-distance fleeting dependencies.

In [2] suggested that supervised learning classifier be used to forecast stock price movement based on financial index data, and determine their ability. In the financial market computational analytical approaches have been portfolio modeling. A discussion about the statistical AI methodology has been addressed; the usage of SVM methodology has been shown in the paper and also shown that tactical methodologies can be applied to predict the stock prices. Manoj S Hegde et al. [3] investigated that The Long Short- Term Memory (LSTM) networks are a type of recurrent neural network (RNN) capable of solving in volute linear problems, and also there is a discussion about the usage of RNN (Recurrent Neural Networks) to predict the share prices.

M. Mondial et al. [4] proposed that the Long ShortTerm Memory is the most popular RNN architecture. In the secret network layer, LSTM introduces a memory cell; a processing device that replaces conventional artificial neurons, using these memory cells, networks can effectively link memory and remote input in time, making it suitable to dynamically capture data structure over time with a high predictive limit. It is also shown in the paper that the stock prediction can be done on the NIFTY50 shares. The data collection is one of the major steps and later the training of our model and there is a need to test the algorithm by applying different data set to the algorithm. Our procedure will be discussed in coming sections

As Kim and H. Y. Kim et al. [5] identified that. another significant issue with basic ANNs for stock forecast is the marvel of detonating fleeting inclination, where the loads of a gigantically huge system either become excessively massively enormous or too minuscule (respectively), drastically easing back their union to the ideal worth. This is regularly brought about by two components:

loads are instated self-assertively and the loads progressively proximate to the end of the system moreover slope to transmute significantly more than those at the beginning. It is also mentioned in the paper that the usage of LSTM networks can be applied in procedure of predicting share prices.

As discussed by S. Selvin et al. [6], Customary types for dealing with the financial exchange investigation and the stock-value forecast include a major review of the past stock-exhibition gander and the general credibility of the organization itself, and a measurable investigation that is solely concerned with the calculation and recognition of stock-value designs, it also mentioned in the paper that different types of analysis that can be performed in order to predict the stock value.

Loke's et al. [7] suggested that the volatile nature of the stock market is an area that needs a lot of analysis based on historical data. Traditional stock trend forecast algorithms use historical time series stock data, traditional technical forecasting procedures for stock prices are based on statistical data analysis. in the paper author also talks about the change and advancements in the process of predicting stock prices using AI and Machine Learning methodologies, there are many research which are being conducted to find an accurate model to predict the stock prices and there is no universal solution which is available to apply, hence the historic data of a share will be considered for stock price prediction.

Xi Zhang¹ et al. [8] suggested that the stock markets play critical roles in modern society's economic operations. It is also mentioned in the paper that the analysis can be performed the data that is retrieved from a legitimate source and proposed a methodology in which we can utilize multiple sources of information to predict the stock values.

Tao Xing and Yuan Sun et al. [9] suggested a model which considers the historical equity share price of a company price and applies RNN (Recurrent) technique called Long Short- Term Memory (LSTM). The proposed approach considers available historical data of a share and it applies prediction on a particular feature. The features of

shares are Opening price, day High, day Low, previous day o price, Close price, Date of trading. The proposed model uses the time series analysis in order to predict a share price for a required time span.

Ordain Prosky et al. [10] suggested that, the CNN methodologies and its usage in predicting stock prices, a method to apply sentiment analysis on stock prediction.

As mentioned by X. Shao and D. Ma [11] it is a more general version of the gated recurrent system. LSTM is more benign than other deep learning methods like RNN or traditional feed forward neural networks because LSTMs tackle the evanescent gradient issue possessed by RNNs and it is also mentioned that how to implement LSTM along with K- means algorithms for a short-term stock predictor system.

3. LSTM – AN OVERVIEW

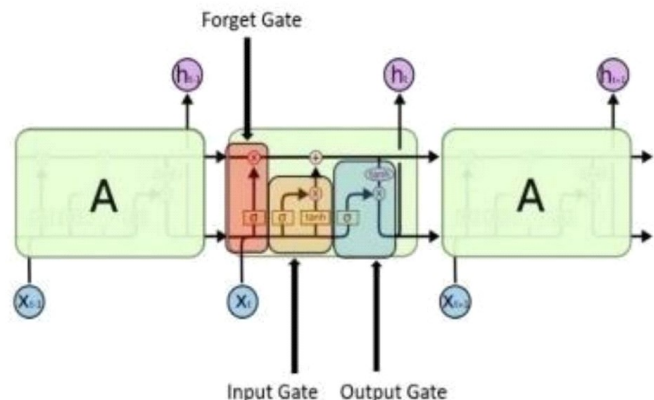


Fig 1 : LSTM Memory Cell

LSTMs are a special subset of RNN's that can capture context-specific temporal dependencies for long periods of time. Each LSTM neuron is a memory cell that can store other information i.e., it maintains its own cell state. While neurons in normal RNN's merely take in their previous hidden state and the current input to output a new hidden state, an LSTM neuron also takes in its old cell state and outputs its new cell state.

An LSTM memory cell, as depicted in Figure 1 has the following three components, or gates

a. **Forget gate:** the forget gate decides when specific portions of the cell state are to be replaced with more recent information. It outputs values close to 1 for parts of the cell state that should be retained, and zero for values that should be neglected.

b. **Input gate:** based on the input (i.e., previous output $o(t-1)$, input $x(t)$, and previous cell state $c(t-1)$), this section of the network learns the conditions under which any information should be stored (or updated) in the cell state

c. **Output gate:** depending on the input and cell state, this portion decides what information is propagated forward (i.e., output $o(t)$ and cell state $c(t)$) to the next node in the network

Thus, LSTM networks are ideal for exploring how variation in one stock's price can affect the prices of several other stocks over a long period of time. They can also decide (in a dynamic fashion) for how long information about specific past trends in stock price movement needs to be retained in order to more accurately predict future trends in the variation of stock prices.

4. TERMINOLOGIES USED

Given below is a brief summary of the various terminologies relating to our proposed stock prediction system:

a. **Training set:** subsection of the original data that is used to train the neural network model for predicting the output values

b. **Test set:** part of the original data that is used to make predictions of the output value, which are then compared with the actual values to evaluate the performance of the model

c. **Validation set:** portion of the original data that is used to tune the parameters of the neural network model

d. **Activation function:** in a neural network, the activation function of a node defines the output of that node as a weighted sum of inputs.

Activation function = "(inputs*weights) + bias"

e. **Batch size:** number of samples that must be processed by the model before updating the weights of the parameters

f. **Epoch:** a complete pass through the given dataset by the training algorithm

g. **Dropout:** a technique where randomly selected neurons are ignored during training i.e., they are "dropped out" randomly. Thus, their contribution to the activation of downstream neurons is temporally removed on the forward pass, and any weight updates are not applied to the neuron on the backward pass.

h. **Loss function:** a function, defined on a data point, prediction and label, that measures a penalty such as square loss which is mathematically explained as follows – $L(f(x_i), Y_i) = (f(x_i) - Y_i)^2$

i. **Cost function:** a sum of loss functions over the training set. An example is the Mean Squared Error (MSE), which is mathematically explained as follows:

$$MSE = \frac{1}{N} \sum_{i=1}^N (f_i - y_i)^2$$

where N is the number of data points,
 f_i the value returned by the model and
 y_i the actual value for data point i .

j. **Root Mean Square Error (RMSE):** measure of the difference between values predicted by a model and the values actually observed. It is calculated by taking the summation of the squares of the differences between the predicted value and actual value, and dividing it by the number of samples. It is mathematically expressed as follows:

$$RMSE = \sqrt{\frac{\sum_{i=1}^n (\hat{y}_i - y_i)^2}{n}}$$

5. PROPOSED SYSTEM

As represented in the previous section getting the historical data from market is mandatory step. Then there is a need to extract the feature which is required for data analysis, then divide it as testing and training data, training the algorithm to predict the price and the final step it to visualize the data. Fig represents the Architecture of the proposed system.

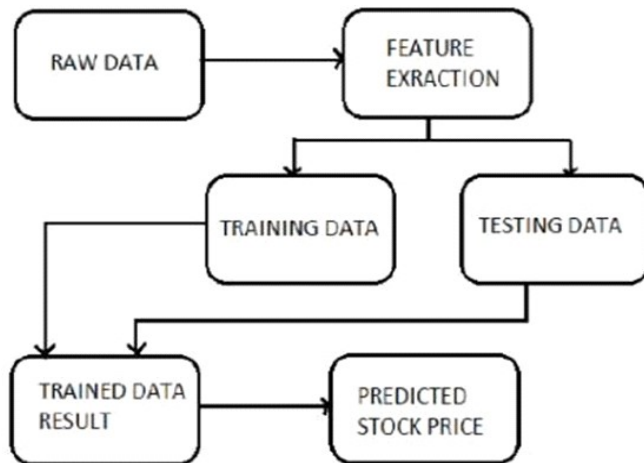


Fig.2 : System Architecture

The typical LSTM unit consists of a cell, an info door, an entrance door and a door with a view. The cell collects values over discretionary time intervals, and the three inputs manage the progress of data into and out of the cell. The main advantage of the LSTM is its ability to learn context-specific temporal dependence. Each LSTM unit collects information for either a long or short period of time (hence the name) without explicitly using the activation function within the recurrent components. A significant certainty to note is that any cell state is uniquely increased by the output of the overlooked entryway, which changes somewhere in the range of 0 and 1. In other words, the overhead door in the LSTM cell is responsible for both the loads and the capacity to initiate the cell state. Subsequently, data from a past cell state can pass through a cell unaltered rather than expanding or decreasing exponentially at each time-step or layer, and loads can meet their ideal quality in a reasonable measure of time. This allows LSTMs to take care of the evaporating slope issue – as the value put away in the memory cell is not iteratively adjusted, the inclination does not disappear when prepared with back engendering, where markets such as NSE and BSE are considered to be Indian trading entities for our analyzes.

6. A STOCK PRICE PREDICTOR USING LSTM

The proposed framework that learns online anticipating the close costs of the stock with the

assistance of Long Short-Term Memory (LSTM). The Long Short-Term Memory (LSTM) is a counterfeit intermittent neural system (RNN) design [1] used in the field of deep learning, unlike standard feed forward neural systems, LSTM has input associations. Not only does the procedure not focus on single information (e.g., pictures) but also on full information arrangements, (For example, a speech or a video). For example, LSTM is material for undertakings, such as un partitioned, associated penmanship recognition, speech recognition and recognition of peculiarities in arranged traffic or IDS (interruption location frameworks).

Algorithm 1: Stock prediction using LSTM Input: Historic stock data

Output: prediction of stock price using price variation Step 1: Start.

Step 2: Data Preprocessing after getting the historic data from the market for a particular share.

Step 3: import the dataset to the data structure and read the open price.

Step 4: do a feature scaling on the data so that the data values will vary from 0 and 1. Step 5: Creating a data structure with 60 timestamps and 1 output.

Step 6: Building the RNN (Recurrent neural network) for Step 5 data set and Initialize the RNN by using sequential repressor.

Step 7: Adding the first LSTM layer and some Dropout regularization for removing unwanted values.

Step 8: Adding the output layer.

Step 9: Compiling theRNN by adding Adam optimization and the loss as mean_squared_error.

Step 10: Making the predictions and visualizing the results using plotting techniques.

Before processing the data there is an important step that is to collect the information from market. Information assortment is the principal step in our proposed framework importing of the information from advertise clearing organizations like BSE (Bombay Stock Exchange) and NSE (National Stock Exchange). The dataset that will be utilized in the market expectation must be

utilized to be separated dependent on different perspectives. Information assortment additionally supplements to upgrade the dataset by including more information that is outside. Our information for the most part comprises of the earlier year stock costs. For python available packages for retrieving the data from NSE is NSEpy.

The next step is to preprocess the data; in this step the Information Pre-Processing is a significant advance in information mining here the change in crude information into a basic configuration is required. The information which is retrieved from source will be conflicting, fragmented and it will contain mistakes. The preprocessing step will purify the information; toward the end there is a need to perform highlights scaling which will restrict the factors.

The preparation of the model incorporates crossapproval, which is a very well-founded, projected execution of the model using the preparation information. the purpose of the tuning models is to explicitly tune the calculation training is to add information to the calculation itself. The test sets are immaculate, as a model ought not to be made a decision about dependent on concealed information. Scale up the information to the genuine offer costs. The final step is to draw the data using visualization technique that helps to show the variation of data in the outcome of our algorithm.

7. RESULTS AND DISCUSSION

The implementation of proposed LSTM model using python which predicts the future price of TATAMOTORS share based on its historical data. The below visualization figure shows the visualization of TATASHARE prediction. In our paper the implementation of an algorithm which predicts the stock price of a share for given period of time, the below graph from our algorithm will show the predicted price of TATAMOTORS share. In the result shown in the below graph is the plotted form our algorithm outcome by applying 96 LSTM units for achieving the accuracy.

The Fig 3 is drawn from original dataset and also shown the result by comparing its correctness with the trained model from algorithm that is defined

in the previous section. the “x” axis is share price. The “y” axis is days. The data is slot of 1500 days is shown in the Fig 4.

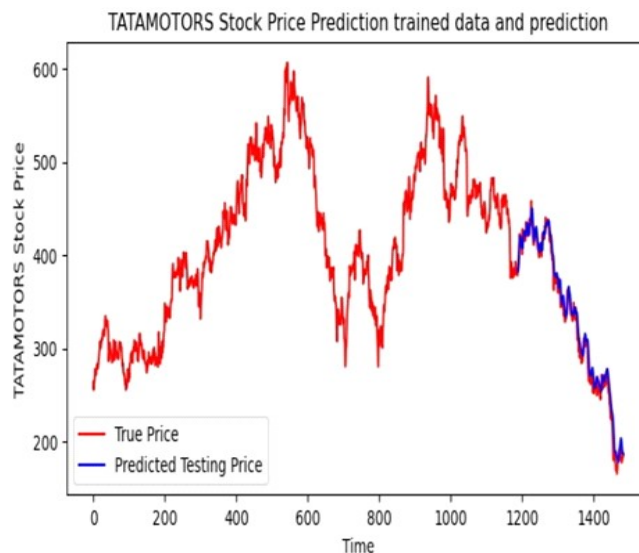


Fig.3 : Predicted testing stock price

The Fig 4 is drawn from original dataset also shown the result by comparing its correctness with the trained model from algorithm which that is defined in the previous section. the “x” axis is share price. The “y” axis is days. The data is slot of 300 days is shown in the Fig 4.

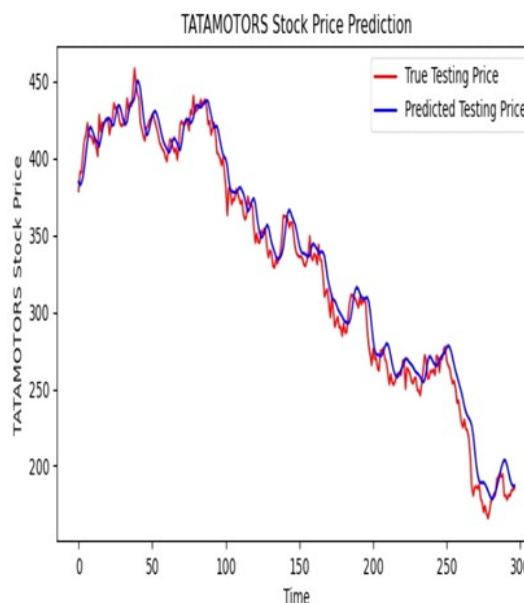


Fig.4: Predicted stock price

In the Fig 3, the graph has been plotted for whole data set along with some part of trained data. the graph is showing the open price of TATAMOTORS share for 1484th day's opening price with very minimal loss. the algorithm has plotted the graph successfully along with the predicted price testing price (blue) and true price (red), there is a slight difference in predicting the price between the predicted price testing price (blue) and true price (red), which proves that our algorithm is able to predict the with minimum loss rate for the given complete data set of a particular share.

In the Fig 4, the graph is showing the open price of TATAMOTORS share for 300th day's opening price with very minimal loss. the algorithm has plotted the graph successfully along with the predicted price testing price (blue) and actual testing price (red), there is a slight difference in predicting the price between the predicted price testing price (blue) and actual testing price (red), which proves that our algorithm is able to predict the with minimum loss rate of 0.0024.

The proposed algorithm is able to predict the share price with very low loss and error rate, if increase the epoch batch rates the training will be more efficient, in the above section we have used epoch batch size of 50 to predict the stock prices.

The figures shown in the previous section (fig 3 and fig 4) of the proposed algorithm is able to predict the price, with loss: 0.0024 300th days open price was 172 rupees INR and our predicted price is 166 rupees per share.

8. CONCLUSION

The study of the share is carried out in this paper and it can be carried out for several shares in the future. Prediction could be more reliable if the model trains a greater number of data sets using higher computing capacities, an increased number of layers, and LSTM modules.

In future enhancement the inclusion of sentiment analysis from social media to understand what the market thinks about the

price variation for a particular share and it can be implement this by adding twitter and Facebook API to our program as Facebook is a leading social media which has lots of market trend information posted by users.

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★★★★★

IOT BASED WEARABLE TRACKING CUM HEALTH CARE DEVICE FOR INDUSTRIAL WORKERS

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ABSTRACT

With huge amount of new healthcare technologies startups, IOT (Internet of Things) is revolutionizing the health care industry. We have designed a Wearable tracking cum health monitoring system for industrial workers with the help of IOT technology. The IOT platform used in this project is Blynk. Blynk is a device independent IoT platform with private clouds, white-label mobile apps, device management, machine learning and data analytics. This IOT device can able to read the pulse, spo2 and temperature of the user and also track the location using Geolocation API. It continuously monitors these parameters and updates them to an IOT platform.

Keywords : IOT, healthcare, wearable device.

1. INTRODUCTION

In the past decade, the need for automation with Internet of Things (IOT) has tremendously increased. IOT is revolutionizing the various industrial sectors especially automation and control. IOT not only plays a vital role in the industrial sector but also plays a crucial role in taking care of our day to day activities. Most of the home are becoming automated with the enlightening of IOT technology. IOT has stepped on to the field of medicine also to help the saviors of life. Smart systems are introduced to remotely monitor the patients and their regular reports can be generated periodically with the help of IOT. These devices act as a good health companion. The key requirements of these sort of devices are power consumption, cost and efficiency [1].

Medical scientists are working on the field of research and innovation to equip human race with better health services.

In chemical industries and power plants, due to the environment of those industries, the health of the workers of these industries are highly affected. They are heading severe health issues due to their working environment. The diagnosis of the diseases is done very late because of the ignorance of their regular health monitoring.

Body temperature, blood oxygen level, heart rate, blood pressure and respiration rate are the prime parameters to diagnose any sort of diseases. This project aims in developing a device which gives the body temperature, heart rate and blood oxygen levels in a regular manner along with the location of the user so as to track them easily to frequently

execute emergency measures in extreme situations.

2. MOTIVATION

In chemical industries and power plants, due to the environment of those industries, the health of the workers of these industries are highly affected. They are heading severe health issues due to their working environment. The diagnosis of the diseases is done very late because of the ignorance of their regular health monitoring.

A Disaster struck Uttarakhand's Chamoli district on February 7, 2021 as a torrential slide and downpour, after a part of the Nanda Devi icy mass severed. The abrupt flood in the day in the Dhaulti Ganga, Rishi Ganga and Alaknanda waterways — all unpredictably connected feeders of the Ganga — set off broad frenzy and huge scope demolition in the high mountain regions.

Two power projects — NTPC's (National Thermal Power Corporation) Tapovan-Vishnugad hydel project and the Rishi Ganga Hydel Project — were widely harmed with scores of workers caught in burrows as the waters came hurrying in. Somewhere around 32 individuals are dreaded dead, and more than 190 missing.

During these kind of emergency situations, tracking the missing workers is a tedious process. It's better to first find the workers who are still alive because finding the persons who were already dead was vain. If we find the workers who are still alive, we can save their lives. To achieve this, there is a need for a device which can monitor the health of the workers and also track them. If we have a device like that, a greater number of lives will be saved during this kind of emergency situations.

Not only for this is emergency situations, during the normal days also caring the health of workers very essential. So, a wearable health monitoring device is necessary for the healthcare of the industrial workers who work in tedious environment where lot of chemicals are used, temperature may be varying, etc....

So, to fulfil the need for a tracking as well as a health monitoring system for the industrial

workers, we went for a better solution that will help them in normal as well as emergency situations.

3. FACTORS TO BE CONSIDERED FOR DESIGN

The following factors are considered while proposing a design for the described problem:

- Affordable design (in terms of external design)
- Cost (Low)
- Efficiency (High)
- Power Consumption (Low)
- Accuracy (High)
- Environmental factors around industries (favorable for the device's working)
- Availability of network services for the better performance of the IOT system
- Size (Compact, mostly like wearable)
- Industrial areas (Terrain is mostly preferred for the proposed design)



Fig.1 : Factors considered for design

4. OBJECTIVE

- To design a tracking cum health monitoring system i.e. it tracks the user's location and measures body temperature, heart rate and blood oxygen level.
- To design a system to store the user data in cloud over a period of time.

- To perform analysis on data collected from the sensors.

5. PROPOSED SOLUTION

A System design is proposed using an MCU (Microcontroller Unit) and a set of medical sensors to monitor the health of the workers and an API (Application Programming Interface) is used to track the location of the worker.

The system consists of the following medical sensors:

- Temperature sensor
- Pulse oximeter sensor

The system also consists of a WIFI module for external communication with the remote monitoring person. The collected data is sent to the remote monitoring person using IEEE 802.11b/g/n. For storing the collected data, a cloud platform is selected. For our design, we have selected BLYNK IOT platform, since it's user friendly.

For the tracking of the user's location, we have used an API called Geolocation API, which will locate the user without the help of a GPS module [2]. This will result in a low-cost design as compared to a design with a GPS module. But accuracy is a factor to be considered according to the user's location [3].

This geolocation API will make use of the nearby LAN (Local Area Network) networks and cell phone base stations to get the exact location of the user. Lower the nearby networks lower will be the accuracy. In the presence of more nearby networks, we can get more precise location coordinates.

5.1 System and overview

Fig.2 shows the overview of the proposed system. The health monitoring sensors are used to collect the data i.e. data acquisition. The ESP8266 Wi-Fi module helps in data collection, communication and controlling as well as in acquiring the user's location through geolocation API. Data processing is done at the server and the collected data is displayed through an application.

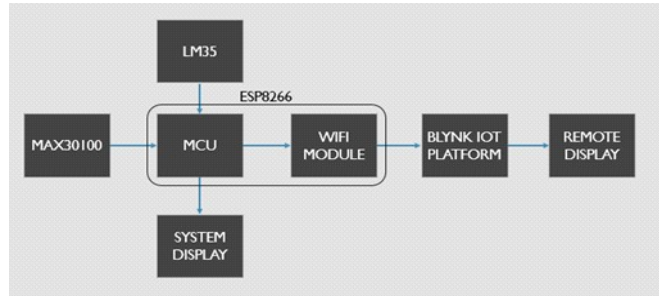


Fig. 2 : Block diagram of the system

5.2 Hardware

- 1) ESP8266 Wi-Fi module
- 2) MAX30100 Pulse oximeter sensor
- 3) LM35 temperature sensor
- 4) OLED (Organic Light Emitting Diode) display

5.3 Software

- 1) Arduino IDE
- 2) Geolocation API
- 3) Blynk IOT platform

6. DESCRIPTION OF COMPONENTS

6.1 ESP8266

The ESP8266 also called NodeMCU is an MCU with wi-fi module and a self-contained System on Chip SoC. The SoC is incorporated with TCP/IP protocol stack which can give any controller access to the Wi-Fi network. ESP8266 utilizes 802.11 b/g/n protocols and its standby power consumption is nearly less than 0.1 mW [4]. Fig 4 depicts the various components assembled in a NodeMCU and Fig 5 shows the pin configuration of ESP8266. The ESP8266 specifications are given in Table 1.



Fig.3 : ESP8266 Wi-Fi module (NodeMCU)

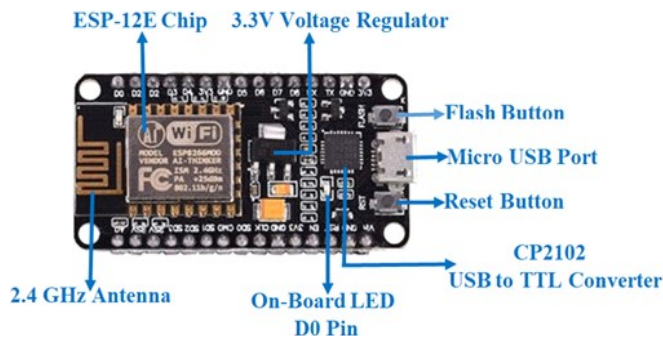


Fig. 4 : ESP8266 components description

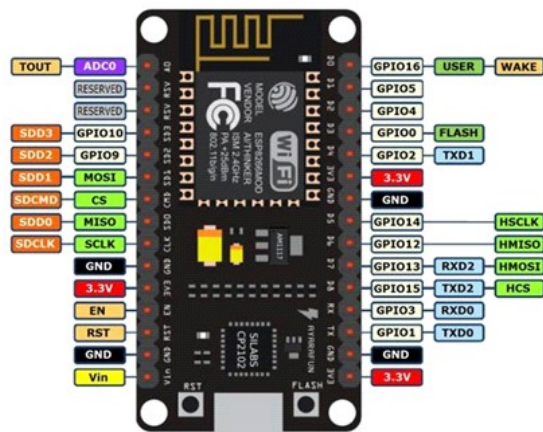


Fig.5 : Pin configuration of ESP8266

Table 1 : ESP8266 specifications

Categories	Items	Parameters
Wi-Fi	Certification	Wi-Fi Alliance
	Protocols	802.11 b/g/n (HT20)
	Frequency Range	2.4 GHz – 2.5 GHz (2400 MHz – 2483.5 MHz)
	TX Power	802.11 b: +20 dBm
		802.11 g: +17 dBm
		802.11 n: +14 dBm
Rx Sensitivity	802.11 b: -91 dbm (11 Mbps) 802.11 g: -75 dbm (54 Mbps) 802.11 n: -72 dbm (MCS7)	
Antenna	PCB Trace, External, IPEX Connector, Ceramic Chip	
Hardware	CPU	Tensilica L106 32-bit processor
	Peripheral Interface	UART/SDIO/SPi/I2C/I2S/IR Remote Control
	Operating Voltage	2.5 V – 3.6 V
	Operating Current	Average value: 80 mA
	Operating Temperature Range	-40 °C – 125 °C
	Package Size	QFN32-pin (5 mm x 5 mm)
Software	External Interface	-
	Wi-Fi Mode	Station/SoftAP/SoftAP+ Station
	Security	WPA/WPA2
	Encryption	WEP/TKIP/AES
	Firmware Upgrade	UART Download / OTA (via network)
	Software Development	Supports Cloud Server Development / Firmware and SDK for fast on-chip programming
	Network Protocols	IPv4, TCP/UDP/HTTP
User Configuration	AT Instruction Set, Cloud Server, Android/iOS App	

6.2 MAX30100

The MAX30100 is a coordinated heartbeat oximetry and heartrate screen sensor arrangement. It combines two LEDs, optimized optics, a photodetector, and low-noise analog signal processing to sense pulse oximetry and heart-rate signals. The operating range of MAX30100 sensor is 1.8 V and 3.3 V. The MAX30100 operates from 1.8V and 3.3V. It consumes negligible standby current thus allowing the power supply to remain connected at all times. The MAX30100 can be powered through software [5]. Fig 7 depicts the pin description of MAX30100.

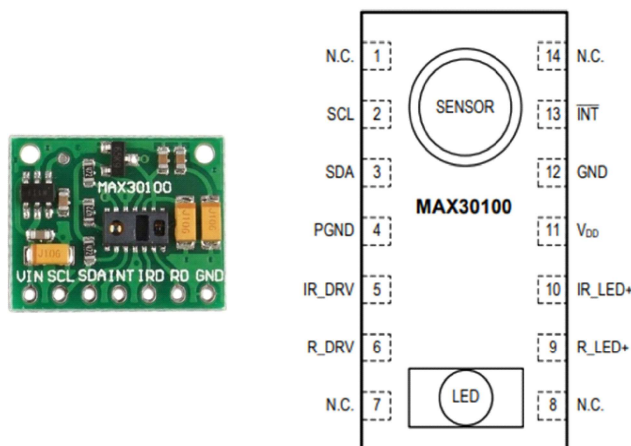


Fig.6 & 7 : MAX30100 Pulse oximeter sensor and Pin description

6.3 LM35

The LM35 series are exactness consolidated circuit temperature sensor devices with an outcome voltage straightly relating to the Centigrade temperature. The LM35 device partakes in an advantage over straight temperature sensors changed in Kelvin, as the customer isn't expected to remove a tremendous predictable voltage from the outcome to obtain accommodating Centigrade scaling. The LM35 device needn't bother with any external change or figuring out how to give ordinary precision of $\pm\frac{1}{4}^{\circ}\text{C}$ at room temperature and $\pm\frac{3}{4}^{\circ}\text{C}$ over a full "55°C to 150°C temperature range [6]. The LM35 is a 3-pin device which operates over a range of 4-20 V as shown in Fig 8.

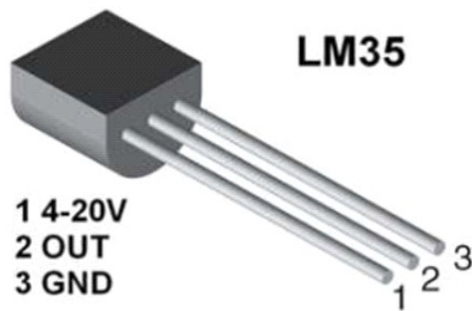


Fig. 8 : LM35 Temperature Sensor

The OLED display utilized is SSD1306 which is a solitary chip CMOS OLED/PLED driver with controller for polymer/organic light producing diode dot-matrix realistic showcase framework. It has 128 segments and 64 common. This IC is committed for Common Cathode type OLED board. The SSD1306 installs with contrast control, display RAM and oscillator, which decreases the quantity of outer parts and energy utilization [7].



Fig. 9 : OLED Display

6.4 Geolocation API

The Geolocation API returns an area and exactness sweep dependent on data about base stations and Wi-Fi hubs that the portable customer can recognize. The Geolocation API assists engineers with locating IoT, M2M (Machine to Machine) and other associated gadgets anyplace on the planet without GPS. The gadget or customer

initially sends the API information regarding which Cellular networks and Wi-Fi networks it can see close by. The API then, at that point, utilizes enormous datasets of Cell towers, Wi-Fi networks supported by various calculations to compute and return the gadget's location precisely to an extent. [8-9].

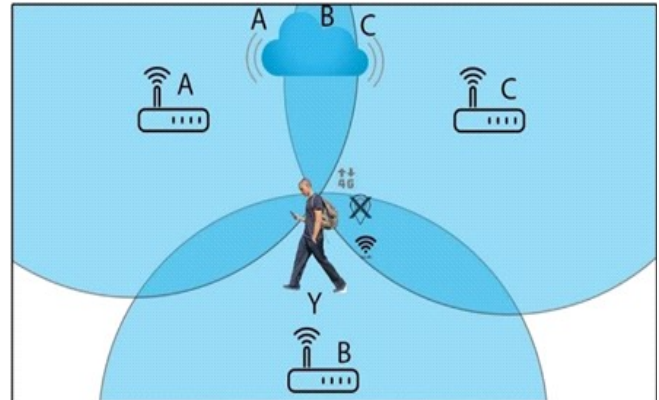


Fig. 10 : Geolocation API

6.5 Blynk IOT Platform

Blynk was intended for the Internet of Things. It is most well-known IoT Platform. It has the ability to control hardware remotely, it can show sensor information, it can store information, envision it and do numerous other cool things. With Blynk Library you can interface over 400 hardware models (including ESP32, ESP8266, NodeMCU, all Arduinos, Particle, Raspberry Pi, Texas Instruments, and so on) to the Blynk Cloud.

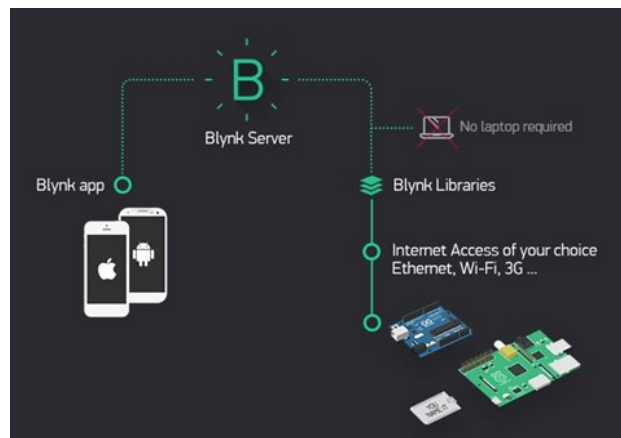


Fig.11 : Blynk IOT platform overview

7. CIRCUIT DIAGRAM AND CONNECTIONS

7.1 Circuit Connections

- 1) The ESP8266 is given with a supply through USB cable.
- 2) The V_{in} and GND pins of MAX30100, LM35 and OLED are connected to 3v3 and GND of ESP8266 respectively.
- 3) The INT of MAX30100 is connected to Data input pin D0.
- 4) The SCL and SDA of MAX30100 and OLED are connected to data input pins D1 and D2.
- 5) The OUT pin of LM35 sensor is connected with A0 pin of ESP8266.

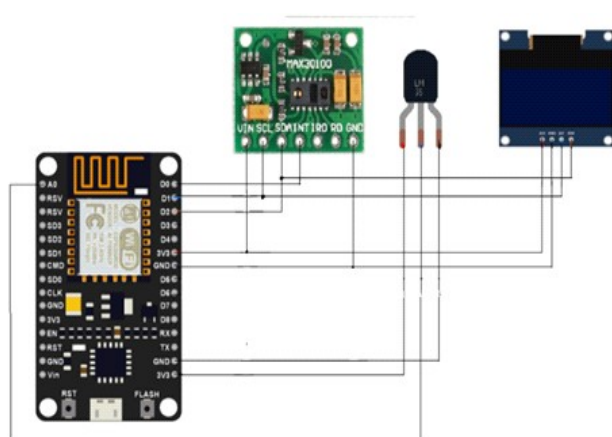


Fig.12 : Circuit diagram



Fig.13 : Project Prototype

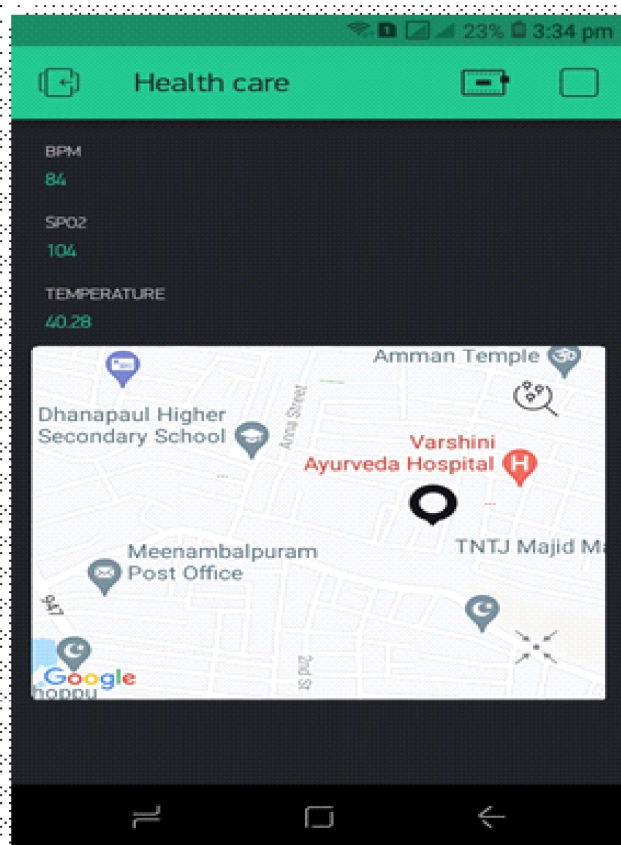


Fig.14 : Blynk app data

Fig.15 : Serial monitor output

8. ADVANTAGES

The proposed system can able to measure the basic and essential health parameters, which are good enough to diagnose any sort of abnormalities in human body. The tracking system helps in finding the location of the user. Since it is a low-cost module, ordering them in large numbers

for industries won't result in a large amount of money. The accuracy of the health parameters makes the system more trustworthy.

9. LIMITATIONS

The system requires a good network availability to update the data to cloud, which will not be possible in all sort of environments. The use of Geolocation API decreases the accuracy of the location of the user, since the accuracy of the location depends on the number of available networks near the user location. The energy management for the device is crucial and the systems needs to be installed with new power supply batteries at regular intervals of time.

10. FUTURE DEVELOPMENTS

Since the location obtained using geolocation API is not much more accurate, we can switch to a GPS module which will provide 95% accuracy. Developing the prototype into a user-friendly module such as a watch. If cost permits, we can also add an ECG module to the device, so that we can perfectly monitor the health condition of the user.

11. CONCLUSION

In this paper, a low-cost tracking cum health care device for industrial workers is proposed. The proposed system can able to measure the essential health parameters like body temperature, heart rate and blood oxygen level and also it returns the location coordinates of the user and displays it in the map. This device greatly helps in maintaining and monitoring the health of the industrial workers working in tedious environments. The tracking feature in the device helps in detecting the user location during emergency situations to save their lives.

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HAND GESTURE CONTROLLED ROBOTIC PALM

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ABSTRACT

In recent technological developments, the need for a robotic hand in areas where safety and accuracy are most important like firework manufacturing, bomb diffusing, medical surgeries, defense, mining, and industrial automation applications are observed. In this paper, a hand-controlled robotic palm that works on wireless technology which uses GFSK modulation for data transmission and is controlled by an ATmega328P processor is proposed. The robot control is provided by hand gestures which are done by wearing a specially designed glove that consists of Flex bend sensors thereby a signal is sent to the servo motor (SG-90) by using the NRF24L01 transceiver module thereby a full hand-controlled wireless ROBOTIC PALM which can load things was achieved. The robot palm can move fingers back and forth. Further, an ability to carry items from one place to another and also image processing can also be included in the proposed prototype as future work.

Keywords : Servo Motors, Flex sensors, ARDUINO UNO R3, NRF24L01 module.

1. INTRODUCTION

Automated palms and arms are machines that are modified to perform assignments rapidly, proficiently, and accurately. A commonplace mechanical robot palm incorporates an arrangement of joints, enunciations, and controllers that work together to closely take after the movement and usefulness of a human palm (at the slightest from a simple mechanical viewpoint). A programmable mechanical palm can be a total machine in and of itself, or it can work as a personal robot portion of a bigger and more complex piece of hardware. With the coming of innovation and the fetched of creating a robot, parts have diminished over a long time, and the final decade or so has

seen a quick increment within the accessibility and buy of robots and mechanical palms in exceptionally wide businesses. This implies that they frequently experience them in less beneficial exercises than before, as they are now not fair and financially practical choices in expansive generation lines that create exceptionally tall volume. It is well-known that the primary arm of an adaptable robot was outlined by George Devol in 1954. At that point in 1962, Common Engines utilized the palm of the unanimated robot in its gathering line to create cars. This mechanical robot, known as Stanford's arm was the primary six-axis arm and affected several commercial robots. The Japanese company, Nachi, built the primary pressure driven mechanical robotic

arm in 1969 and after that, the German company, Kuka, spearheaded the primary commercial deal of a six-axis robot arm, called the Famulus, in 1973. In specific, these robots were utilized for welding operations on beneficial plants but as innovation progressed, the extent of potential mechanical palm operations too expanded. Progresses in innovation incorporate the developing assortment of accessible end-of-life apparatuses. This implies that the Robots' palms can perform numerous capacities without welding depending on the devices joined to the closes of their palms.

There are distinctive sorts of automated palms/arms like Cartesian (gantry) automated palms, round and hollow mechanical palms, Polar/Spherical mechanical palms, and SCARA mechanical palms. Mechanical palms/ arms have a few focal points like Accuracy and precision, Moved forward generation capacity, Quick and Proficient, and Progress plant working conditions.

2. LITERATURE REVIEW

A method of obtaining different models of the kinematics of a robot and its dynamics and its control system is discussed by D. Kostic et al [1]. A quadrotor operated under the control of a two-DOF robot arm was discussed by Suseong Kim et al [2]. A trajectory tracking control using a robotic arm was discussed by Tingting Meng et al [3]. Recent developments on Humanoid robot hands were discussed thoroughly by Haruhisa Kawasaki et al [4], in which different designs were addressed. A forearm with 3D print technology having 46 individual parts and printed with white biodegradable polylactic acid (PLA) was discussed by Fazil Salman et al [5]. Different robotic systems used in industries, mechatronic systems implementing the hardware and software methodologies were discussed by industrial robotic and mechatronic systems. Hardware and software methods et al [7]. Applications of robotic arms in energy consumption industries were discussed by Aiming Liu et al[8].

3. ROBOTIC PALM DESIGN

3.1 Components of the Robotic Palm using a Microcontroller

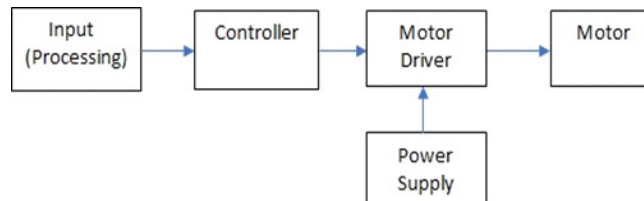


Fig.1 : Block diagram of the circuit



Fig.2: ARDUINO UNO R3

The fundamental square chart of the Automated palm circuit appears in Fig.1. The Arduino Uno appeared in Fig.2 is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and created by Arduino. cc. The board is prepared with sets of advanced and analog input/output (I/O) pins that will be interfaces with different extension sheets and other circuits. The board has 14 advanced I/O pins (six able of PWM yield), and 6 analog I/O pins, and is programmable with the Arduino IDE (Coordinates Improvement Environment), by means of a sort B USB cable. It can be fueled by a USB cable or by an outside 9-volt battery, in spite of the fact that it acknowledges voltage between 7 to 20volts.

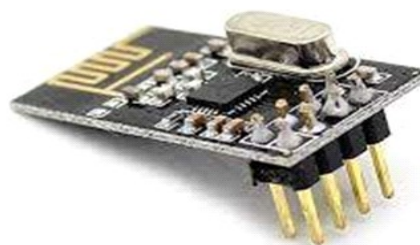


Fig.3: NRF24L01 module

NRF24L01 appeared in fig.3 may be a remote handset module (works on SPI Convention), which is utilized for sending and accepting information at a working radio recurrence of 2.4 to 2.5 GHz ISM band. This handset module comprises a recurrence generator, stun burst mode controller, control enhancer, precious stone oscillator modulator, and demodulator. This module is planned for long-distance and quick transmission of information. We utilize NRF modules as a transmitter as well as a collector of a flag because it acts as a handset that makes a difference to send signals from flux sensors to servo engines.

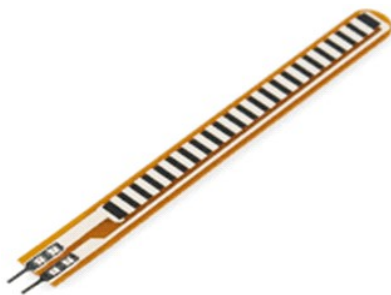


Fig.4: Flex Sensors

A flex sensor that appeared in Fig.4 may be a sensor that's utilized to degree the sum of abandonment something else bowing. The plan of this sensor can be done by utilizing materials like plastic and carbon. The carbon surface is orchestrated on a plastic strip as this strip is turned aside then the sensor's resistance will be changed. In this way, it is additionally named a twist sensor. As its shifting resistance can be straightforwardly relative to the amount of turn in this way it can moreover be utilized like a goniometer. Here flex sensor utilized to identify how much is the twisting of the fingers subsequently it produces a flag that was transmitted to the servo engines.



Fig.5: Servo Motors

Servo engines or "servos", which appeared in Fig.5, as they are known, are electronic gadgets and rotational or straight actuators that turn and thrust parts of a machine with exactness. Servos are basically utilized in precise or direct positions and for a particular speed, and speeding up. Here Servo engines are utilized to create the developments within the fingers of the mechanical palms. Here Servo engine depends on the flag that was gotten by the NRF modules.

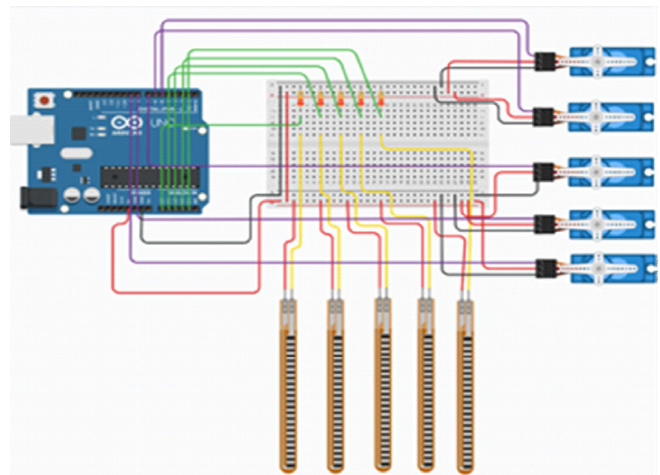


Fig.6: Electric connections of the prototype

Fig.6 represents the details of the electric connections in building the prototype of the Robotic palm.



Fig.7 : Final designed prototype

The designed prototype of the robotic palm controlled by the ARDUINO UNO R3 is shown in Fig.7.

3.1 Working on the Robotic Palm

A. Transmitting circuit

The transmitting circuit consists of ARDUINO UNO R3 which acts as a microcontroller for this circuit and 5 flex sensors are attached to the hand gloves such that any movement in the gloves makes the flex sensor stretch, as the flex sensor consists of a conducting medium surrounded by a copper layer these can act as variable resistors. As we stretch the flex sensor there will be a varying in the resistance thereby it detects the movement from which a signal is generated which was sent to the NRF module thus the module acts as a transmitter in the communication medium thus the signal is sent to the NRF of receiving circuit.

B. Receiving circuit

The receiving circuit consists of ARDUINO UNO R3, which acts as a microcontroller for the receiving circuit. This also consists of NRF modules that receive the signal from the transmitting circuit and this signal is used to control the servo motors. As these servo motors are attached to the robotic palm in the required manner thus, whenever we make hand gestures by using the hand glove attached with flex sensors there will be a required movement in the robotic palm. In this way the Hand controlled Robotic palm can be made by using a servo and ARDUINO board.

3.2 Improvements made in the Design

A. Real-Time Robotic Hand Control Using Hand Gestures

The advanced enhancement of the Hand controlled Mechanical palm is recognizing the hand signals not by utilizing flex sensors but instep by utilizing AI (Fake Intelligence). Computer-assisted human interpretation is utilized for human-machine interaction within the field of computer vision. The most reason for touch detection is to distinguish a person's touch and to communicate data to the client almost every touch. From the corpus of motions, an extraordinary touch of intrigued can be distinguished, and based on that, a specific command of action can be given to the robot framework. The total reason is to form the computer and get it the human body dialect, hence closing

the hole between the machine and the individual. Touch signals can be utilized to move forward human interaction with a computer without depending on standard input gadgets such as a console and mouse.

B. Energy consumption modeling of an industrial robot based on simulated power data and parameter identification

The progressed upgrade of the Hand controlled Mechanical palm is recognizing the hand signals not by utilizing flex sensors but instep by utilizing AI (Fake Insights). Computer-assisted human translation is utilized for human-machine interaction inside the field of computer vision. The foremost reason for touch location is to recognize a person's touch and to communicate information to the client nearly every touch. From the corpus of movements, an uncommon touch of interest can be recognized, and based on that, a particular command of activity can be given to the robot system. The whole reason is to make the computer and get it the human body tongue, subsequently closing the gap between the machine and the person. Touch signals can be utilized to move forward human interaction with a computer without depending on standard input contraptions such as a support and mouse.

C. Image processing and Recognition System for a Robot Palm Control

Picture handling (IP) and acknowledgment framework is based on ceaseless checking of the environment with sensors and reacting in like manner. These are considered brilliantly as their behavior is totally based on changes in environmental framework and activated related modified actions.

D. The Development of Six D.O.F. Robot Palm for Intelligent Robot

The movement is guided by the physically worked controller or a program that guides the suitable movement and activities of the robot. The degrees to which the automated unit makes moves or procures movement essentially contribute to the change of operation. Each included or overhauled movement speaks to ease of operation in a certain working setting.

E. Design and Implementation of Robotic Palm based on Haptic Technology

Haptic innovation, or haptics, may be a material criticism innovation, which takes advantage of the sense of touch by applying strengths, vibrations, or movements to the user. This mechanical stimulation can be utilized to help with the creation of virtual objects in a computer reenactment, to control such virtual objects, and to upgrade the farther control of machines and gadgets (telerobotics)

4. CODE

Circuit diagram without consisting of NRF modules

A. PROGRAM

```
#include <Servo.h>
Servo thumb;
Servo index;
Servo middle;
Servo ring;
Servo little;
int flex[]={0,0,0,0,0};
int angle[]={0,0,0,0,0};
void setup(){
  Serial.begin(9600);
  thumb.attach(5);
  index.attach(6);
  middle.attach(7);
  ring.attach(8);
  little.attach(9);
}
void loop()
{
  for (int i=0;i<5;i++){
    flex[i]=analogRead(i);
    Serial.println(flex[i]);
```

```
  }
  thumb.write(map(flex[0],433,122,0,180));
  index.write(map(flex[1],433,122,0,180));
  middle.write(map(flex[2],433,122,0,180));
  ring.write(map(flex[3],433,122,0,180));
  little.write(map(flex[4],433,122,0,180));
}
```

5. CONCLUSION

This paper investigates the features of artificial finger machines, which are the most important parts of bionic hands. After extensive discussion of working conditions (divided into physical features), artificial fingers driven by connections have been extensively reviewed. The flexibility and hand control of humanoid robots have almost been established, and more applications using the humanoid robotic hands are expected. However, there are still many problems such as coherence, high mechanical strength, extremely reliable sensory nerves, humanoid hand robot training, and artificial intelligence skills. This paper offers an artificial hand design and glove to control the implanted hand. The servos, controlled by Arduino, are used to control finger movements with a rope. The finger can be moved as an almost real finger. In the future, part of the response will be improved because of the artificial hand.

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A REVIEW PAPER ON EXPERIMENTAL INVESTIGATION ON LIQUEFACTION MITIGATION USING PUMICE AGGREGATE AND GEOSYNTHETICS

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ABSTRACT

Liquefaction is a geotechnical disaster induced by earthquake in a saturated sand deposit. Due to their loose, saturated, and cohesionless nature, the sand are susceptible to liquefaction when subjected to dynamic loading. The shaking table test is used to study the geotechnical problem such as liquefaction. As liquefaction is major problem the researches and efforts are emphasized on the necessity of soil remediation against liquefaction. To mitigate the effect of liquefaction, a new countermeasure method by using pumice aggregate and geosynthetics are discussed in this review paper.

Keywords: *Liquefaction, Geosynthetics, Shaking table test, Acceleration, Settlement.*

1. INTRODUCTION

During earthquakes, liquefaction is one of the main problems faced for foundations in saturated loose sand deposits, which can be dangerous for the stability of infrastructure. Liquefaction is the phenomenon that develops in saturated loose sand deposits when it is subjected to dynamic loading. Liquefaction damage is important when there is not enough land for people to build plots on hard, reliable soil. After understanding the mechanism of liquefaction failure, engineers were able to find effective measures to prevent liquefaction. The lateral flow caused by liquefaction is one of the widespread and dangerous consequences, damaging many other important structures both underground and above the surface near or above liquefied slopes.

Since 1965, a number of researchers have been examining the liquefaction behaviour of sands. After the Bhuj earthquake in Gujarat in 2001, the research on liquefaction has grown in terms of relevance. For enhancing the resistance of liquefied soil to liquefaction, various soil development strategies had been evolved to mitigate liquefaction, together with gravel drainage, sand consolidation, deep blending, jet injection and improvement by using geosynthetics have been developed for liquefaction mitigation.

2. TYPES OF REINFORCEMENT

Since geosynthetics (planar products manufactured from polymeric materials) are considered to be non – biodegradable and are quite cost effective, they are used in the form of

geotextiles, geogrids and geotextile-polymer core composites. The naturally available material such as Pumice aggregate also used as reinforcements.

3. GEOTEXTILES

Geotextiles are porous geosynthetics that resembles a thick strong cloth or blanket with its strands and fibers visible. Geotextile are commonly used to control erosion and improve soil over which road, embankment, pipeline, earth retaining structure are built depending on application, geotextile may have an open mesh weave a warp-knitted structure or a closed fabric on woven surface the special type of geotextile use disbased on several criteria, including separation filtration, drainage reinforcement selling and protection. Figure 1. Shows the various type of geotextile .

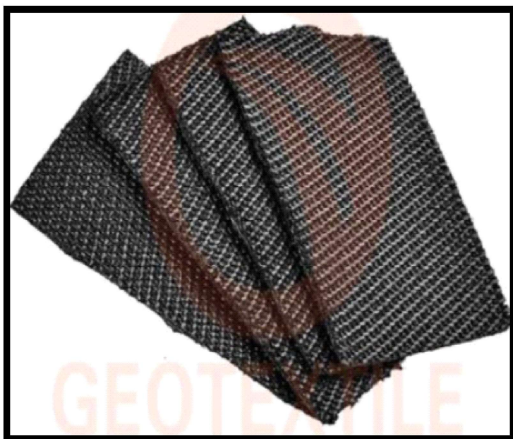


Fig.1.(a) : Woven Geotextile



Fig.1(b) : Nonwoven Geotextile

Fig. 1. : Type of Geotextile

4. PUMICE AGGREGATE

Pumice stone is a natural lightweight aggregate which is formed by the sudden cooling of molten volcanic matter. It is widely available, environmentally friendly, natural, and highly porous material. It can be utilized in variety of specific conditions, it has various structural and geotechnical applications. It is a low density raw material the primary use of structural light weight concrete is to reduce the dead load of structure and it maintain to decrease the size of column and footings and other load bearing elements. Under Earthquake conditions , pumice is more elastic for reduction in brittleness, good drainage capacity. It also possesses excellent mechanical strength and acts as an excellent insulating material. It imposed in high sound regions as a good sound proofing material due to its sound proofing properties. Understanding the qualities and behaviour of such low-cost materials is a crucial step toward long-term sustainability. Figure 2 shows the Pumice Lightweight Aggregate



Fig. 2. Pumice Lightweight Aggregate

5. LITERATURE REVIEW

The study regarding the mitigation of liquefaction by using various geosynthetics, sand compaction column, deep soil mixing, sheet piles, etc. had been carried out experimentally and analytically by various researchers. These works are reviewed keeping in view the methodology, principles and various aspects of experimental and analytical investigation for the improvement of liquefied soil.

Hendra Setiawan *et.al* (2018)¹ carried out experimental analysis on shaking table equipment to study the influence of geosynthetics along with gravel usage to reduce the vertical soil displacement caused by liquefaction. Model tests were performed on the sand with a relative density of 90% and 50% by providing the geosynthetics along with gravel by using shaking table equipment. They can be concluded that the vertical ground displacement decreased by the use of geosynthetics and gravel up to 54% and 32% for loose sand and dense sand states, respectively. Furthermore, test results also show that there is a decrease in the differential settlement between loose sand and dense sand conditions by around 62%.

Gowtham Padmanabhan *et al.* (2019)² carried out experimental investigation on liquefied soil by using Sand Compaction Pile having diameter 110 mm and 600 mm length. The shaking table experiments were performed with and without improvement technique under sequential accelerations of 0.1g, 0.2g, 0.3g and 0.4g with 5 Hz frequency. They can be concluded that the Liquefaction potential of sand deposits increased with increase in accelerations. Performance evaluation of sand compaction piles subjected repeated acceleration amplitude was attempted and it was found that, sand compaction piles performed exceptionally well under repeated acceleration amplitude and improved the liquefaction resistance of sand deposits.

Rouzbeh Rasouli *et al.* (2013)³ performed a shaking table test for analyzing the factors affecting the deep mixing column method. The effect of columns pattern, the length and improvement ratio were studied. The models were shaken by sinusoidal waves of 200 Gal (1Gal = 1cm/sec²) and after that 300 Gal with frequency of 10 Hz and duration of 12 sec. They can be concluded that increase in improvement ratio reduced the lateral displacement, length of improvement found to be effective on magnitude of lateral flow, increase in length of improvement also reduced lateral displacement of liquefied sand. Moreover, it reduces excess pore water pressure inside the improvement zone.

Rouzbeh Rasouli *et al.* (2012)⁴ performed a series of shaking table tests to examine mitigation of subsidence using sheet piles. Fixity of top and bottom of sheet piles and rigidity of sheet piles were found to be important in improving the efficiency of this mitigation technology. All models were shaken by sinusoidal waves of 350 Gal, frequency of 10 Hz and shaking duration was 30 seconds. They can be concluded that installing sheet piles adjacent to the structure can reduce the magnitude of lateral shear deformation of soil under the structure. It was found that constraining top ends of sheet piles could reduce both subsidence of structure and maximum induced bending moment in the sheet pile. Thus, increase in efficiency of sheet piles performance and using stiffer sheet piles leads to less subsidence.

Salemi *et al.* (2017)⁵ presented findings from an analysis of stone columns' potential for liquefaction remediation. The research was based on 24 case studies in which SPT and CPT tests were conducted before and after stone column strengthening. The mechanisms of densification and stiffness were examined, and both their individual and combined effects were examined.

Adalier *et al.* (2003)⁶ conducted experimental studies in which centrifuge testing was conducted to assess the performance as liquefaction countermeasure. Instead than emphasizing on the drainage impacts, research was done on how the positioning of the stone columns stiffened the entire site. Under simple dynamic excitation circumstances, the behaviour of a saturated silt layer was examined. That stratum was examined in a series of four different model experiments, initially without, then with stone columns, in a free-field condition, and with a surface foundation surcharge. Based on the dynamic responses that were obtained, the fundamental mechanism and efficiency of the stone columns were discussed.

Hemanta Hazarika *et. al* (2019)⁵ performed numerical studies on unimproved and improved ground separately using PLAXIS two-dimensional software. Analyses were performed to measure the effect of jet grouting in liquefaction mitigation. In order to gauge the behavior and performance of high

modulus Jet grout columns in liquefiable soil, numerical cases with and without soil improvement, were separately evaluated. They can be concluded that the close spacing of jet grout contiguous columns with horizontal slab can effectively control the shear deformation of improved ground layer during the earthquake.

6. CONCLUSION

From the brief review it can be concluded that many studies have been carried out experimentally and analytically to mitigate the liquefaction of soil using various traditional methods but there is need to study the effect of liquefied soil using recent methods. So, in future research work should be focused on the study of the performance of geosynthetics (geotextile, geogrid and geotextile-polymer core composite) and naturally available materials such as Pumice aggregate in liquefied soil.

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A CRITICAL ANALYSIS OF OUTCOME BASED EDUCATION

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ABSTRACT

*Outcome-Based Education (OBE) means emphasizing on results. OBE practitioners begin by determining the knowledge, competencies, skills and abilities that they want students to demonstrate as and when they complete their schooling and confront the challenges of the real world. OBE is a way of designing, delivering and documenting instructions in order to achieve desired goals and outcome. During 1980s Americans reported that schools were in a serious trouble and many children were not being able to learn. In reality, the fresh mind and the eagerness to learn in children makes them look and learn as much as possible. They learn how to talk, walk, ride bicycles, and make a bond with parents and teachers and so much more. Academic institutions are solely responsible for designing curriculum for children. Numerous studies reported that schools are not being able to implement curriculum and the obvious resolution to that problem is educational restructuring which is broadly known as "Outcome Based Education" (OBE). The present research article is an attempt to analyse critically the "Outcome Based Education" (OBE) and try to introduce an alternative to OBE which is **THE PROCEDURAL-INQUIRY MODEL**.*

Keywords: *Educational restructuring, Learner-centred classroom, Outcome Based Education, Procedural-inquiry model, Teaching and Learning*

1. INTRODUCTION

"Education is a process, not a product" wrote Jerome Bruner 30 years ago. Education is a social-reflexive process that must be negotiated in classrooms on a daily basis. No amount of "teacher-proof" curricula, tables of specifications, scope and sequence charts, or lists of objectives can change these facts. The first and foremost aim of teaching and learning is to establish a cordial relationship between teacher and student. The word education

comes from the Latin *educare*, meaning to rear, just as a mother rears her children. Rearing in this sense connotes loving and caring. It is not some form of engineering one in particular directions. It is artistic and creative, because the student thinks and creates meaning. Learning is a form of "meaning making". It is not the goal of teaching to produce results, but to create an experience in which the student can arrive at creative encounters, be drawn out, and make meaning. Curriculum is not a thing

to be “covered” by teachers; it is meant to create occasions in which learning takes place.

Can a rational alternative to OBE be developed? Criticizing this model without suggesting a suitable alternative vision for curriculum and instruction is inappropriate. The purpose is not only to critique with a view of inviting experimental testing that would lead to refutation or refinement, but also to posit an alternative “procedural-inquiry” model of education. Thus the critical analysis of OBE is required.

It is contended that curriculum and instruction can be effectively organized by a logic other than the “technical-rational planning” of outcomes. Clearly, OBE is a “means-ends” model of curriculum planning, based on what Spady describes as essentially a “design” for learning. According to Spady (1994) following are the basic principles of OBE:

1. Student-centric- The approach centres around students and focuses on skill acquisition.
2. Clarity in focus – This approach focuses on the specific outcomes of the learners.
3. Design down, deliver up: The objectives and the expected outcomes must be clearly outlined and thereby facilitating the performance of students.
4. Exceeding expectations – The self-efficacy of students may be enhanced in order to facilitate their performance.
5. Expanded opportunities – Students may be given several chances in order to meet learning objectives and the principle of individual differences (every learner is unique) must be incorporated.

Outcomes-Based Education (OBE) means emphasizing on the goal. OBE is a clear shift from teacher centric education to student centric education and it expects students to develop knowledge, competencies, and qualities as and when they finish schools and face the challenges in the external world. OBE is a unique way of designing and delivering instructions in order to achieve intended goals and outcomes.

Another supporter of OBE has argued that in a Learner-centred classroom, the focus is on the outcomes and not on the methods and materials.

Daggett, also a supporter of OBE, viewed OBE as a “training-instructional” model that views schools as vocational skills dissemination centres and not educational environment.

It may be useful to clarify terms and distinguish among types of “education”. Training is concerned with such student performances as making a picture frame, typing a letter on a word processor, kicking a field goal, and so on. Instruction hints at retention of information-for example, knowing the names of the states and their capitals. Finally induction into knowledge results in human understanding. I use “induction into knowledge and understanding” synonymously with “education,” for it represents initiation into culture and worthwhile episodes of learning.

The major limitations of OBE are that it is not equally relevant in different planning models for different areas of the curriculum development. For example, OBE may be highly suitable for teaching technical writing skills; but the teaching of art or English literature does not take the form of a step-by-step progression towards outcomes. I would argue that models such as mastery learning or outcomes-based education can function at the levels of training and instruction, but they contradict the idea of education as induction into knowledge. As Stenhouse so eloquently argued, “Education as induction into knowledge is successful to the extent that it makes the behavioural outcomes of the student unpredictable.” If our aim is to get pupils to use knowledge creatively, then it is nonsensical to try to define specific behaviours that will result from education. The crucial thing about knowledge is that we think with it. How can I, as a teacher of English literature, define what a student will have as an outcome from reading *Paradise Lost*?

Claims that OBE can be applied to the entire curriculum presuppose those objectives are appropriate for all subjects, at all levels of education. Teachers and theorists in the arts and humanities in particular have countered that in these fields the concern is not for the students to reach goals or

exit outcomes once and for all, but rather for them to develop standards of judgement, criticism, and taste.

Spady and Marshall couch their arguments for OBE in a “success for all” vision. They contend that OBE rests on three basic premises:

- All students can learn and succeed (but not at the same rate).
- Success in school breeds further success.
- Schools control the conditions of success.

Well, this may be true for some pupils and some subjects. But perhaps this theory needs refinement-or even rejection. The idea of significant, observable educational outcomes and the notion of curriculum as preparation for adult life is not new; the “objectives model” formulated by educators such as Franklin Bobbitt and Ralph Tyler exalted the instructional objective.

2. OBJECTIONS TO OUTCOMES BASED EDUCATION

The most fundamental criticism against OBE is that it reduces education, teaching, and learning to the forms of human engineering and quasi-scientific planning procedures-procedures that view education as an instrumental means to specified ends. This model, educators may find unacceptable, amounts to molding students through behaviour modification. It resembles the activity analyses of human behaviour discerned by Bobbitt 75 years ago.

To treat knowledge as instrumental is to dismiss a most important possibility: that the justification for education lies within the process itself. The pupil who has been truly educated may lead us into unexplored meanings and outcomes, into unanticipated and unpredictable directions. Imagine a student of Macbeth purchasing a text that includes all the possible interpretations and understanding of that play. If we teachers possessed all the answers, we could publish such a text-surely an absurd scenario. The educated mind will always achieve unique and novel interpretations because knowledge is a tool to think with. To cite the significant outcomes in advance of teaching and learning is absurd.

A second objection to OBE relates to its assumption that knowledge and curriculum content can be sequentially broken down into “micro-outcomes” that eventually lead to more significant “exit outcomes”. Such a view of knowledge disregards the epistemology of knowledge. The translation of the deep understanding can never be reduced to behaviours, lists of skills, and observable performances. Knowledge is an open-ended inquiry, neither a product nor an outcome. Adapting OBE is trivializing knowledge by reducing objective facts

A related problem is the implication that there are systematic hierarchies of objectives, beginning with lessons and continuing through units, courses, programs, and, indeed, the entire educational career of the student. This linear, step-by-step view is a little too tidy for most learning that goes on in schools. In most of the cases, knowledge and understanding and affect go hand-in-hand. True learning, like excellent teaching, is more arguably developmental and not linear.

Thirdly, while OBE may improve the structure of lessons and units within courses, it does not necessarily improve the quality of curriculum there is serious dearth of empirical evidences suggesting that OBE functions more effectively than a process model. No evidence suggests that this is how pupil’s best learn or understand their educational experiences. If 90 per cent of our students attain honours grades in trivial pursuits and experiences, curriculum and learning are not advanced. Moreover, teachers, policy makers, and others with an educational stake do not have a tradition of teaching or planning in this outcomes-directed way.

A fourth objection relates to the tendency for outcomes to be expressed as simple “recall” or “learning” objectives, often because these are easiest to assess. This tendency helps explain the enormous drive toward centralized state assessment procedures. In fact, OBE is characterized by state prescriptions of student outcomes measurably by external testing. This characteristic diminishes the professionalism of teachers by reducing their involvement in research and assessment activities.

Stating outcomes as a comprehensive form of intellectual scaffolding limits inquiry and speculation and gives schools and curriculum framers unwarranted authority and power over knowledge and understanding. One could argue that it is arrogant to suggest that outcomes, as expressed in paper and pencil assessments or examinations, define knowledge of a field, or of a student. More often assessments or examination determine what the student has not learned. Knowledge has more in common with speculation than with mastery. To define education as set of outcomes decided in advance of teaching and learning conflicts with the wonderful, unpredictable voyages of exploration that characterize learning through discovery and inquiry. In addition, many significant outcomes may express themselves only over the long run or in the fact of particular contingencies. For example, I worked on the construction of a cultural studies programme in Northern Ireland that aimed at encouraging “mutual understanding and tolerance in intergroup relations”. Such a significant and important goal cannot be realized (or assessed in a unit or term), but may take many years to manifest itself.

Fifth, a linear OBE model is non-reflexive-it does not examine itself. It specifies the limits of the field of study and suggests that there cannot be more education than is encompassed by the stated outcomes. In this sense it is really a ‘minimalist’ instruction model, and furthermore, it implies a poverty-stricken model of student-teacher uncomfortable close to playing the role of indoctrinator. Indeed, one could argue that it is undemocratic to dictate the ends of learning in advance of teaching and learning. Education requires inquiry, and we cannot predict the ends of pure inquiry. “How can you put on the blackboard the mysterious internal goal of each creative person?”

This is not to say that we should not have an aim, or outcome. To teach without a goal would be irrational. But OBE carries much of the baggage of behaviouristic psychology applied to schooling and curriculum. Its basic argument suggests that education should be about planning behavioural changes in students’ performances. It further

brazenly argues that all of the significant outcomes can be specified in advance. Moreover, it implies that all pupils should demonstrate similar outcomes and behaviours. I must ask, is education about some standard packaging of outcomes as products, or is it more akin to a reflective social process?

3. AN ALTERNATIVE: THE PROCEDURAL - INQUIRY MODEL

As indicated above, the outcome-based approach may be satisfactory for areas of training, demonstration, and low-level skill required in vocational courses; but it clearly breaks down in this sphere where knowledge is used to produce meaning.

In certain areas of the curriculum-those focusing upon knowledge and understanding-an alternative to OBE, which may be called “procedural-inquiry model,” is more appropriate. The great advantage of the procedural model is that it rests ultimately on the strength of the teacher. Characteristics of the OBE and procedural-inquiry models are appended in table 1.

Table 1: Salient feature of OBE and Procedural-Inquiry Model of Education

OBE	Procedural-Inquiry Model
Outcome driven. More extrinsic in nature	Understanding and knowledge driven, more intrinsic in nature
Teaching and content are selected in order to attain pre-determined objectives	Key concepts of teaching and enquiry methods are emphasized
Standard of student performance represents goals and objectives	Selection of methods and concepts are based on the criteria and procedure
Goals and objectives are the bases of content selection	Unit method not necessary
Teaching materials and units follow a logical sequence	Teaching is a reflective social process
Curriculum divided into micro units	Instructional training orientation
Teaching instruction aims at specific goals and objectives	Emphasizing on creativity, assertiveness, and quality of experience
Emphasis on convergence	Emphasis on divergence
Teacher adjusts Time based on learner’s aptitude	Complex evaluation by teacher
Assessments and evaluations are based on objective tests	Assessments are judgmental and interpretive in nature

The procedural-inquiry model starts not with the specification of ends or outcomes, but with the principles of procedure for doing inquiry in a particular field or form of knowledge. It does not presuppose some lockstep, linear progression through a continuum of goals from the level of lesson on through unit, course, programme, and finally, national agenda. It is about teaching through inquiry, and evaluating teaching and learning through teacher classroom research and thereby leads to self-development of a teacher.

The procedural-inquiry model has three parts: (1) a broad aim, (2) principles of procedure, and (3) criteria for assessing student work.

The broad aim of the procedural-inquiry model is to advance understanding of social situations and controversial issues and the human and moral values thrown by these issues. The principles of procedure are as follows:

- Discussion is the best teaching strategy for enhancing understanding.
- The teacher remains “neutral” on moral value issues.
- The teacher adopts a facilitator role and “chairs” the discussion to ensure continuity, summary, and access to evidence.

The following criteria are used for assessing student work:

- The extent to which students to use knowledge and concepts to explore issues. For example, in discussions, the students might be asked to use the concept of role to compare the situations of men and women. A subsequent examination might ask the students to define “role” and use the concept in discussing relations and gender.
- Extent to which a student can understand wide of range of views of an issue of different perspectives associated with a view. For example, a discussion in which students consider many different points of view on marriage might lead to an examination in which students are asked to give to accounts on alternative forms of marriages.

Procedural-inquiry model pose as an alternative to OBE. Procedural-inquiry model, a rational planning model for curriculum which is based on the “principles of procedure” in a particular field or form of knowledge

By employing the principles of procedure teachers adopt a research, or inquiry, stance towards teaching, which asks for self-evaluation of professional development and judgement. Our curriculum design aims at advanced understanding of key concepts in social studies. It attempts to use key concepts in question and tries to identify the criteria of judging the performance. It also specifies the procedures to be followed by teachers and students in the educational activities. Content may be selected to illustrate the best procedures, concepts, and criteria. In a fundamental sense, the teaching processes and principles become the “objectives” or outcomes. It is thus very much a pedagogical model to test teaching and learning. A style of pedagogy that adopts action research or action inquiry-studied enactment can provide a basis for the teacher to reconceptualise OBE into a theory of professional self-development, because the teacher’s ideas are integral to professional and practical competence.

American educators have been denied what Europeans have called “pastoral care” in curriculum: systematic schemes whereby tutors take on a special role of caring for children and their learning. Another feature of teaching and learning suggests that they cannot be directed at specific objectives. To learn one must be *free to learn*-not constrained by plans and objectives and various other obstacles. If the student is to have the freedom to learn, then teaching cannot be constantly directed towards various objectives. The technical OBE stance devalues professional judgement by not focusing upon the process of education but instead highlighting the ends or outcomes.

Other than this “procedural principle, a second argument supports the notion of placing teachers in charge of assessment and evaluation: the teachers-as-inquirer is truly in charge of the classroom and is managing the learners and the learning. Besides, classrooms are ideal laboratories

for doing research that will enhance curriculum and educational theory.

4. CONCLUSIONS

OBE hints at “mastery”, when in fact most teachers are learners along with their students. Teachers should not set themselves up as experts but as models of inquiry. Much of the argumentation for OBE has not come from teachers or curriculum designers but from those within the field of assessment and testing, and its lore has been widely adopted by central offices and educational policy makers. Outcomes-based education is also objectionable from an ethical deliberative point of view. It begins with outcomes and results and then goes to extremes to plan and deliver instruction that will mould and change students to become what we want them to be. It is a form of human engineering, not a process of education. There is no question that curriculum must have a goal. If a teacher works toward a long-term aim, such as to promote tolerance among students, and then specifies a set of procedures that work towards achieving that goal, states what content is to be used, elucidates the sort of classroom experience necessary, and builds in evaluation of this experimental process, then she will of course be acting rationally and planning rationally. This process casts the teacher in the role of a researcher by examining practice as problematic and curriculum planning, implementation, and research, taking a close look at the work of the students and teachers as the basis for school and curriculum improvement.

OBE suits the technical rationality currently prevailing in the United States and other Western nations whose policies emphasize high-tech culture and the preparation of students to compete in the workplace for global economic warfare. This skills-oriented model views schools as vocational centres producing workers and rests upon the argument that skill requirements on the job change faster than do curriculum and organizational changes in schools.

This skills model is not an artistic or creative response to the culture of schooling. It is an industrial model that views students as raw materials. As

such, it explains the following statement issued by the U.S. Department of Defence Dependents schools: Based upon an assessment of the future we believe our students will face challenges and opportunities in a world characterized by worldwide economic competition and interdependence which creates ever-increasing requirements for job related performance.

The ultimate aim of education is to produce quality learner who will be able to collaborate effectively. Education must teach valuing things for their own sake not because some outcome is associated with it.

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