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Healthcare Platform Using Blockchain

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***Abstract*—The health care system is a complicated and important sector of the economy that handles private patient information, transactions, and information sharing. But it frequently struggles with issues like data security, privacy, interoperability, and ineffective administrative procedures. Blockchain technology provides a decentralised and secure platform for data management and transactions, which is a possible solution to these problems. Therefore, the introduction of blockchain technology into the healthcare sector has enormous potential to improve interconnection, security, privacy, and productivity. It can encourage collaborative, innovative research while streamlining procedures for administration and empowering patients. Blockchain technology has the potential to significantly improve the delivery of healthcare with careful planning and implementation.**

Keywords— solidity, metamask, ethereum, transaction, hardhat .

I. INTRODUCTION

Blockchain technology is a decentralized, secure database that can be used to record transactions and track assets. It is well-suited to a wide range of applications, including health, because of its ability to create a verifiable, immutable record of transactions. A blockchain-based health care platform offers a revolutionary method of managing and storing data. The data is resistant to unauthorised access, manipulation, or data loss because of its decentralised design, which assures that no single party has total control over it. Currently, it is challenging to obtain and exchange essential information since health care data is frequently dispersed across several systems. Blockchain technology enables healthcare providers to securely access and exchange patient data in a standardised and interoperable manner, fostering collaboration and increasing patient outcomes.

II. LITERATURE REVIEW

A review of the literature on blockchain-based healthcare systems shows that this cutting-edge strategy has the potential to completely change how healthcare data is exchanged and maintained. The security and privacy of patient data may be increased through the use of blockchain technology, which can also improve interoperability across various healthcare systems. Patients can exert more control over their health information and authorize access for healthcare professionals. Additionally, blockchain technology can make it possible to employ smart contracts for medical transactions, which might lessen fraud and mistakes. These literary works offer insightful information on the use of blockchain technology in healthcare. They address a wide range of topics, including clinical research, integration, confidentiality, and data security. These studies advance knowledge of how blockchain technology could revolutionise the healthcare sector through examining its advantages, difficulties, and potential future directions.

III. SCOPE OF THE WORK

The scope of work in using blockchain for healthcare system is to use this technology to create a more transparent, efficient, and secure system for supporting good causes. There are several ways in which blockchain could be used to improve the healthcare sectors:

- Increased transparency: One of the key benefits of using blockchain for healthcare system is the increased transparency it provides.
- Data Security & Privacy: Using blockchain technology, sensitive patient data may be sent and stored securely, shielded against unauthorized access, manipulation, and data breaches.
- Management of Consent: Blockchain enables patients to safely manage their consent preferences.
- Blockchain technology has the potential to completely change how electronic health records are managed and shared. It allows people to have a single, unchangeable record of their medical history that is available to licenced healthcare professionals.
- Blockchain technology has the potential to completely change how electronic health records are managed and shared. It allows people to have a single, unchangeable record of their medical history that is available to licenced healthcare professionals.
- Greater efficiency: By automating various aspects of the treatment process, blockchain technology can help healthcare organizations operate more efficiently.

IV. MODULES

A. Admin module:

The core of a blockchain-based healthcare platform for controlling and supervising different components of the system is the admin module. The admin module's functions and duties are summarized in the following main points:

- User Management: In the platform, user accounts and permissions are managed by the admin module. Depending on their duties, the admin can create, edit, or cancel user accounts.
- Access Control: Admin create and implement access control rules to guarantee that only those with the proper authorization may access particular platform features or data.

B. Patients verification module:

Identity verification is an important aspect of any online platform, and a healthcare platform using blockchain technology is no exception. Ensuring that the identity of patients and healthcare organizations is properly verified is essential for maintaining the security and integrity of the platform. It also helps to protect against fraudulent activity, such as impersonation or identity theft. There are several ways in which an identity verification module could be implemented on a healthcare platform using blockchain technology.

One option would be to use a centralized identity verification service, such as a third-party provider that specializes in verifying the identity of online users. This service would be responsible for verifying the identity of users who want to register on the platform, using methods such as government-issued identification documents or biometric data. Once a user's identity has been verified, theywould be granted access to the platform. Another option would be to use a decentralized identity verification system, such as a self-sovereign identity platform. With this approach, users would be able to create their own digital identity, which they could then use to prove their identity on the platform.

This could be done using a variety of methods, such as digital certificates or biometric data.

The advantage of this approach is that it puts users in control of their own identity,rather than relying on a centralized third party. Regardless of the approach taken, an identity verification module on a healthcare platform using blockchain would need to be secure and reliable. This would ensure the integrity and confidentiality of identity data, as well as implementing measures to prevent identity fraud and abuse.

C. Smart contract module:

This module enables the automatic execution of pre-agreed terms and conditions for the treatment. A smart contract module in a healthcare platform using blockchain technology can help to improve the transparency, security, and efficiency of the treatment process. In this system, a smart contract is a self-executing contract with the terms of the agreement between the doctor and the patient being written directly into lines of code. The code contained therein is stored and replicated on the blockchain network. When a patient wants to take an appointment, they can do so through the platform by sending the details. The smart contract will then automatically verify the patient identity. The information is recorded on the blockchain, providing an immutable record of the treatment.

In addition to improving the transparency and security of the treatment process, the use of smart contracts can also help to streamline and automate various administrative tasks, such as tracking treatments and generating tax receipts for patients. Overall, the use of smart contracts in a healthcare platform can provide numerous benefits, including increased trust and confidence among patients, reduced transaction costs, and improved efficiency and speed.

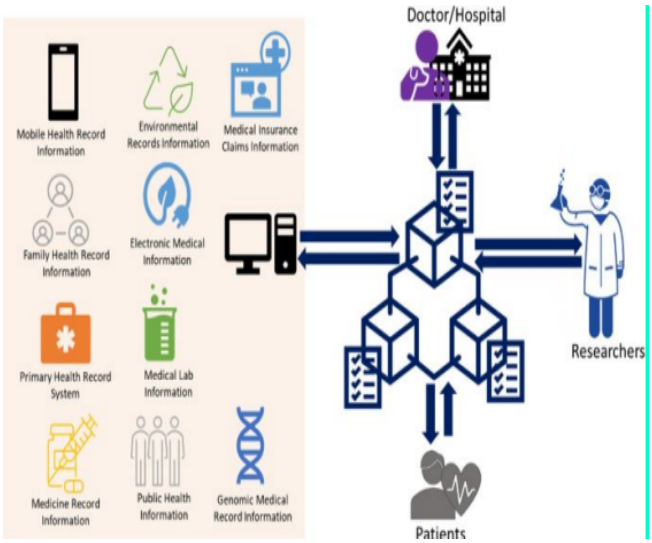


Fig.1 All module dependency

D. Transparency module:

This module allows for the transparent tracking of treatments on the blockchain, ensuring that doctors can see how their contributions are being used. A transparency module in the platform using blockchain technology can help to increase the accountability and transparency of the process. In this system, the transparency module would allow doctors to track the use of their contribution in real-time.

Using the distributed ledger technology of the blockchain, the module would provide a transparent and immutable record of all transactions. This can help to build trust and confidence in the platform. In addition to providing transparency for patinets, the module can also be used by the healthcare organization to demonstrate the impact of their work to potential patients. Overall, the transparency module can help to increase the accountability and transparency of the entire treatment process, which can lead to increased trust and confidence among patients.

E. 410Reporting module:

This module generates reports of the patients, including information of the treatments. A reporting module in a healthcare platform using blockchain technology can provide valuable insights and data to both doctors and the patients about their treatment plan .

The module would allow users to track and analyze various aspects of the treatment process, such as the amount of medicine used, the number of checkups, and the kind of the treatments. For doctors, the module would provide a way to see the impact of their treatment. This can help to increase engagement and encourage ongoing support. For the healthcare organization, themodule can be used to better understand patient behavior, identify trends, and make data-driven decisions.

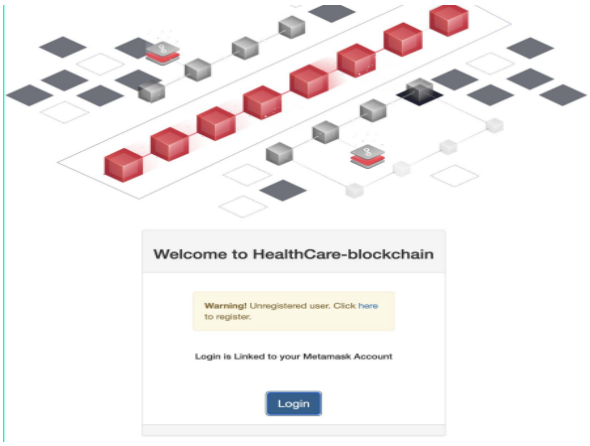


Fig.2. Healthcare Platform Connection

V. RESULT AND DISCUSSION

The results and discussion of a blockchain healthcare project will depend on the specific goals and objectives of the project, as well as the metrics used to measure its success. Here are some potential outcomes and discussion points for a blockchain healthcare project:

Transparency and accountability

One of the main benefits of using blockchain for healthcare platform is the ability to increase transparency and accountability in the process.

By tracking and verifying treatment on a decentralized ledger.

B. Interoperability

Blockchain can make it easier for various healthcare organisations and systems to communicate with one another. By offering a standardised platform for data exchange, it enhances coordination and continuity of treatment by enabling seamless sharing of medical records, test results, and other health information among various providers.

C. Data Integrity and Immutability:

The blockchain makes it virtually hard to change or manipulate data once it has been recorded there. Clinical trial data, medical record integrity, and other healthcare information are all protected by this feature. It can aid in the prevention of fraud, the detection of fake prescriptions, and the accuracy of patient data.

D. Challenges

The problems of using blockchain in the healthcare industry are unique. Here are a few of the main difficulties:

- When dealing with significant transaction volumes and big amounts of healthcare data, blockchain networks may have scalability problems.
- It is difficult to achieve interoperability across various healthcare systems, legacy systems, and blockchain networks.
- It is essential to guarantee the reliability and accuracy of healthcare data on the blockchain. The accuracy of the data submitted into the system is not a guarantee provided by blockchain technology by default.
- It can be expensive to deploy and maintain a blockchain infrastructure, especially for healthcare organizations with limited funding.

The implementation of the above mentioned design hasresulted in the following results:

- Used blockchain to analyse the constraints of the current healthcare platform. Centralised data storage, a lack of transparency and interoperability, and vulnerability to cyberattacks are drawbacks of current healthcare platforms, which undermine patient data security and privacy.
- Rendered navigation bar, login-in page, better UI/UX design.
- Blocks is being created, as when patient and doctor registration take place.
- Patient and Doctor details is being saved in the application, and hash256 value is generated
- A ganache IPFS Server has been created with meta mask as the wallet, using the NodeJs interface.
- All details related to be patient is kept in blocks and this is crypto lock for privacy and fair interoperability.
- Specified the possible modifications like integration of online systems with blockchain along with the use of secure authentication systems.

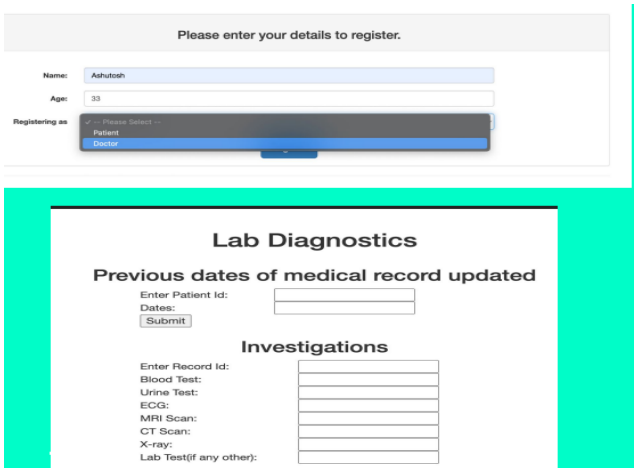


Fig.4. patient detail on blockchain

VI. CONCLUSION

By offering a secure, decentralized, and effective platform that enhances communication and cooperation between patients and healthcare providers, the patient request for medical requirements and doctor response system utilizing blockchain technology has the potential to revolutionize healthcare delivery.

The system's goal is to establish a safe, open environment where people may exchange their health information and work with healthcare professionals to enhance their medical results.

Patients may gain from the creation of this system in a number of ways, including enhanced healthcare delivery efficiency, increased control over their health information and treatment plans, and simplified communication and healthcare transactions. Patients have complete control over who gets access to their health data thanks to the safe storage of such data

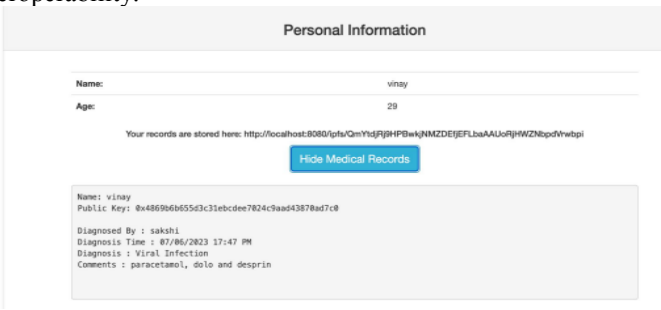
on the blockchain. Due to access to more precise and current patient data, this can also lessen the chance of medical mistakes and misdiagnoses.

By providing encrypted texting and in-the-moment consultations, the technology can help simplify communication between patients and medical professionals. As a result, patients may be more engaged and satisfied, while healthcare practitioners may have less paperwork to do. The technology can assist to lessen the stress on healthcare practitioners, improve efficiency, and save costs by automating healthcare transactions including appointment scheduling, medication refills, and insurance claims.

By ensuring that patient data is managed in a safe and confidential manner, the system can also assist to increase regulatory compliance in addition to these advantages. Blockchain technology can offer a transparent, tamper-proof record of healthcare transactions, making it simpler for healthcare providers to adhere to HIPAA laws.

However, there are difficulties in putting such a system into place. The system's integration with current healthcare systems is one of the biggest obstacles. Healthcare providers have made significant investments in their current systems, so integrating a new system can be expensive and time-consuming. As healthcare data is extremely sensitive and private, there are also worries regarding data privacy and security. The effectiveness of the system depends on protecting the confidentiality and security of patient data.

Despite these obstacles, employing blockchain technology to create a system for patient requests for medical needs and doctor responses can have a positive impact on both patients and healthcare professionals. The system can boost patient involvement and happiness while lowering costs and improving healthcare outcomes. It can also assist in addressing some of the difficulties the healthcare sector is now experiencing, including centralised data storage, a lack of transparency, and a lack of interoperability.



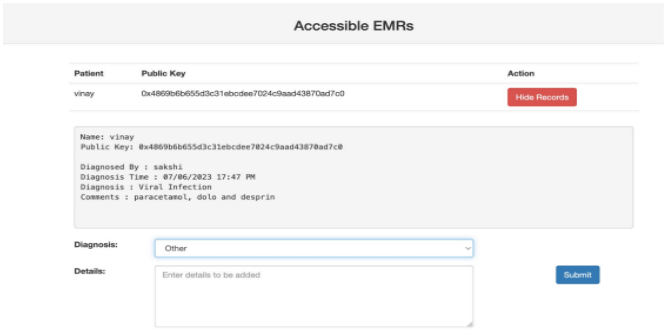


Fig. 5. Patient detail

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Smart Traffic System for Automatic Regulation

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Abstract— **Traffic congestion is becoming one of the basic issues with expanding populace and vehicles in urban areas. Traffic jams not just goal additional deferral and stress for the drivers, yet additionally increment fuel utilization and air contamination. In spite of the fact that it appears to swarm all over the place, megacities are the ones generally impacted by it. Also, its consistently expanding nature makes it important to work out the street traffic density progressively for better sign control and viable traffic the board. The traffic regulator is one of the basic elements influencing traffic streams. Accordingly, the requirement for enhancing traffic control to all the more likely to oblige this rising interest emerges. Our proposed framework aims to use live images from the cameras at traffic intersections for traffic density estimation utilizing image processing and AI. It additionally centers around the calculation for exchanging the traffic lights in view of the vehicle density to lessen congestion, consequently giving quicker travel to individuals and diminishing contamination.**

Keywords—CCTV, Video Summary, YOLO(you only look once)

I. INTRODUCTION

In urban cities of India, congestion of traffic on roads is an issue that need to be addressed urgently. In today's scenario, the traditional methods (signaling system) works efficiently only in the sparse surroundings. In scenarios like where traffic density on either side of the roads increases or traffic in comparison to normal days is more, these methods fail to give promising results. So the main purpose of our project is to develop a model that is intelligent and performs smart switching of the timer of the traffic signal for all sides on the crossing to ensure that no side of the crossing has a waiting time of a longer interval along with smooth flow of traffic on the road.

- The system accepts input from multiple CCTVs (one for each direction) placed at intersection of roads
- Frames of traffic are captured after regular intervals (ideally every second)
- Resizing of the image is done before passing it to the model
- The model trained by us uses these images to predict whether the vehicle is two wheelers, cars and large vehicles like trucks and buses, and also keeps the count of each type
- Our model is capable of detecting multiple types of vehicles in a single image and tell for each one of them if it is two wheelers, cars and large vehicles like trucks and buses
- Now our model will smartly allocate more green time to the side which has higher traffic density/has higher number of HMV vehicles (as they take longer to cross) and less green time to the lane with lower traffic density

II. LITERATURE REVIEW

Object detection is an application of computer vision that works on the problem to detect objects in the given input video or an image. The objects that can be detected are like- a person, car, buildings, animals, stones and can have applications in so many related problems. Two basic questions need to be answered while addressing this problem-

A. What is the object?

The question- where is an object in an image or video tries to find the object in the input dataset. The algorithm needs to find the exact location that is the pixel values of the detected object. This question is to find the class or category of the object in a specific input image.

There are various approaches and algorithms introduced by many researchers in the past for the task of object detection. Some of such models are- Viola-Jones object detection, SIFT, HOG, Retina-Net, YOLO, R-CNN, fast R-CNN, and Single-Shot MultiBox Detector (SSD). Mentioned models were able to solve many issues in the task of object detection such as limitation and scarcity of data that is used for modelling of algorithms. The YOLO algorithm has gained much popularity in the recent times because of reasons like its precise and accurate performance over the aforementioned object detection techniques.

B. How does an input image processed in machines?

Any machines can only model the objects in the categories for which algorithm has been designed. The machine themselves cannot know and identify anything naturally as humans can do. It can only perform the task for which that algorithm is constructed that is, it can only recognize one category of objects in the input images. The model will only be able to identify whether the objects present in the given images or frame of video corresponds to the category of object or not. Task is to find if the model will try to fit object in the category or not.

- For any machine learning model, an input image or video is composed of only data which is an array or matrix of pixel values in RGB format. The pixels are represented in the three colors that are red, green and blue. The range of these colors varies from 0 to 255. Pixel value 0 means black color while maximum value 255 means white. For example, red color is represented as [255 0 0] which means red pixel value is maximum while no indication of green and blue colors in that pixel.
- Any machines learning model doesn't focus on the whole image or frame of a video. They just have attention on the interesting pixel values and try to find patterns in these values as that is the main task of any learning model. From an image, pattern of the pixels of the object is taken and compared with the pixels of already labelled data. If the patterns of both the input image and labelled image matches or are above a threshold, then machines outputs it as the labelled class or category.

1. Gaussian Mixture Model (GMM)

The outcome of the preceding layer, with height and width, $w^{-\rightarrow}$ provides as the input for the convolution layer, $\alpha^{\rightarrow}(0)$ acting as the input image. Afterward, employing kernel/filter F, the convolution operator

$$\psi\left((\vec{a}^{(\overrightarrow{l-1})} \odot F)_{\vec{p},\vec{q}}\right) = \psi(\sum_{1}^{\vec{h}^{(\overrightarrow{l-1})}} \sum_{1}^{\vec{w}^{(\overrightarrow{l-1})}} F_{i,j} * \vec{a}^{(\overrightarrow{l-1})}{}_{(\vec{p}+i-1,\vec{q}+j-1)})$$

2. Kernel Density Estimation (KDE)

An unstructured approach also can be an accustomed model to a multimodal PDF. during this perspective, Elgammal et al. [13] planned a Parzen-window estimate at every background pixel:

where K could be a kernel (typically a Gaussian) and N is the variety of previous frames accustomed estimate P(.). once coping with color video frames, a product of one-dimensional kernels is used:

A picture element is labeled as foreground if it's unlikely to return from this distribution, i.e. when P(Is,t) is smaller than a predefined threshold. Note that σj is pre-estimated following Elgammal et al.'s technique [14]. additional subtle ways also can be envisaged like Mittal and Paragios's [15] that rely on "Variable Bandwidth Kernels".

3. Faster R-CNN

Faster R-CNN is a machine learning algorithm based on deep convolutional neural network. This algorithm is majorly used to detect objects in an input image of video. It provides a single, end-to-end, unified network that is tries to accurately find the object in the image or frame of a video and predict the exact pixel values of the detected object. Along with accuracy, time complexity also needs to be reduced to achieve real-time exploration. The architecture of faster R-CNN model is described below as it is a single unified model:

RPN (Region Proposal Network): It is a type of convolutional neural network (CNN) that is for selecting specific regions and the categorizing the type of the object to be considered in that region based on study.

- **Fast R-CNN:** It is also a variant of convolutional neural network (CNN) that has a main purpose of extracting features from the proposed selected region and forming the bounding box with colors and the labels of the class.

Faster R-CNN model made it possible to solve complex problems of image processing and computer vision in machine learning.

4. You Only Look Once (YOLO)

YOLO works on the principle of looking just once and making the decision. Hence the time complexity of algorithm is less with just 45 fps as speed of detection of an image. YOLO model divides an input image into a grid of cells. Each cell needs to predict the bounding box. To predict the location of bounding box, probabilities of each class of object for each section of grid is calculated. From this, parameters of bounding box are found. If the box lies in the centre of found box, then we say object is detected. Once an object is sighted in the first look is the basic principle of YOL This paper was associated with improvement on previous models that used Gaussian mixture models with economical update equations. Particularly with the fast object detection model in [5], the YOLO model was diagrammatical. This paper projected object detection as a regression disadvantage to dimensionally separated bounding boxes and associated class potentialities. One neural network is used to predict every bounding box and its class probability, making end-to-end improvement easy. although YOLO makes plenty of errors, it's less potential to predict false positives compared to completely different techniques

III. SCOPE OF THE WORK

In the model of CNN design, the traffic thickness pictures are perceived and characterized such that produces prevalent results. For different convolutional layers, a variable piece size, for example, 5*5 or 3*3, has been utilized. The introduced technique might group the ongoing traffic block in the wake of utilizing film taken by introduced cameras to screen traffic. The objective is to involve this as a model to give master frameworks information on traffic thickness from different areas and settle on other huge choices in regards to traffic light. To accomplish more exactness, complex Profound Brain Organizations are carried out utilizing NVIDIA GPU (Designs Handling Unit). Fig. 2. portrays the general structure plan for traffic thickness arrangement.

A completely associated multifaceted perceptron is joined to a CNN's convolutional layer, which is thusly trailed by sub-examining or pooling layers. It exploits the picture's 2D construction. CNN's essential objective is to consequently separate delineated qualities from pictures. Convolution is performed utilizing haphazardly instated channels to bring down the picture size without losing any highlights, accomplished by the quantity of component maps.

For the most part, pooling is performed after convolution. With max pooling, the most elevated conceivable pixel esteem is distinguished and delivered as a solitary pixel esteem. The trademark prompts the main number of characteristics with identical qualities. The complex perceptron (MLP), which is completely associated, gets the parts that were at last recovered to characterize the test input.

The CNN classifier is utilized in the introduced technique to decide traffic volume. We changed the different tuning boundaries to give testing results with more prominent accuracy than the past ones. The Traffic pictures are resized to send to different CNN layers subsequent to gathering the information. To extraction of highlights, each info is shipped off the convolutional layer and afterward to max-pooling layer. A CNN is an exceptionally renowned and generally involved Profound Learning procedure that accepts picture as an information, and by utilizing learnable inclinations and loads, focus on various qualities and items and separate between them. CNN gives better precision for picture order.

IV. MATERIALS AND METHODS

The SVM models utilize a bunch of procedures to make a calculation that will decide if a picture relates to the objective item or on the other hand in the event that it doesn't. From the dataset it was set with, the SVM model is prepared to isolate a hyper plan into a few classes. During the cycle, contingent upon the pixel esteems, the items are being put in the hyper plan their position predicts a class in light of the classification detachment

gained from the preparation stage.
Support Vector Machine(SVM) is an artificial intelligence calculated algorithm that utilizes for both characterization and relapse. However, we say relapse issues also its most appropriate for characterization. The goal of SVM calculation is to find a hyperplane in a N-layered space that particularly groups the data of interest. The component of the hyperplane relies on the quantity of elements. On the off chance that the quantity of information highlights is two, the hyperplane is only a line. In the event that the quantity of information highlights is three, the hyperplane turns into a 2-D plane. It becomes hard to envision when the quantity of elements surpasses three.

SVM can be categorized into two types-

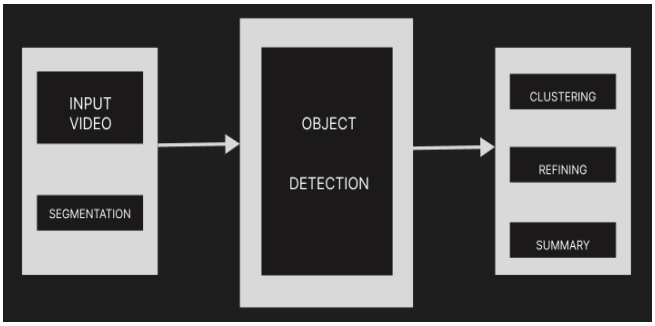
Direct SVM: The major application of direct SVM lies in distinguishing the information. In this, dataset is studied, if it can be divided into two classes and plotted datapoints of these two classes can be distinguished using a straight line. Such model is called Straight SVM classifier.

Non-direct SVM: In Non-Direct SVM the plotted datapoints cannot be distinguished using a straight line and instead a non-straightly line is used to isolate the information. Such model is called Non-straight SVM classifier.
The upside of the venture will be to distinguish the significant pieces of the video. It will be simpler to distinguish the people present in the video and without any problem

A. Residual Blocks

Firstly, an image or frame is divided into lattices of specific size. Every matrix has a specific value of row and column. Figure 1 below depicts the division of an input image into lattices.
In the picture underneath, there are numerous lattice cells of equivalent aspects. Each lattice cell will recognize objects that show up inside them. For instance, in the event that an item place shows up inside a specific matrix cell, this cell will be liable for recognizing it.

Fig 1: Partitioning of an image into lattices.



B. Bounding box

A bouncing box is a diagram that features an item in a picture. Each bouncing box in the picture comprises of the accompanying ascribes:
o Width (bw)
• Level (bh)
• Class (for instance, individual, vehicle, traffic signal, and so on)- This is addressed by the letter c.
• Bouncing box place (bx,by)

The accompanying picture shows an illustration of a bouncing box. The bouncing box has been addressed by a blue diagram. Consequences be damned purposes a solitary bouncing box relapse to foresee the level, width, focus, and class of items. The picture above addresses the likelihood of an item showing up in the bouncing box.

C. Intersection over union

Crossing point over association (IOU) is a peculiarity in object location that depicts how boxes cross-over. Just go for it utilizes IOU to impeccably give a result box that encompasses the articles.
Every network cell is liable for anticipating the bouncing boxes and their certainty scores. The IOU is equivalent to 1 on the off chance that the anticipated bouncing box is equivalent to the genuine box. This component disposes of jumping boxes that are not equivalent to the genuine box.
Figure 2 depicts the IOU functions detects an object.

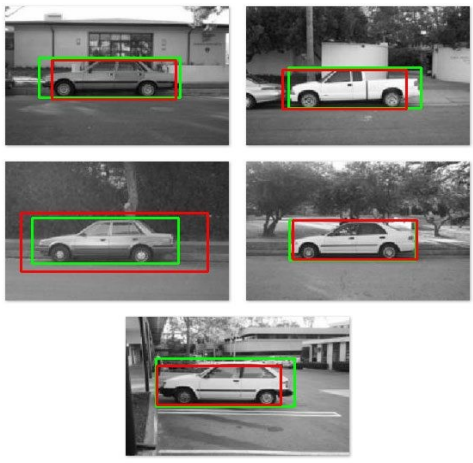


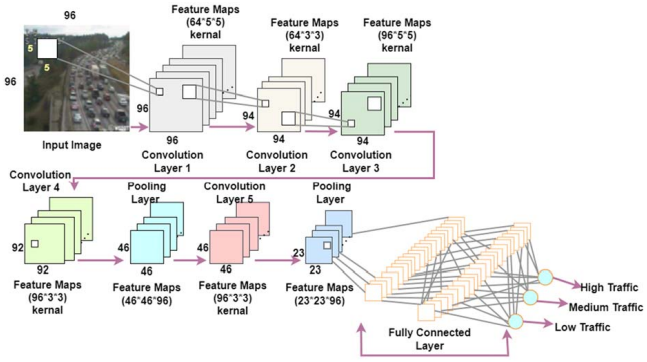
Fig 2: Detection of an object using IOU function

The image above shows two boxes bounded with green and red colored lines. The red-colored box represents the predicted detection while the green-colored box represents the real box. The task of YOLO is to ensure that the two bounding boxes are equal.

V. RESULTS AND DISCUSSIONS

The Washington State Branch of Transportation gave a continuous dataset of film caught by thruway CCTVs in Seattle, WA, which was utilized to assess how well the proposed model performed. In view of current traffic, explore discoveries arrange traffic thickness as high, low, and medium and precisely expect

it up to 99.6 %. We've chosen a five-layer plan with different info highlight guides and channel sizes displayed in Fig.
3. There are 64, 64, 96, 96, and 96 component maps for each sets of convolution and max-pooling layers. Each pair's relating channel sizes are 5*5, 3*3, 5*5, 3*3, and 3*3.
The last layer, a completely associated multifaceted perceptron with two completely associated layers, is utilized to group the picture into its last three classifications: 0 (low traffic), 1 (medium traffic), and 2 (high traffic). To naturally extricate the highlights from the picture, the Convolution and Max Pooling systems were applied multiple times and two times, individually. The initiation capability utilized is Corrected Straight Unit (ReLU) in light of the fact that it is known to create unrivaled outcomes for muddled circumstances, and 0.5 was utilized as the dropout for completely associated MLPs to avoid explicit neurons from the preparation stage. In our model, there are three gatherings of result neurons for the traffic thickness
.



VI. CONCLUSIONS

The framework has been effectively made utilizing the NVIDIA GT930M, however a superior designs card is required for a superior smooth framework and higher FPS. Little Just go for it makes the framework run at better execution yet with lower exactness. The framework just identifies vehicles inside the return for money invested which makes this framework more proficient for controlling traffic signals to keep away from gridlock. It figured out how to count the number and the sort of vehicles distinguished. In any case, the framework can be improved by focusing on the greater vehicle so the clogged traffic can be settled quicker on the grounds that greater vehicles require some investment to move.
Later on, we accept this framework could be coordinated with other related traffic the executive frameworks, for example, programmed tagging, street thickness checking, or likewise a street car accident indicator. Thus, there will be more information and there could be more systems to diminish the gridlock issue effectively.

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Machine Learning And Mental Health

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Abstract-- Undoubtedly a health issue, mental illness impacts a person's thoughts, emotions, and social interactions. These issues demonstrate that soundness of mind will have a profound social impact and that new prevention and intervention strategies are needed is important. An individual's work innovativeness and efficiency can be impacted by both work and mental health. In fact, according to current estimates, the global economy suffers a $1 trillion annual loss in productivity due to mental health difficulties, absenteeism, and worker turnover. You can feel alone, overburdened, and unclear of what to do when work-related stress, harassment, or mental health problems affect your relationships performance, or physical functioning. Due to the disease's severe impact there is a requirement for effective mental health care. Studies in the field of machine learning (ML) might help in the detection, diagnosis, and treatment of mental health. ML techniques have the potential to create new opportunities for understanding human behaviour patterns, identifying risk factors and symptoms associated with mental illness, forecasting the evolution of diseases, personalising and improving therapy. This paper presents an effective way to determine whether a person is suffering from mental disorder based on various factors using machine learning algorithms like neural network etc.

Keywords— Machine Learning, Random forest, Logistic regression, Decision tree.

I. INTRODUCTION

Mental health is a public issue that affect individuals worldwide. They afflict persons at all ages, from children to the elderly, and both men and women are affected. Among this anxiety and depression disorders have a wide range of health and well-being consequences. They are important risk factors for a wide range of other lifestyle problems, including ischemic heart disease, hypertension, diabetes, unintentional injuries, and purposeful injuries. Suicidal thoughts are closely linked to depression, and depression can lead to suicide. They palpitation, sleeplessness or hypersomnia, tremor, considerable weight loss or increase, depression, social withdrawal, poor workplace productivity, suicidal thinking or attempt, and lack of focus. Due to this, people lose access to economic and social opportunities, resulting in a bad quality of life.

Machine Learning is the use of advanced probabilistic and statistical approaches to build computers that can learn on their own from data. ML has facilitated significant progress by enabling speedy and scalable analysis of complex data. This enables data patterns to be detected more quickly and correctly, as well as more accurate predictions from data sources.

Machine learning algorithms and Artificial Intelligence (AI) have the potential to be fully utilised in forecasting the onset of mental disease. When such applications are implemented in real time, they will benefit society by acting as a surveillance tool for individuals who engage in aberrant behaviour.

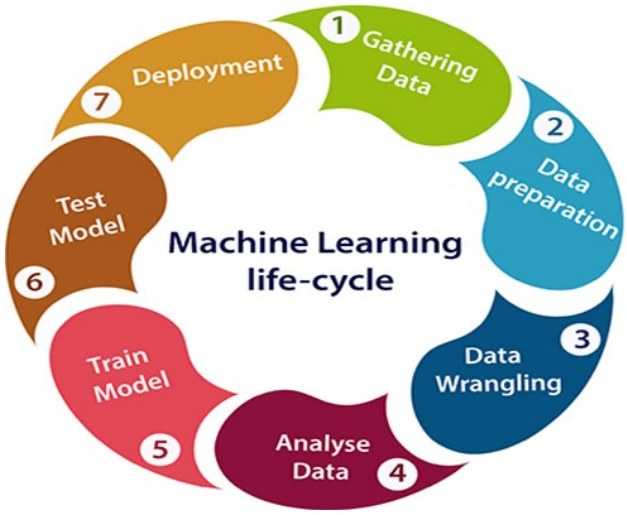

Fig 1. Steps of Machine Learning

II. MACHINE LEARNING AND DATA MINING

Data mining is the process of preparing raw data from unstructured data and structuring it to derive meaningful insights from the data that can be used in projects. Organizing and reflecting data is a way of understanding what it contains and what it doesn't. There are different kinds of methods that people can use to analyze data. It is very easy to use data in the analysis phase to reach a certain conclusion or agenda. Data collection tools provide vast amounts of data, and data mining processes bring together techniques from multiple disciplines such as statistics, machine learning, and more, database technology, pattern recognition, neural networks, information retrieval, and spatial data analysis. Data mining techniques are used in various fields such as business administration, science, engineering, banking, data management, administration, and many other applications.

Machine learning is designing algorithms that allow computers to learn. Learning does not necessarily involve awareness, but learning is about finding statistical regularities and other patterns in data. Therefore, many machine learning algorithms bear little resemblance to human approaches to learning tasks. However, learning algorithms can provide insight into the relative difficulty of learning in different environments. Machine learning consists of his three parts:

- Computational algorithms at the heart of decisions.
- Decision-making variables and characteristics.
- Basic knowledge for which you know the answer.

This enables learning (training) of the system. First, the model is given parameter data for which the answers are known. The matches the known answer. At this point, more and more data is input to help the system learn and process more sophisticated computational decisions.

III. PROPOSED WORK

The proposed work is providing the structured and well-prepared data to our model and predicting the people affected by the disease. The steps follow as-

Extracting the dataset

Data has been collected from the open source Kaggle repository. The dataset contains information that has been collected for mental behaviour for analysing but not all parameters are used.
Loading dataset:

```
df= pd.read_csv('survey.csv')
df.head()
```

Pre-processing the data

Pre-processing is one of the most important steps in machine learning. To produce a clean dataset for further visualization and prediction, it is required. We have used python libraries for the same purpose. In preprocessing, there are many steps like cleaning null data, removing the unwanted labels and columns keeping the format of data same etc. Steps involved in pre-processing were:

1. Using the remove duplicates function, no duplicates were found.
2. All gender inputs were sorted into Male, Female, or Other for simplification. Using find and replace initially to standardize "M","F","male" and "female" to "Male" and "Female". Then, Filtering out "Male" and "Female" in order to manually replace the remaining inputs with "Male", "Female", or "Other" depending on if the initial input seemed to be a misspelling, or if the entry suggested the participant was non-binary.
3. Using filtering, if Self Employed is entered as "NA", using find and replace, it was replaced with "No".
4. Using filtering, if Treatment is entered as "Yes", and work_interfere is NA, work_interfere was changed to "Never"

For example-

1. For finding null value percentage we have used and hence we obtained

```
round((df.isna().sum()/df.shape[0])*100,2)
```

algorithm is then run and adjusted until the algorithm's output (training)

```
timestamp                   0.00
age                         0.00
gender                      0.00
country                     0.00
state                      40.91
self_employed               1.43
family_history              0.00
treatment                   0.00
work_interfere             20.97
no_employees                0.00
remote_work                 0.00
tech_company                0.00
benefits                    0.00
care_options                0.00
wellness_program            0.00
seek_help                   0.00
anonymity                   0.00
leave                       0.00
mental_health_consequence   0.00
phys_health_consequence     0.00
coworkers                   0.00
supervisor                  0.00
mental_health_interview     0.00
phys_health_interview       0.00
mental_vs_physical          0.00
obs_consequence             0.00
comments                   86.97
dtype: float64
```

2. Removing columns not required for predicting

```
df = df.drop(['country','state','timestamp','c omments'], axis = 1)
```

3. Rounding off age above and below normal limits

```
df.loc[df.age<12,'age']=15
df.loc[df.age>75,'age']=75
```

4. Replacing self-employed column with mode and null values of work interference

```
se_mode = train_data['self_employed'].mode().values[0]
train_data['self-employed'].fillna(se_mode,inplace=True)
train_data[train_data['work_interfere'].isna()]['treatment'].value
_counts
```

5. Dividing training data

```
X_train = train_data.drop('treatment',axis=1)
y_train = train_data['treatment'].copy()
```

Various libraries used for data mining purposes are-

1. Sklearn: This stands for Scikit learn and is built on the SciPy package. It is the primary package being used in this project. It is used for providing interface for supervised and unsupervised learning algorithms. Following groups of models are provided by sklearn Clustering, Cross Validation, Datasets, Dimensionality Reduction, Ensemble methods, Feature extraction, Feature selection, Parameter Tuning, Manifold Learning, Supervised Models.
2. NumPy: It is a library for the Python programming language, adding support for multi-dimensional arrays and matrices, along with a large collection of high-level mathematical functions to operate on these arrays. It provides functions for Array Objects, Routines, Constants, Universal Functions, Packaging etc. In this project it is used for performing multi-dimensional array operations.
3. Pandas: This library is used to provide high-performance, easy-to-use data structures and data analysis tools for the Python programming language. It provides functionalities like table manipulations, creating plots, calculate summary statistics, reshape tables, combine data from tables, handle times series data, manipulate textual data etc.

In this project it is used for reading csv files, comparing null and alternate hypothesis etc.

IV. Model Selection

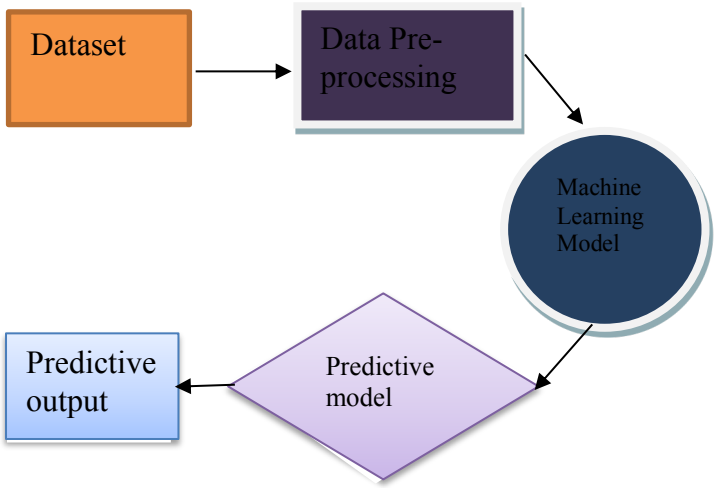

Fig 2. Basic model workflow

After splitting the dataset, we used our training dataset on various models like logistic regression, random forest, xgboost and f1 score to predict the accuracy of model.

Logistic Regression: The logistic regression is used the find the probability of an event that weather an event is going to occur or not. The logistic regression is used in statistics to find the probability of the occurrence of an event like the probability the school will open or not is either 1 or 0 where 1 means that the school will open and 0 means that the school will remain closed.

Decision Tree Algorithm: The decision tree algorithm is a type of a supervised learning algorithm which can be used in the case of classification as well as regression it has capability to solve both the kind of problems. In decision tree for predicting the value we start from the root of tree and then form a sub-tree from that root and finally come to a conclusion which is nothing but the predicted value.

Random Forest Algorithm: The random forest algorithm is a type of supervised learning algorithm which is used for both classification as well as regression as the basic idea behind the random forest algorithm is the decision tree algorithm, this algorithm creates multiple decision trees and then predicts the values

XGBoost-In this algorithm, decision trees are created in sequential form. Weights play an important role in XGBoost. Weights are assigned to all the independent variables which are then fed into the decision tree which predicts results.

Prediction using suitable model

Different models were used and the model with best F1 score was used.

1. Logistic regression

```
from sklearn.linear_model import LogisticRegression
log_reg = LogisticRegression(penalty='l1',solver='liblinear')
train_evaluate(log_reg,X_train,y_train,'Logistic Regression')
```

	Name	F1_score_trainset	F1_score_validationset
0	Logistic Regression	0.826521	0.817808

2. Decision tree

```
from sklearn.tree import DecisionTreeClassifier
dt_clf = DecisionTreeClassifier(max_leaf_nodes=4,random_sta
te=42)
train_evaluate(dt_clf,X_train,y_train,'DecisionTreeClassifier')
```

3. Random Forest

	Name	F1_score_trainset	F1_score_validationset
0	DecisionTreeClassifier	0.851698	0.851769

```
from sklearn.ensemble import RandomForestClassifier
rnd_clf = RandomForestClassifier(random_state=42)
train_evaluate(rnd_clf,X_train,y_train,'RandomForestClassifier'
)
```

	Name	F1_score_trainset	F1_score_validationset
0	RandomForestClassifier	1.0	0.842216

4. XgBoost

```
from xgboost import XGBClassifier
xgb_clf = XGBClassifier(verbosity=0)
train_evaluate(xgb_clf,X_trainy_train,"XG Boost CLASSIFIE
R")
```

	Name	F1_score_trainset	F1_score_validationset
0	XG Boost CLASSIFIER	0.882042	0.846219

XgBoost had the best overall score .so it was used for predicting. We fine-tuned XgBoost so that the prediction was more accurate.

Testing the model on the dataset

First, we obtain the f1 score of this tuned model.

```
X_test = test_data.drop('treatment',axis=1)
y_test = test_data['treatment'].copy()
X_test['self_employed'].fillna(se_mode,inplace=True)
X_test['work_interfere'].fillna('Never',inplace = True)

from sklearn.preprocessing import OrdinalEncoder
X_test[features[1:]] = ord_encoder.transform(X_test.iloc[:,1:])
X_test[features] = std_scaler.transform(X_test
y_test = lb_encoder.transform(y_test)y_test_pred = XGBoost_f
inal.predict(X_test)
print(fF1_score on Test Set : {f1_score(y_test,yst_pred)}')
```

We get the score as:

```
F1_score on Test Set : 0.8212560386473429
```

Now we predict the people having mental disorder by fitting our training data on the model:

```
XGBoost_final.fit(X_train,y_train)
dfTestPredictions = XGBoost_final.predict(X_test)
results = pd.DataFrame({'Index': X_test.index, 'Treatment': dfTestPredictions})
results.to_csv('results.csv', index=False)
results.head(10)
```

The output obtained by testing the test data on our model was:

	Index	Treatment
0	833	1
1	918	0
2	819	1
3	43	1
4	1021	1
5	926	1
6	889	1
7	398	0
8	290	0
9	183	1

The final prediction consists of 0 and 1. 0 means the person is not needed any mental health treatment and 1 means the person is needed mental health treatment.

V. CONCLUSION

The accuracy of the disease prediction is about 82% so we can say that the dataset is not in over-fitting situation and predicts the correct output. The performance of machine learning models depends on the data samples taken and the characteristics of the data. Additionally, machine learning models can also be subject to pre-processing activities such as data cleaning and parameter optimization for optimal results.

Existing research and studies show that machine learning can be a useful tool for understanding mental disorders. Apart from that, it also helps to distinguish and classify mental health problems in patients for further treatment. The approach has proven to be a practical resource, among other things, for detecting mood states and reactions in patients.

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The influence of physics in computer science: A multifaceted perspective

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Abstract: **Physics plays a pivotal role in shaping the landscape of computer science, influencing diverse aspects of the field. This paper explores the importance of physics in computer science, highlighting key areas where physics knowledge is essential. Physics offers the theoretical foundation, mathematical models, and algorithms that shape several domains within computer science. Its profound influence enables a deep understanding of computing hardware, facilitates simulation and modeling of physical systems, inspires optimization algorithms, empowers computational physics, aids data analysis and machine learning, and provides a framework for information theory. By embracing the interplay between physics and computer science, researchers and practitioners can push the boundaries of computational capabilities and foster innovation in various technological domains.**

Keywords: Physics, computer science, computational physics, quantum computing

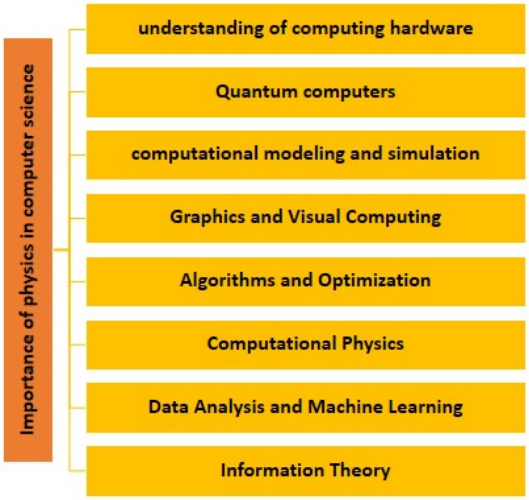
I. INTRODUCTION

Physics is of immense importance to human beings as it helps us understand the fundamental principles that govern the natural world. Physics enables us to unravel the mysteries of the universe, from the smallest subatomic particles to the vastness of space. It helps us comprehend the origin, evolution, and behavior of celestial bodies, galaxies, and the entire cosmos. It drives technological advancements that improve our quality of life. Many innovations, such as electricity, telecommunications, computers, and medical imaging, are rooted in principles of physics. It provides the foundation for numerous fields, including engineering, electronics, materials science, and energy production. Physics contributes to advancements in medical diagnostics and treatments. Techniques like X-rays, MRI, ultrasound, and radiation therapy rely on physics principles. Additionally, physics is instrumental in understanding the properties of biological systems, helping us explore topics such as biomechanics and neurophysics.

Physics impacts our daily lives through various technological devices. From smartphones and GPS navigation to household appliances and transportation systems, physics-based technologies have become integral to our modern lifestyle.

Overall physics enhances our knowledge, drives technological progress, and provides us with a deeper understanding of the world we inhabit. It impacts numerous aspects of our lives, from technology and energy to health and scientific exploration. By unraveling the mysteries of nature, physics empowers us to make informed decisions and shape a better future.

Physics plays a significant role in all the engineering sciences. But this paper mainly explores the importance of physics in computer science, highlighting key areas where physics knowledge is essential and how it is influencing various aspects of the field [1-2].



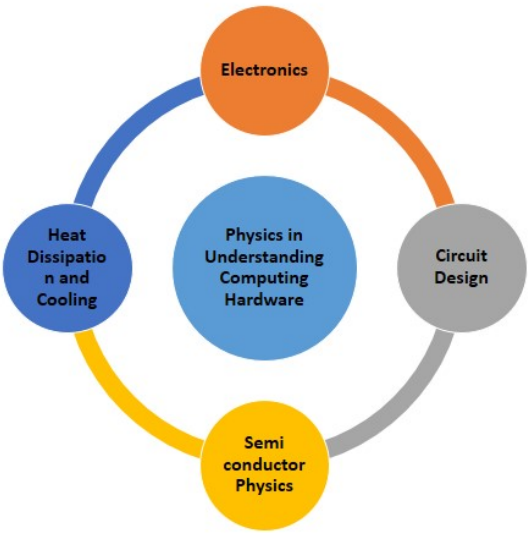
Firstly, physics provides a deep understanding of computing hardware. Secondly, the field of quantum computing heavily relies on quantum physics principles. Quantum computers exploit quantum mechanics to perform computations at an exponential speed compared to classical computers. Physics also plays a significant role in computational modeling and simulation. Accurate representation and prediction of physical systems require a profound comprehension of physics principles. Physics-based simulations are crucial in graphics and visual computing [3-5]. The field of computational physics, where computer science and physics intersect, employs high-performance computing and numerical methods to solve complex physical problems, ranging from quantum systems to cosmology. Computational physics relies on computer science techniques for efficient computation and data analysis. Physics principles also form the foundation for data analysis and machine learning. Moreover, physics inspires the development of innovative machine learning models and architectures, such as neural networks, emulating the physical processes of the human brain. Last but not the least, information theory, a branch of physics, provides a mathematical framework for understanding information representation, transmission, and storage.

II. DISCUSSION

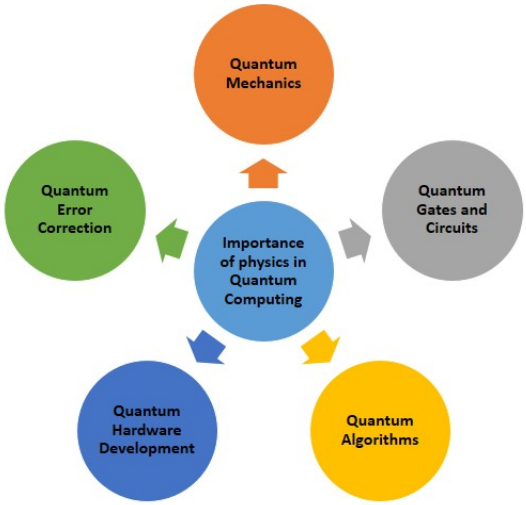
Physics plays a crucial role in the development and advancement of technology. It provides the fundamental understanding of the

natural laws and principles that govern the behavior of matter and energy. Here are some key reasons why physics is important in computer science:

1. **Understanding Computing Hardware:** Knowledge of physics helps computer scientists understand how hardware components function, enabling them to optimize performance and develop new technologies. The principles of electronics and electromagnetism, derived from physics, form the foundation of digital circuits, microprocessors, and other hardware components [6, 7]. Here are some key aspects highlighting the importance of physics in understanding computing hardware:

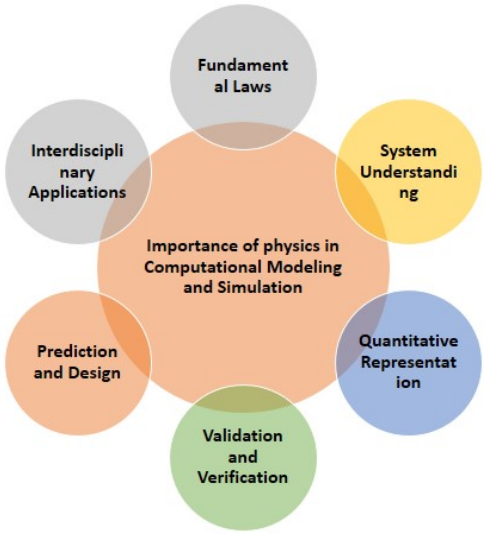


2. **Quantum Computing:** Quantum physics is of particular importance in the field of quantum computing. Quantum computers leverage the principles of quantum mechanics to perform certain computations significantly faster than classical computers. Understanding quantum physics is crucial for developing quantum algorithms, designing quantum systems, and harnessing the power of quantum computing [8, 9].

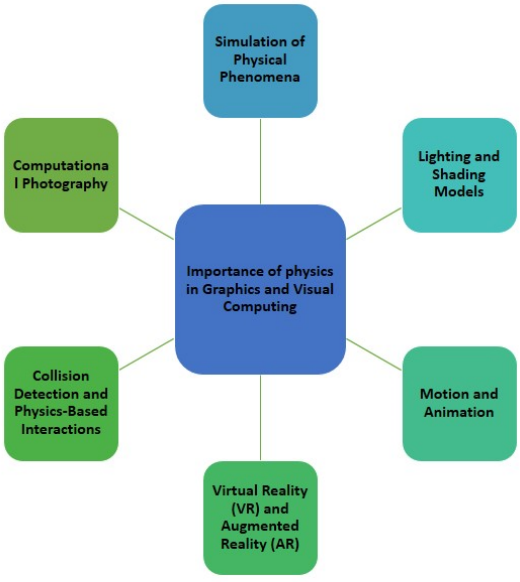


3.
4.

D. **Computational Modeling and Simulation:** Physics provides the mathematical models and algorithms for simulating and modeling physical systems. Computer scientists utilize physics-based simulations to study and understand complex phenomena in fields such as fluid dynamics, astrophysics, climate science, and material science. These simulations require a deep understanding of physics principles to accurately represent and predict the behavior of physical systems[10] .

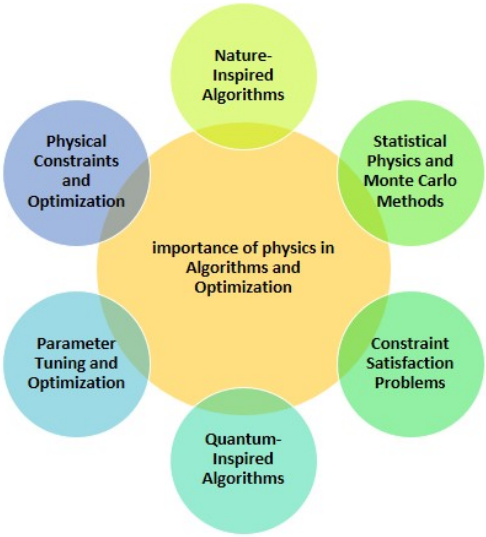


E. **Graphics and Visual Computing:** Physics-based simulations are also vital in computer graphics and visual computing. Physics engines and algorithms are used to simulate realistic physical interactions, such as gravity, collisions, and fluid dynamics, in virtual environments. This enhances the realism and immersion in video games, virtual reality (VR), and computer-generated imagery (CGI) for movies and simulations [11, 12].

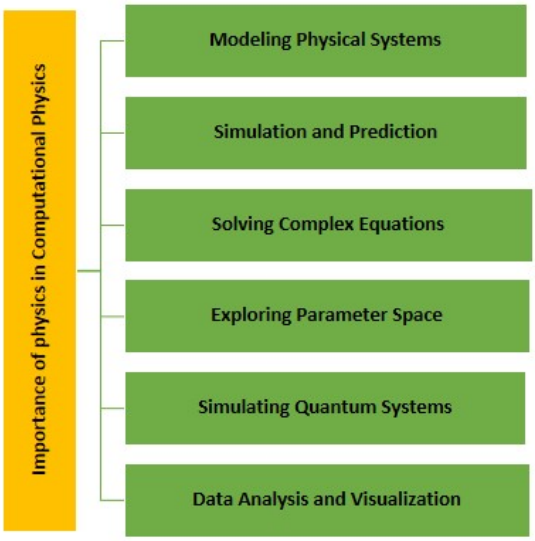


5. **Algorithms and Optimization:** Physics concepts, such as optimization, can be applied to algorithm design and analysis. Optimization algorithms based on physics principles, such as simulated annealing and particle swarm optimization, are used to solve complex optimization

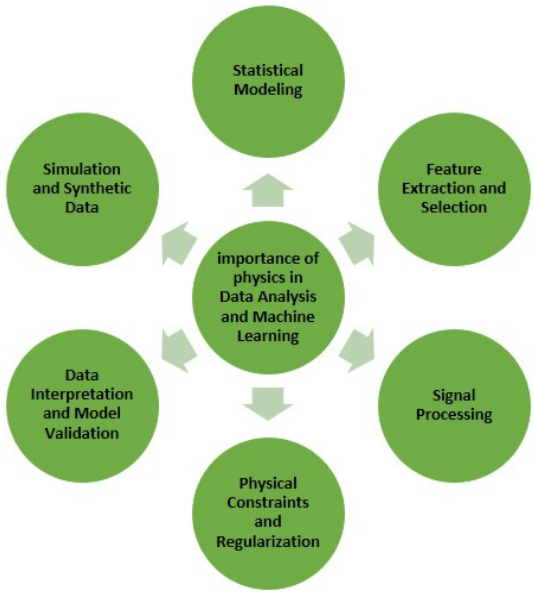
problems in various areas of computer science, including machine learning, data analysis, scheduling, and network optimization [13].



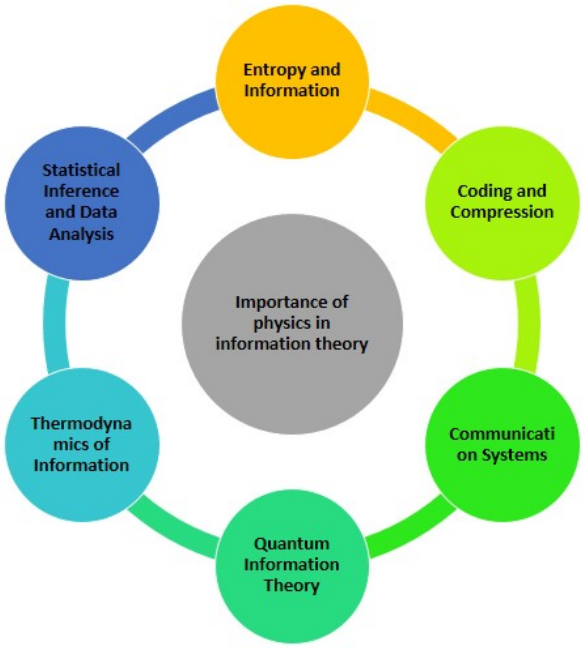
6. **Computational Physics:** Computer science and physics intersect in the field of computational physics, which involves using computers to solve complex physical problems. High-performance computing and numerical methods are applied to simulate and analyze physical phenomena, ranging from quantum systems to cosmology. Computational physics relies heavily on computer science techniques for efficient computation and data analysis [14].



7. **Data Analysis and Machine Learning**: Physics principles, such as statistical mechanics and signal processing, provide a theoretical basis for data analysis and machine learning algorithms. Techniques like regression analysis, Fourier transforms, and Bayesian inference, rooted in physics, are widely used in analyzing and extracting valuable insights from large datasets. Physics also inspires the development of new machine learning models and architectures, such as neural networks inspired by the human brain's physical processes [15].



8. **Information Theory:** Information theory, a branch of physics, provides a mathematical framework for understanding the representation, transmission, and storage of information. It plays a fundamental role in computer science, particularly in areas such as data compression, error correction codes, cryptography, and communication protocols. Information theory enables efficient data storage, secure communication, and reliable data transmission over networks. Physics plays a significant role in information theory, a field that deals with quantifying, processing, and transmitting information [16].



III. CONCLUSION

Overall, physics provides the theoretical foundation, mathematical models, and algorithms that underpin various aspects of computer science. Its principles enable computer scientists to understand and optimize computing hardware,

simulate physical systems, develop algorithms, analyze data, and push the boundaries of computational capabilities

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Integral Transform of Appell Function of Matrix Arguments

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***Abstract*—In this paper we define and investigate certain integral representations of Appell Functions F1, F2 and F3 of real symmetric positive definite matrices. Hypergeometric functions are derived from hypergeometric series and further from geometric series. These functions are special functions which can be defined analytically. In this paper, we will construct an extension of Appell's hypergeometric function and will give integral representation to these functions.**

***Keywords*—Generating Functions, Appell functions; differentiation; integrals; recurrence relations; multiple hypergeometric functions; series; special functions.**

I. INTRODUCTION

Following the technique developed by Exton, Bailey, and Slater the authors define the Appell functions F_1, F_2 and F_3 of two matrix arguments in terms of certain double integrals of matrix arguments. Special function are applied in different area of research like Quantum physics, and also applicable in field of computers such as Mathematica and Maple etc. Special functions can also be applied in the area of statistics and econometric. Distribution theory can also use these functions due to number of variables. The generalized hypergeometric functions are special function which have wide variety of application. Higher-order transcendental functions are generalized from hypergeometric functions. The objective of this paper is to derive certain integral representations for Appell functions F_1, F_2 and F_3 of two matrix arguments.

The paper consists of extending Appell's Hypergeometric geometric function by contiguous relations of hypergeometric series. The content in this paper referred to various literature. These functions was introduced by the by Erdélyi (1953). The detailed study can be seen in the results of Srivastava and Karlsson on Multiple

Gaussian hypergeometric series where Lauricella functions of several complex variables occur
naturally. Other useful work on special functions can be seen in the paper of Chu and Wang. Brychkov explained several integral representations for Lauricella functions of real symmetric positive definite matrices.

For the theory, we referred to Erdélyi (1953), Whittaker and Watson (2005) and Singh (2016) and for more comprehensive proof we consider Tarasov (2003) and Slater (1966).

A. The Generalized Hypergeometric Series

The general Hypergeometric function is given by:

$$ {}_pF_q\left(a_1 \dots\dots a_p;\ b_1 \dots\dots b_q; z\right) = \sum_{n=0}^{\infty} \frac{\prod_{k=1}^{p}(a_k)_n}{\prod_{k=1}^{q}(b_k)_n} \frac{z^n}{n!}, $$

$$ = \sum_{n=0}^{\infty} \frac{(a_1)_j \dots\dots\dots (a_p)_j}{(b_1)_j \dots\dots\dots (b_q)_j} \frac{z^n}{n!}. \qquad (2.1) $$

Where p and q are nonnegative integers, $a_1, a_2 \dots\dots\dots, a_p$ and $b_1, b_2 \dots\dots\dots, b_q$ are numerator and denominator parameters respectively of generalized hypergeometric function (2.1), z is the argument of same and no b_i's is zero or a negative integer. In this paper we deal with eqn (2.1) and most of the part deals with special cases of the generalized hypergeometric function.

Various important outcome we get with eqn (2.1), where one of the parameters of a_i is zero and all c_j are non-negative integer, then

$$ {}_pF_q(0, a_2, a_3 \dots\dots\dots a_p;\ c_1 \dots\dots\dots, c_q; z) = 1. \qquad (2.2) $$

Also,

$$ {}_pF_q(a_1, a_2 \dots\dots\dots a_p;\ c_1 \dots\dots\dots, c_q; 0) \equiv 1, \qquad (2.3) $$

If we interchange parameters of function, those parted by commas are feasible, for multiplication is commutative.

$$ {}_pF_q(a_1, \dots\dots, a_r, \dots\dots a_s \dots;\ b_1 \dots\dots, b_k, \dots\dots, b_r \dots\dots; z) $$

$$ \equiv {}_pF_q(a_1, \dots\dots, a_r, \dots\dots a_s \dots;\ b_1 \dots\dots, b_r, \dots\dots, b_k \dots\dots; z) $$

$$ \equiv {}_pF_q(a_1, \dots\dots, a_s, \dots\dots a_r \dots;\ b_1 \dots\dots, b_r, \dots\dots, b_k \dots\dots; z) $$

$$ \equiv {}_pF_q(a_1, \dots\dots, a_s, \dots\dots a_r \dots;\ b_1 \dots\dots, b_k, \dots\dots, b_r \dots\dots; z). $$

However, if we interchange semicolons (means amongst a_i and b_j) are not attainable as for division is not commutative.

As well as, in case $\exists\ a_r = b_m$, then

$$ {}_{p+1}F_{q+1}(a_1, \dots\dots\dots a_p, a_{p+1};\ b_1 \dots\dots\dots, b_q, b_{p+1}; z) $$

$$ \equiv {}_pF_q(a_1, \dots\dots\dots a_p;\ b_1 \dots\dots\dots, b_q; z). $$

A significant property for the convergence of the hypergeometric functions will be subject to the relative numbers p and q. The radius of convergence for the series of variable z is depending on r_c. The series will converge if $|z - d_c| < r_c$ and diverges if $|z - d_c| > r_c$, where if in case d_c is equal to 0, then it will represent the center of the disc convergence. The parameters a_j and b_j must be such that b_j's in the term of series should never be zero and a_j's are not nonnegative integers for any j.

a) For $p \leq q$, the ratio of coefficients for z^k as in expansion of ${}_pF_q$ will tend to 0 as $k \to \infty$; and the radius of convergence over their is ∞, thus the series will converge for all values of $|z|$. Hence the function ${}_pF_q$ is entire.

b) For $p = q + 1$, the ratio of coefficients for z^k will tend to 1 if $k \to \infty$, and radius of convergence will be 1, thus given series will converge when $|z| < 1$. We can say that the function ${}_2F_1$ have radius of convergence as 1.

c) For $p > q + 1$, the ratio of coefficients for z^k will tend to ∞ if $k \to \infty$, and the radius of convergence is 0, thus we will say that the series will not converge $\forall\ |z|$.

Sometimes we explore hypergeometric functions corresponding to $|z|$ enclose by radius of convergence.

In case of $p = q + 1$, the situation on convergence for the unit disc will be absolutely convergent at $|z| = 1$ if

$$Re\left(\sum_{j=1}^{q} b_j - \sum_{j=1}^{p} a_j\right) > 0 \qquad (2.4)$$

So, we will choose values for a_j and b_j accordingly.

B. The Hypergeometric Function

The Guass hypergeometric function ${}_2F_1(a, b; c; z)$ is defined as

$${}_2F_1(a, b; c; z) = \sum_{j=0}^{\infty} \frac{(a)_j (b)_j}{(c)_j} \frac{z^j}{j!}, \qquad (3.1)$$

$$= 1 + \frac{ab}{c} z + \frac{a(a+1)b(b+1)}{c(c+1)} \frac{z^2}{2} + \dots,$$

where the series having radius of convergence for z such that $|z| < 1$.

If we consider the integral over $[0, 1]$, we will get following result. The initial result is an interpretation for ${}_2F_1$ in terms of beta integral,

$$B(a, b) = \int_0^1 t^{\alpha-1} (1 - t)^{b-1}\, dt \qquad (3.2)$$

In further recognizable terms, ${}_2F_1$ the hypergeometric function is

$${}_2F_1(a, b; c; z) = \frac{1}{B(b, c-b)} \int_0^1 t^{b-1} (1-t)^{c-b-1} (1 - tz)^{-a}\, dt \qquad (3.3)$$

The above representation can be attained through expanding $(1 - tz)^{-a}$ with the help of binomial theorem and then integrating it term wise as proved in Singh(2019)

If we do the substitute of $y = tp$, then it will give us,

$$\int_0^1 y^{b-1} (p - y)^{c-b-1} (p - xy)^{-a}\, dy = p^{c-a-1} B(b, c - b)\ {}_2F_1(a, b; c; x), \qquad (3.4)$$

The special case $c = b + 1$ produces,

$$\int_0^p y^{b-1} (p - xy)^{-a}\, dy = \frac{1}{b}\, p^{b-a}\ {}_2F_1(a, b; b + 1; x), \qquad (3.5)$$

where we applied $B(b, 1) = \frac{1}{b}$

To eliminate p^{-a}, we put $x = -pr$ to obtain,

$$\int_0^p y^{b-1}\ (1 + ry)^{-a}\, dy = \frac{1}{b} p^b\, {}_2F_1(a, b; b + 1; -rp). \qquad (3.6)$$

Also,

$$\int_0^z x^a\ (1 + \alpha x)^b\, dx = \sum_{i=0}^{\infty} \binom{b}{i} \int_0^z x^a (\alpha x)^i\, dx, \qquad (3.7)$$

$$= \frac{z^{a+1}}{a+1}\ {}_2F_1(-b, a+1; a+2; -\alpha z),$$

where $Re(a + 1)\ \epsilon\ R_+$

The above equation is derived by applying binomial theorem then by integrating it term wise as explained in Singh (2020). For $b \in N\ U\ \{0\}$, the given series will be finite for $b + 1$ terms and then it can be obtained by doing successive integration,

$$\log(1 + z) = z\ {}_2F_1(1, 1; 2; -z) = (-1) \sum_{j=0}^{\infty} \frac{1}{j+1} (-z)^{j+1}. \qquad (3.8)$$

If $z = 1$, and we reorganize above equation such that negative term continues next to two consecutive positive term and then

we will obtain $\frac{3\log 2}{2}$ as for $\log 2$. We can refer to Wittaker and Watson (2005) for its explanation. Eqn (3.8) is a log function expansion in an infinite series. For $|z| < 1$, series is convergent and for $z = 1$, the series is conditionally convergent.

$$(1+z)^{a} \equiv {}_1F_0(-a;-z) \equiv {}_2F_1(-a,b;b;-z), \quad (3.9)$$

where b is arbitrary.

$(1+z)^{a}$ is infinite when $z = -1$ and $a \in R^{-}$ or $|z| \to \infty$ and $\alpha \in R^{+}$.

So, except above two, we will get finite value for our series expansion. If $1 < |z| < \infty$ we will get convergence of hypergeometric series. Special formulas for analytic continuation of Generalized Hypergeometric series are specified in Erdelyi (1953)

C. Appell Function F_1 of Matrix Arguments

The Appell function F_1 of matrix arguments will be denoted as $F_1(\alpha, \beta, \beta'; \gamma; X, Y)$ related to the equivalent case of scalar and explained as in the integral

$$F_1(\alpha,\beta,\beta';\gamma;X,Y) = \frac{\Gamma_m(\gamma)}{\Gamma_m(\alpha)\Gamma_m(\gamma-\alpha)}\int_0^1 |U|^{\alpha-(m+1)/2}|I-U|^{\gamma-(m+1)/2}|I-UX|^{-\beta}|I-UY|^{-\beta'}dU$$

for $Re(\gamma) > \frac{m-1}{2}$, $Re(\alpha) > \frac{m-1}{2}$, $Re(\gamma-\alpha) > \frac{m-1}{2}, X = X' > 0, Y = Y' > 0, \|X\| < 1$, and $\|Y\| < 1$.

Appell function F_1 for matrix arguments have integral representation which is being described in next two theorems.

Theorem 1 – For Re $(\delta) > \frac{m-1}{2}$, Re $(\beta) > \frac{m-1}{2}$, Re $(\beta') > \frac{m-1}{2}$, $X = X' > 0, Y = Y' > 0$, $\|X\| < 1$ and $\|Y\| < 1$, we have $F_1(\alpha, \beta, \beta'; \gamma; X, Y)$

$$= \frac{\Gamma_m(\delta)\Gamma_m(\delta')}{\Gamma_m(\beta)\Gamma_m(\beta')\Gamma_m(\delta-\beta)\Gamma_m(\delta'-\beta')}$$

$$\int_0^I \int_0^I |U|^{\beta-\frac{m+1}{2}}|V|^{\beta'-\frac{m+1}{2}}|I-U|^{\delta-\beta-\frac{m+1}{2}}|I-V|^{\delta'-\beta'-\frac{m+1}{2}} F_1(\alpha,\delta,\delta';\gamma;X^{\frac{1}{2}}UX^{\frac{1}{2}}, Y^{1/2}VY^{1/2}) \quad (4.1)$$

Proof: If we employ above mentioned result on the equation of theorem (4.1) and change integration order and it can be applied as it satisfies the absolute convergence of the given integrals and then we integrate by using the result.

$${}_2F_1\left(\alpha,\beta;\gamma;Z^{\frac{1}{2}}XZ^{\frac{1}{2}}\right) = \frac{\Gamma_m(\gamma)}{\Gamma_m(\alpha)\Gamma_m(\gamma-\alpha)}\int_0^I |U|^{\alpha-\frac{n+1}{2}}|I-U|^{\gamma-\alpha-\frac{m+1}{2}}\left|I-U^{\frac{1}{2}}Z^{\frac{1}{2}}XZ^{\frac{1}{2}}U^{\frac{1}{2}}\right|^{-\beta} dU \quad (4.2)$$

where Re $(\alpha) > \frac{m-1}{2}$, Re $(\gamma-\alpha) > \frac{m-1}{2}$, Re $(\gamma) > \frac{m-1}{2}$ and $\|XZ\| < 1$,

We also have

$${}_2F_1(\alpha,\beta;\beta;Z) = {}_1F_0(a;Z) = |I-Z|^{-\alpha}, \text{ for } \|Z\| < 1. \quad (4.3)$$

The result (4.1) follows subject to the following conditions:

$$\|X^{1/2}UX^{1/2}\| \le \|X\|.\|U\| \le \|X\|, \text{ since } \|U\| < 1$$

Also, $\|Y^{1/2}VY^{1/2}\| \le \|V\|.\|Y\| \le \|Y\|$, since $\|V\| < 1$.

Theorem 2 – If Re $(\beta) > \frac{m-1}{2}$, Re $(\beta') > \frac{m-1}{2}$, $\|X\| < 1, \|Y\| < 1$, then the following result holds:

$$\Gamma_m(\beta)\Gamma_m(\beta')F_1(\alpha,\beta,\beta';\gamma;X,Y) = \int_{R>0}\int_{S>0}\exp(-tr(R+S))|R|^{\beta-\frac{m+1}{2}}|S|^{\beta'-\frac{m+1}{2}}{}_1F_1\left(\alpha;\gamma;X^{\frac{1}{2}}RX^{\frac{1}{2}}+Y^{\frac{1}{2}}SY^{\frac{1}{2}}\right)dRdS \quad (4.4)$$

The above theorem can also be proved as Theorem 1..

D. Appell Function F_2 of Matrix Arguments

The Appell function F_2 of matrix arguments can be represented by $F_2(\alpha, \beta, \beta'; \gamma, \gamma'; X, Y)$ as per to the equivalent case of scalar and will be defined as

$$F_2(\alpha,\beta.\beta';\gamma,\gamma';X,Y) = \frac{\Gamma_m(\gamma)\Gamma_m(\gamma')}{\Gamma_m(\beta)\Gamma_m(\beta')\Gamma_m(\gamma-\beta)\Gamma_m(\gamma'-\beta')}\int_0^I\int_0^I |U|^{\beta-\frac{m+1}{2}}|V|^{\beta'-\frac{m+1}{2}}|I-U|^{\gamma-\beta-\frac{m+1}{2}}|I-V|^{\gamma'-\beta'-\frac{m+1}{2}}\left|I-X^{\frac{1}{2}}UX^{\frac{1}{2}}-Y^{\frac{1}{2}}VY^{\frac{1}{2}}\right|^{-\alpha} dU\,dV \quad (5.1)$$

Where $Re(\beta,\beta',\gamma-\beta,\gamma'-\beta') > \frac{m-1}{2}, X = X' > 0, Y = y' > 0, U = U', V = V', \|X\| + \|Y\| < 1$.

Here we can emphasize that in definition (5.1) we can use :

$$|I - L'UL - M'VM|^{-\alpha} \quad (5.2)$$

And L, M are matrices satisfying $L'L = X, M'M = Y$. If we consider $H = X^{\frac{1}{2}}L^{-1}, K = Y^{\frac{1}{2}}M^{-1}$then we get $H'H = 1, K'K = 1$, i.e. we have orthogonal matrix H and K. If we further consider $X^{\frac{1}{2}}UX^{\frac{1}{2}} = L'H'UHL, Y^{\frac{1}{2}}VY^{\frac{1}{2}} = M'K'VKM$ for (5.1), and transform it into $R = H'UH, S = K'VK$, then we will attain the result as in (5.2).

II. CONCLUSION

We constructed an extension of Appell's hypergeometric function. We had given integral representations to these functions and obtained some relations for these functions and extended Guass hypergeometric function. Further we had presented some transformation formulas for first and second kind of Appell's functions. Also, we had given some relation between the first kind of extended Appell's hypergeometric functions by contiguous relations of hypergeometric series.

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Grey-fuzzy logic-based technique for multi-response optimization of micro-EDM drilling of Titanium alloy

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Abstract — This Fuzzy logic-based multi-criteria decision-making techniques have been used significantly more recently in the optimization of EDM (Electric Discharge Machining) and other industrial processes. Combining fuzzy logic based optimization methods with other optimization methods can boost their usefulness. In this paper, drilling rate (DR) and tool wear rate (TWR) for micro-hole drilling on Titanium alloy using EDM have been explored experimentally. The best parametric setting for the EDM process is discovered using the grey-fuzzy integrated technique, which also optimizes the responses. Utilising response surface methodology (RSM) based central composite design (CCD), the experiments were built with current (I_p), pulse-on-time (T_{on}), and pulse-off-time (T_{off}) as input parameters and drill rate and tool wear rate as performance indicators. A fuzzy-based method paired with grey relational analysis (GRA) is used to determine the grey fuzzy reasoning grade (GFRG). The optimal setting of parameters is found to be I_p= 3 A, T_{on} =70µs, T_{off} =40µs. The analysis results illustrated that current is the most influencing parameter followed by pulse on time for multi-objective responses. Two experimental results that were obtained under initial and optimal conditions were compared using the GFRG value.

Keywords— Response surface methodology; Electrical Discharge Machining;; drilling rate; Analysis of variance; Central composite design;; Grey fuzzy reasoning grade; Grey rational analysis; Tool Wear Rate

I. INTRODUCTION

Titanium is one of the most robust materials with high strength, high corrosion resistance and good thermal stability. It is used in a wide range of industrial and commercial applications. This is employed in the creation of a wide range of components and tools for a number of industries, including the chemical, electronics, automotive, aerospace, and medical sectors [1]. Micro-technology can be the most advanced bright manufacturing hub with different fields of application like sensor technologies, medical sector, micro-machining for aircraft and automotive industry [2]. Compactness combined with other mechanical qualities like strength, stability, and long-term sustainability is currently a novel and advanced technology. Micro holes or micro-cavities have different applications in different products, such as fuel injection nozzles, drug delivery orifices, turbine blades cooling channels etc. [3]. Micro-EDM is used to produce micro-cavities and micro holes. EDM is a revolutionary machining process used to machine hardened materials such as titanium alloys where there is a little gap between tool and specimen during machining. It is a nontraditional machining technique used to cut hard materials like Ti alloys. It is a non-contact material removal process used to drill a high aspect ratio hole [4]. It is difficult to remove debris from high aspect ratio holes during micro-hole drilling. The debris accumulates at the bottom of the drill hole, affecting both the micro-holes drilling efficiency and surface quality [5-6]. By use of an electric power supply, the electrode and workpiece are connected.

Plaza et al. [7] conducted the experimental investigation into the effects of input parameters on MRR (material removal rate), electrode wear, the quality of micro-drilled holes, and machining time during the micro-EDM of Ti alloy. They also developed a new helical-shaped tool that made it less difficult to remove debris from deep holes. The effectiveness of EDM is increased and tool wear is decreased by cryogenic treatment. The results described that the tool life of the cryogenically treated HSS electrode tool increased from 91% to 816% [8]. According to Venugopal et al. [9], turning with a liquid nitrogen jet while under cryogenic conditions decreased tool wear. When copper electrode tool is used during titanium alloy EDM after cooling. This cooling improved electrical and thermal conductivity while reducing tool wear by 27% [10]. Sapkal and Pravin [11] described the Titanium alloy micro-drilling experiment that they conducted using RSM. Pulse-on, capacitance, voltage, and rotating speed all had an effect on the output responses, such as MRR, side gap width, and taper rate. Discharge voltage, capacitance, and rotating speed are the three factors that have the greatest impact on MRR. Meena and Singh [12] looked at how various input variables affected titanium alloy micro-EDM performance results. The GRA (Grey Relational Analysis) approach and ANOVA were used to find the best combination and significant input parameters. Lin et al. [13] employed fuzzy logic and the Taguchi technique to optimize a number of performance parameters in the EDM process. The statistics collected data show that two performance measures, MRR and EWR, have significantly improved. Using RSM-based fuzzy logic and GRA, Singh and Bharti [14] aimed to optimize the micro-EDM process parameters. Maximum DR and minimal TWR have been achieved using the process parametric combination of Ip = 5 A, T_{on} = 70 µs, and T_{off} = 60 µs. An ANOVA analysis reveals that pulse on time, followed by current, has the greatest influence. To enhance the EDM process parameters, Lin et al. [15] attempted to combine GRA with Taguchi-based fuzzy logic. The Electrode Wear Ratio and MRR were considered as output responses in this study, whereas discharge current, duty factor, and pulse-on duration were considered as input factors. The results demonstrate that the

performance parameters are enhanced by using the method based on orthogonal array experiments.

According to the literature, EDM drilling in titanium alloys has been the subject of in-depth research. Previous researchers attempted to drill micro-holes in titanium alloy using RSM-based methods. The grey-fuzzy integrated technique is therefore adopted in this study to maximize DR and minimize TWR during micro-drilling. A repeat experiment's experimental result and the optimized result are compared.

II. EXPERIMENTAL DETAILS

A. *Experimentation*

The studies were carried out using a quick drill electrical discharge machine (JK, ID-25). Along with x-y motion, it has a moving work table. A servo-controlled system (along the z-axis) feed the electrode vertically. The dielectric medium utilized was distilled water, and the tool employed was a tubular brass electrode with a diameter of 500 µm. Figure 1 depicts the block diagram of the drill EDM setup. Ti alloy (Grade 4) was chosen as the experimental work material, and it had the dimensions 20 x 85 mm, with a thickness of 6 mm. The output parameters were decided upon as drilling rate and tool wear rate. The ratio of drill hole thickness to drilling duration is used to calculate DR. Using a timer, the drilling time is calculated and expressed in millimeters per minute. TWR is defined as the volume of material removed from the tool per unit of drilling time. The subsequent equations Eq. (1) and (2) are used to determine these responses [16].

$$DR = \frac{D}{T} \quad \text{(mm/min)} \qquad (1)$$

Where D – work material thickness, T- drilling time

$$TWR = \frac{V_{(electrode)}}{T} \ (\text{mm}^3/\text{min}) \qquad (2)$$

Where $V_{(electrode)}$ – Volume of material removal

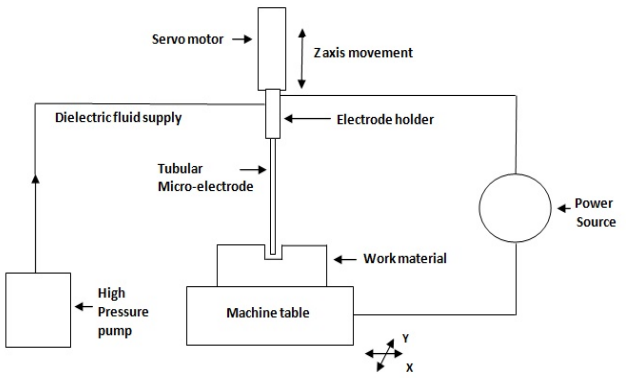

Fig.1. EDM Drill set up

Table 1. Input parameters and their level

Tool material	Brass			
Selected parameters	Unit	Levels		
		Low	Middle	High
I_p	Amp	3.0	5.0	7.0
T_{on}	µs	30.0	50.0	70.0
T_{off}	µs	40.0	60.0	80.0
Constant Parameters				
Flushing pressure	MPa	6		
Tool speed	rpm	145		

B. Design of Experiments

Experiments are carried out using the central composite design, which has three levels for each design factor. The DR and TWR are optimized by the regression model of important factors as I_p , T_{on} and T_{off}. Twenty trials were needed for the design, consisting of six factorial points, eight axial points for forming a CCD with α=1, and six centre points. Through a trial run with their values, as indicated in Table 1, the appropriate level of the chosen parameters was discovered.

Using the brass tool depicted in Table 2, the experiment has been carried out in accordance with the design matrix.

Table 2. Experimental outcomes

Exp. No.	Inputs			Output	
	I_p	T_{on}	T_{off}	TWR	DR
1	7	70	40	8.195	78.261
2	3	30	80	0.115	5.508
3	5	50	60	2.477	39.430
4	5	50	60	2.164	34.450
5	7	70	80	5.909	56.426
6	5	50	60	2.516	40.044
7	3	30	40	0.534	12.757
8	7	50	60	5.618	53.651
9	5	50	60	2.422	38.544
10	5	70	60	2.696	42.908
11	5	50	60	2.562	40.770
12	3	50	60	0.240	11.436
13	3	70	80	0.588	14.035
14	7	30	40	3.392	40.495
15	5	50	40	2.582	41.096
16	5	50	80	1.708	27.190
17	5	30	60	1.080	17.184
18	5	50	60	2.547	40.541
19	7	30	80	1.395	11.101
20	3	70	40	0.521	16.444

C. Response Surface Methology

In any problem where various variables influence desire response, RSM is the most useful mathematical and statistical method for analysis and modelling. The objective is to identify a relationship between the independent variables and the desire response and to connect the desire response with the provided variables. The mathematical model has established a relationship among independent variables $(Y_1, Y_2, Y_3, \ldots \ldots Y_n)$ and desire

responses(Y_u). An appropriate approximation relationship is found when the relationship between two variables is uncertain. If the relationship is non-linear, a second-order model is created and described in Eq. (3) as follows:

$$Y_u = \beta_\circ + \sum_{i=1}^{n} \beta_i . Y_i + \sum_{i=1}^{n} \beta_i . Y_i^2 + \sum_{i.j=1, i\neq j}^{n} \beta_{ij.} Y_i . Y_j \quad (3)$$

where (Y_u) represents the desire response like DR and TWR in the present research, Y_i represents input variables, Y_i^2 & $Y_i . Y_j$ are squares and interaction terms of these given input variables. β_0,β_i, β_{ii}, β_{ij} are the unknown regression coefficient. In order to use RSM to determine the interaction between responses (DR and TWR) and process parameters, the quadric model was devised [17]. On design expert software, the analysis is carried out. Desire responses and dependent variables are related in actual factors according to equations (4) and (5).

$$Z_U\,(DR) = -45.80118 + 12.92538.I_p + 0.421352.T_{on} + 0.449094.T_{off} + 0.233992.I_p.T_{on} - 0.142409.I_p.T_{off} + 0.005125.T_{on}.T_{off} - 0.689269.I_p^2 - 0.013137.T_{on}^2 - 0.002894.T_{off}^2 \quad (4)$$

$$Z_U\,(TWR) = -0.223391 - 1.19185.I_p + 0.008080.T_{on} + 0.065422.T_{off} + 0.027679.I_p.T_{on} - 0.012286.I_p.T_{off} + 0.000061.T_{on}.T_{off} + 0.167063.I_p^2 - 0.000932.T_{on}^2 - 0.000288.T_{off}^2 \quad (5)$$

III. RESULT AND DISCUSSION

For both responses, analysis of variance (ANOVA) was conducted at a 95% confidence level, as shown in Table 3 and Table4.

Table 3. ANOVA for TWR

Source	DOF	TWR		
		f- Value	p- Value	% Contribution
I_p	1	466.20	< 0.0001	63.29 %
T_{on}	1	119.40	< 0.0001	16.20 %
T_{off}	1	27.93	0.0004	3.79 %
I_p*T_{on}	1	90.21	< 0.0001	12.24 %
I_p*T_{off}	1	17.77	0.0018	2.42 %
T_{on}*T_{off}	1	0.0445	0.8372	0.006 %
I_p^2	1	11.30	0.0072	1.54 %
T_{on}^2	1	3.52	0.0902	0.48 %
T_{off}^2	1	0.3368	0.5745	0.045 %
		R-sq= 98.65%		
		R-sq(adj) = 97.44%		

Table 4. ANOVA for DR

Source	DOF	DR		
		f-Value	p-Value	% Contribution
I_p	1	358.36	< 0.0001	53.24 %
T_{on}	1	145.36	< 0.0001	21.60 %
T_{off}	1	53.19	< 0.0001	7.90 %
I_p*T_{on}	1	74.38	< 0.0001	11.05 %
I_p*T_{off}	1	27.55	0.0004	4.09 %
T_{on}*T_{off}	1	3.57	0.0882	0.53 %
I_p^2	1	2.22	0.1672	0.33 %
T_{on}^2	1	8.06	0.0176	1.20 %
T_{off}^2	1	0.3910	0.5458	0.06 %
		R-sq= 98.59%		
		R-sq(adj) = 97.31%		

For a better response, it establishes the importance and contribution of each parameter. This model characterises the whole data set with extraordinary probability, as indicated by the higher R^2 value. The input I_p, T_{on}, T_{off} and interaction terms I_p*T_{on}, and I_p*T_{off}, are very important and significant parameters for both responses. The quadratic terms I_p^2 and T_{on}^2 are most influencing factors for both responses. For both responses, I_p has the largest percentage contribution among others factors, followed by T_{on} .

For DR, the model variability is 0.9731, which is extremely close to the necessary value of 1. Among the control factors taken into account, current has the greatest F value (358.36), indicating the highest contribution percentage i.e 53.24%. The model variability is 0.9744 for TWR, which is extremely close to the necessary value of 1. Among the control factors taken into account, current has the greatest F value (466.20), indicating the highest contribution percentage i.e 63.29%.

IV. METHODOLOGY

Grey Relation Analysis

The grey system was created specifically to deal with complex and ambiguous interactions between input parameters and output responses. Researchers working on EDM are currently interested in multi-objective optimization techniques based on GRA. In confusing and uncertain situations, fuzzy logic analysis is helpful. The application of multi-criteria decision-making methods based on fuzzy logic to the optimization of EDM and other industrial processes has significantly increased recently. By merging fuzzy-logic based optimization approaches with other optimization techniques, their effectiveness can be increased. Figure 2 depicts the steps of the grey-fuzzy-logic approach.

Grey theory-based GRA is an effective method of decision-making based upon Grey theory.

This theory assumed two types of data i.e known quantities and unknown quantities. Data can occasionally be known in certain cases and unknown in others.

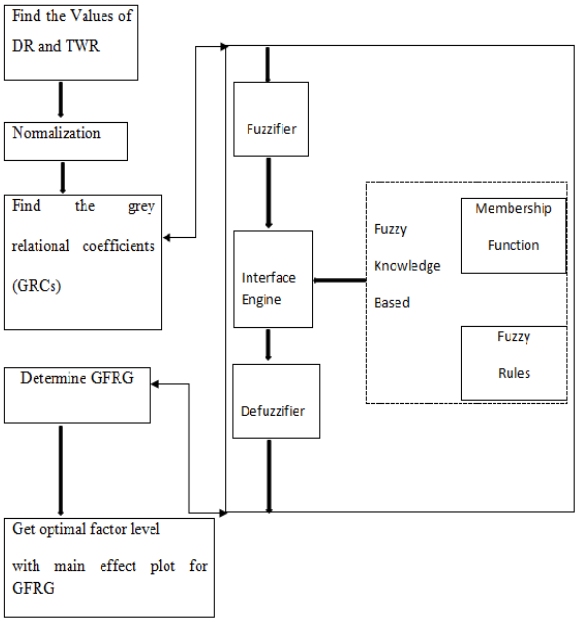

Fig. 2. Main steps for grey-fuzzy logic technique

We refer to this incomplete data as a "grey system." Two responses, such as DR for maximizing and TWR for minimization, are taken into consideration in this work. The GRC (Grey relational coefficient) values are computed using the procedures listed below [18].

(a) Initially, Convert all the data into normalizes value within the range of 0 to 1. Equation 6 describes the "higher-the-better" criterion that are utilised if the response is to be maximised.

$$X_i^*(k) = \frac{X_i(k) - minX_i(k)}{maxX_i - minX_i(k)} \quad (6)$$

The following Eq. 7 describes the "lower-the-better" criteria that are used to normalise the data if the response is to be minimised.

$$X_i^*(k) = \frac{maxX_i(k) - X_i(k)}{maxX_i - minX_i(k)} \quad (7)$$

Where $X_i^*(k)$ and $X_i(k)$ are normalizing and experimental data respectively for i^{th} experiment using k^{th} response, $minX_i(k)$ is the minimum value, $maxX_i(k)$ is the largest value.

(b) In the next steps, the value of GRC will be determined. The preceding equation, Eq.8, serves as a general representation of the GRC and can be used to determine it. It is represented by $\zeta_i(k)$.

$$\tau_i(k) = \frac{\Delta_{min} + \tau\Delta_{max}}{\Delta_i(k) + \tau\Delta_{max}} \quad (8)$$

Where $\Delta_i(k)$ is the absolute value of difference between $X_i^*(k)$ and $X_i(k)$, $\Delta_i(k) = |X_i^*(k) - X_i(k)|$, Δ_{max} and Δ_{min} are the data's global maximum and minimum values. The range of coefficients (τ) is 0 to 1. The standard interpretation is 0.5 for equal weightage [19].

Grey Fuzzy Logic

In GRA, each response is accepted based on either 'higher-the-better' or 'lower-the-better' criteria. There is some uncertainty in these results. Fuzzy logic provides an excellent analysis of this unpredictability. GRA and fuzzy logic's integrated approach can be applied to solve a multi-objective optimization problem. The fuzzy-logic method (Mamdani system) uses a fuzzifier, membership functions, a fuzzy rule base, an inference engine, and a defuzzifier. The Mamdani system uses membership functions to fuzzify the GRC values. The fuzzy value is estimated based on fuzzy reasoning through fuzzy rules. Now, this fuzzy value converts to a single equivalent Grey Fuzzy reasoning Grade (GFRG). [14].

The fuzzy rule defines 'if-then' control rules based on two desired inputs (Y_1 and Y_2) and one output (Z), that is:

Rule1: If both Y_1 and Y_2 are higher then Z is very high else

Rule2: If Y_1 is high and Y_2 is low then Z is medium else

-

-

Rule n: If both Y_1 and Y_2 are lower then Z is very low else

Figure 3 and Figure 4 display the inputs and output for a fuzzy system. In this study, five subsets (very-low (V-L), L, M, H, and very-high (VH)) are defined for the output, while three subsets (Low (L), medium (M), and High (H)) are provided for each input. DR and TWR are the inputs for fuzzy system and GFRG is the output.

A Simulink model in Matlab is used to get GFRG values as shown in figure 5. GRC values of both input (DR and TWR) convert into GFRG by fuzzy logic controller. Table 5 displays the normalized and GRC data for every experiment run.

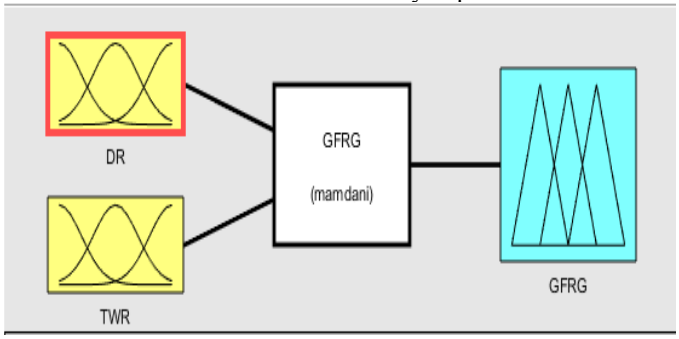

Fig. 3. Fuzzy logic system

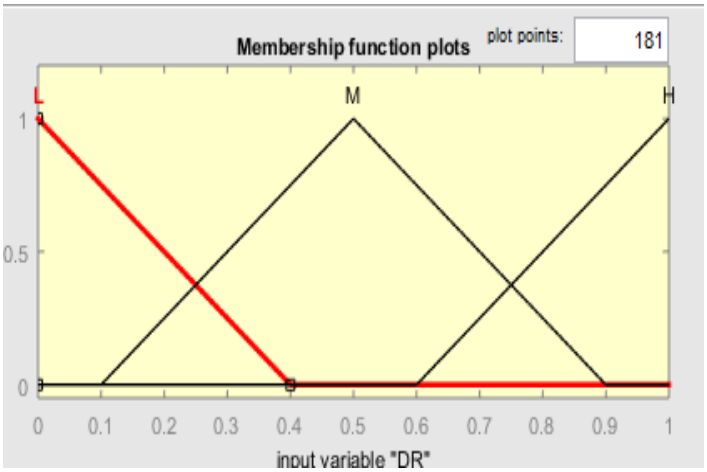

Fig. 4(a) Input subset of fuzzy system

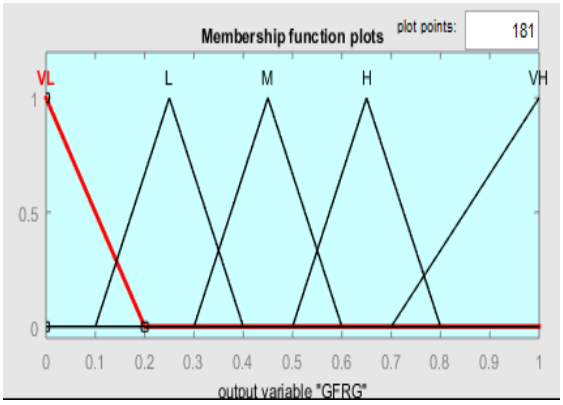

Fig. 4(b) Output subset of fuzzy system

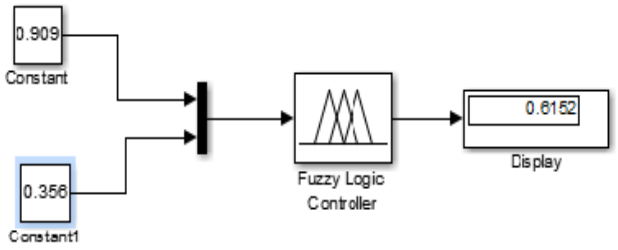

Fig. 5. Simulink model convert GRC's Values into GFRG

Table 5. GRC and GFRG values

Run Order	Normalized Value		GRC (Grey relation coefficient)		GFRG	Rank
	TWR	DR	TWR	DR		
1	0.000	1.0000	0.333	1.000	0.5995	5
2	1.000	0.0000	1.000	0.333	0.5995	6
3	0.7076	0.4663	0.631	0.484	0.4753	12
4	0.7464	0.3978	0.663	0.454	0.4978	10
5	0.2829	0.6999	0.411	0.625	0.4707	14
6	0.7028	0.4747	0.627	0.488	0.4723	13
7	0.9481	0.0996	0.906	0.357	0.6152	2
8	0.3189	0.6617	0.423	0.596	0.4500	20
9	0.7145	0.4541	0.637	0.478	0.4797	11
10	0.6806	0.5141	0.610	0.507	0.4585	18
11	0.6972	0.4847	0.623	0.492	0.4691	16
12	0.9846	0.0815	0.970	0.352	0.6123	4
13	0.9415	0.1172	0.895	0.362	0.6128	3
14	0.5944	0.4809	0.552	0.491	0.4500	19
15	0.6947	0.4892	0.621	0.495	0.4675	17
16	0.8028	0.2980	0.717	0.416	0.5311	8
17	0.8806	0.1605	0.807	0.373	0.5540	7
18	0.6990	0.4815	0.624	0.491	0.4699	15
19	0.8416	0.0769	0.759	0.351	0.5107	9
20	0.9497	0.0964	0.909	0.356	0.6159	1

The nine fuzzy rules are defined. A stronger correlation between the sequence and the reference sequence can be seen in the higher value of GFRG. The 20th experiment had the highest GFRG.

Based on Table 5, the optimal parametric setting is determined for experiment run number 20. i.e I_p at level one (3 A), T_{on} at level three (70 µs) and T_{off} at level one (40 µs). Table 5 displays the average GFRG value for each parameter at each level. The table also displays the difference between the maximum value and the minimum value. I_p is the most influencing factor followed by T_{on}. Figure 6 displays the plot of GFRG and Rank.

Table 5. Mean value of GFRG for each level of input

Parameter	I_p	T_{on}	T_{off}
Low Level	0.6111	0.54588	0.5496
Medium Level	0.48752	0.4925	0.4938
High Level	0.49618	0.55148	0.5449
Diff. (max.-min)	0.12358	0.05898	0.0558
Rank	1st	2nd	3rd

The outcomes of tests carried out to validate the optimum machining parameters offered by the fuzzy logic and integrated GRA approach are displayed in Table 6. The optimum outcome acquired through the use of integrated methodologies is contrasted with the results of another experiment.

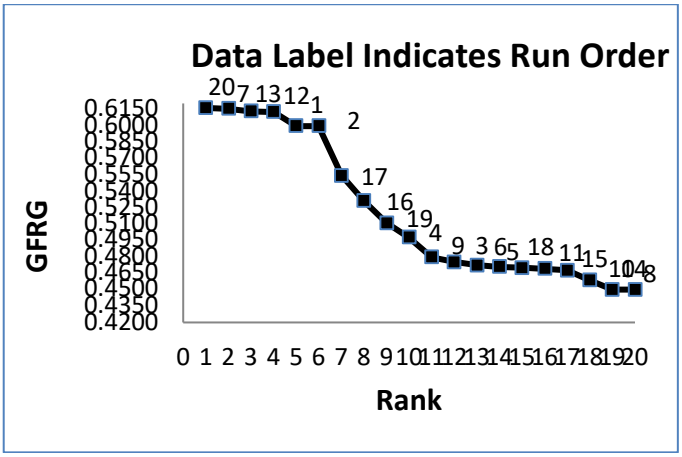

Fig. 6. GFRG Vs Rank

Table 6. Confirmatory outcomes

Input		Output measures	
		DR	TWR
Initial	I_p= 3 A, T_{on}=70 µs, T_{off}= 80 µs	14.035	0.588
Optimum	I_p= 3 A, T_{on}=70 µs, T_{off}= 40 µs	16.444	0.521
Improvement		increase of 17.64 %	decrease of 11.39 %

BASED ON THE OPTIMIZED PARAMETERS COMPARED TO THE INTIAL EDM PARAMETERS, THE FINDINGS SHOW THAT DR INCREASED FROM 14.035 TO 16.444 AND TWR DROPPED FROM 0.588 TO 0.521.

V. CONCLUSION

The application of grey relational analysis along with fuzzy logic is used in the current work to simultaneously optimize multi

responses for EDM micro-hole drilling on Titanium alloy. The optimal process parametric combination of I_p = 3 A, T_{on} = 70 µs, T_{off} = 40 µs has been found using GRA-fuzzy approach for optimum DR and TWR. Experimental results (experiment no.13) has been compared with optimum results (experiment no.20) obtained based upon GFRG value. The results show that for the optimized settings over the initial parameters of the micro-EDM, DR increases from 14.035 to 16.444 and TWR decreases from 0.588 to 0.521.

However, the following topics need to be the focus of future research:

(a) To examine the effects on machining parameters during micro-EDM of Titanium alloy, it is possible to use mixed abrasives of different powders, such as copper, aluminum, graphite, and silicon.
(b) Numerous super alloys whose micro-EDM research results have not yet been published in the literature may be considered for further investigation.
(c) It may be possible to hybridize the micro-EDM procedure for future research by simultaneously using vibration and magnetic field help when micro-drilling titanium alloys.
(d) Some other input parameters of micro-EDM such as types of dielectric fluid (EDM oil or kerosene), flow rate, electrode rotational speeds and flushing pressure of the dielectric can be considered to see their effects on performance measures.

VI. ACKNOWLEDGMENT

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SPEECH Emotion Recognition Using Convolution Neural Network

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***Abstract*—Speech emotion recognition is a rapidly growing area of research in the field of artificial intelligence and natural language processing. It involves developing algorithms and systems that can automatically recognize and classify the emotions conveyed through speech. This can be useful in various applications, such as improving customer service by detecting and responding to callers' emotions, or helping to identify individuals who are experiencing emotional distress and may need additional support.**

***There are several approaches to speech emotion recognition, including using machine learning algorithms, the analysis of acoustic features of speech such as pitch and intensity, and using lexical and syntactic features of the language. Researchers have also explored multimodal approaches incorporating information from facial expressions and other nonverbal cues.**

Despite these challenges, the potential applications of speech emotion recognition are vast, and researchers and practitioners are actively working to advance the state of the art in this exciting and rapidly evolving field. Some potential applications of speech emotion recognition include improving customer service, detecting emotional distress in individuals, and developing more natural and engaging virtual assistants. As the field continues to grow and mature, we can expect to see even more innovative and impactful applications of this technology in the future

***Keywords*— Speech Emotion Recognition, Machine Learning, CNN**

I. INTRODUCTION

Speech emotion recognition is a field of study that involves developing algorithms and systems that can automatically recognize and classify the emotions conveyed through speech. This can be useful in various applications, such as improving customer service by detecting and responding to callers' emotions, or helping to identify individuals who are experiencing emotional distress and may need additional support.

There are several approaches to speech emotion recognition, including using machine learning algorithms, the analysis of acoustic features of speech such as pitch and intensity, and using lexical and syntactic features of the language. Researchers have also explored multimodal approaches incorporating information from facial expressions and other nonverbal cues.

While significant progress has been made in the field, there are still many challenges to be addressed in the development of robust and reliable speech-emotion recognition systems One challenge is the need to better understand and model the complex and nuanced ways in which emotions are expressed through speech. Emotions are often conveyed indirectly, through a combination of verbal and nonverbal cues, and can be influenced by factors such as the speaker's cultural background and the social context in which the speech is taking place. Additionally, there is a need to improve the generalization of models to diverse languages and cultures, as emotions can be expressed differently across cultures and languages.

II. LITERATURE REVIEW

Speech emotion recognition is important because it has the potential to improve the quality and effectiveness of human-computer and human-human interactions and to enable a wide range of applications in areas such as education, health, entertainment, and communication.

Some specific reasons why speech emotion recognition is important to include:

- It can enhance the usability and user experience of human-computer interfaces by adapting the system's behaviour and response to the user's emotional state.
- It can improve the performance and reliability of automatic speech recognition systems by taking into account the emotional context and cues of the speech.
- It can enable the development of intelligent tutoring systems that can adapt to the emotional and learning needs of the students.
- It can assist in diagnosing and treating mental health and communication disorders by providing objective and continuous measures of the emotional state of the patients.
- It can enable the creation of more natural and engaging virtual assistants and social robots by enabling them to recognize and respond appropriately to the emotional state of the users.

Overall, speech emotion recognition is an important research area that has the potential to impact a wide range of applications and to improve the quality and effectiveness of human-computer and human-human interactions.

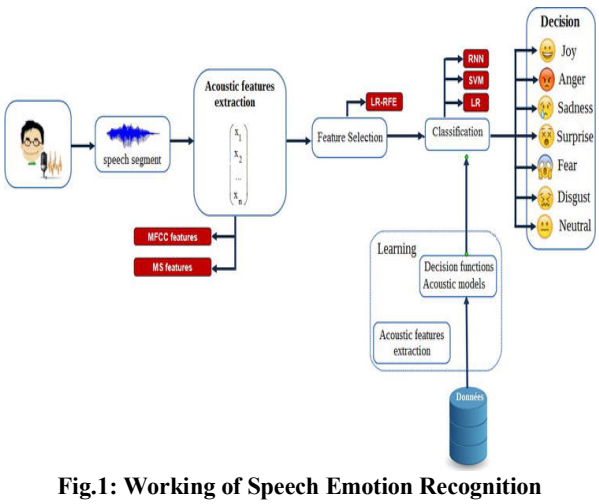

Fig.1: Working of Speech Emotion Recognition

A. Key Features And Capabilities

Some key features and capabilities of speech emotion recognition systems include:

- The ability to detect and classify emotional states from speech signals
- The ability to handle multiple languages and accents
- The ability to operate in different acoustic and environmental conditions
- The ability to deal with variations in the duration and content of the speech
- The ability to handle different types and intensities of emotions
- The ability to integrate multimodal information, such as facial expressions and body gestures
- The ability to operate in real-time or near real-time
- The ability to adapt to the specific needs and preferences of the users and the application

In order to achieve these capabilities, speech-emotion recognition systems rely on a variety of techniques and technologies, including machine learning, deep learning, signal processing, and natural language processing. They also require large and diverse datasets of annotated speech, careful design and optimization of the feature representation and modelling, and attention to the context and task-specific requirements of the application.

Overall, speech emotion recognition is a challenging and active research area, with the potential to impact a wide range of applications and to improve the quality and effectiveness of human-computer and human-human interactions.

B. Potential Limitations And Insights Gained

There are several challenges and limitations in the field of speech emotion recognition, including:

- Lack of large and diverse datasets: There is a need for large and diverse datasets of annotated speech that capture the variability and complexity of emotional states and their expression in speech.
- Limited generalization ability: Speech emotion recognition systems often struggle to generalize to new languages, accents, and domains, and they can be sensitive to variations in the duration and content of the speech.
- Sensitivity to noise and environmental factors: Speech emotion recognition systems can be sensitive to noise and environmental factors such as reverberation, background music, and speaker distance, which can degrade the quality of the speech and the accuracy of the recognition.
- Lack of robust and reliable features: There is a need for robust and reliable features that can capture the key acoustic and prosodic characteristics of emotional speech, and that is robust to variations and noise.
- Limited interpretability and explainability: Many speech emotion recognition systems are black-box models that are difficult to interpret and explain, which can limit their trustworthiness and acceptance by users and stakeholders.

Speech Emotion Recognition using convolutional neural networks (CNNs) can yield several insights:

- CNNs can identify patterns in speech signals to classify different emotions (such as happiness, sadness, anger, etc.).
- It can automatically learn relevant features from raw audio data which might include spectral characteristics, pitch variations, and prosodic cues, enabling the network to discern emotional nuances.
- Analyzing how CNNs recognize emotions in speech could offer insights into the dynamics of different emotions. It might reveal patterns or cues that signify emotional states and how they manifest in speech.

Speech emotion recognition using CNN is a cumbersome and active research area, and there is still much work to be done to overcome these challenges and limitations. However, advances in machine learning, deep learning, signal processing, and natural language processing are helping to improve the performance and reliability of speech-emotion recognition systems and to enable a wide range of applications and scenarios.

C. Proposed System

Convolutional neural networks (CNNs) have been widely used for speech emotion recognition, due to their ability to learn discriminative features from raw audio data and their good generalization ability. A typical CNN-based system for speech emotion recognition consists of the following steps:

- Data preparation: This involves collecting and preparing a dataset of annotated speech samples that represent the emotional states of interest. The dataset should be large and diverse, and it should be balanced and representative of the target population and application.
- Feature extraction: This involves extracting a set of relevant features from the raw audio data that capture the acoustic and prosodic characteristics of emotional speech. Common features include pitch, energy, spectral properties, prosodic features, and linguistic features.
- Data preprocessing and normalization: This involves preparing the data for training and evaluation by preprocessing and normalizing the features. This can involve techniques such as scaling, centering, and dimensionality reduction.
- Model training and evaluation: This involves training a CNN model on the prepared data, using techniques such as stochastic gradient descent and backpropagation. The model can be evaluated using metrics such as accuracy, precision, recall, and f1 score.
- Model deployment and application: This involves deploying the trained model in an application or system, and using it to make predictions or decisions based on the input speech.

Overall, CNNs have proven to be effective for speech emotion recognition, and they have been used in a wide range of applications and scenarios. However, the performance of a CNN-based system for speech emotion recognition depends on the quality and diversity of the data, the design, and optimization of the feature representation and modeling, and the context and task-specific requirements of the application.

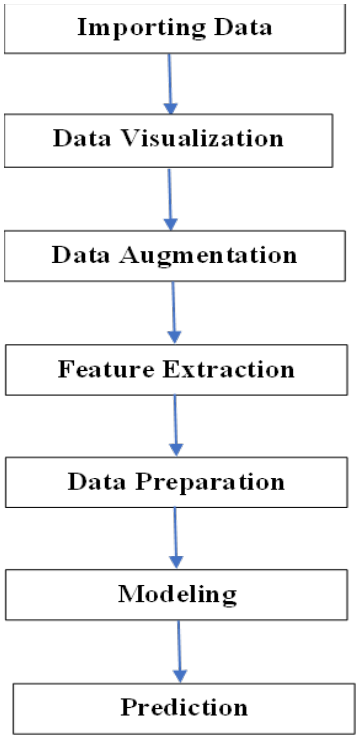

Fig 2: Flow Chart Representation of Dat Flow

D. Dataset And Preprocessing

Four datasets were created in the English language, namely the Toronto Emotional Speech Set (TESS), the Surrey Audio-Visual Expressed Emotion (SAVEE), CREMA, and RAVDESS Emotional Speech Audio contain more diverse and realistic audio. The descriptions of the datasets are as follows:

- TORONTO EMOTIONAL SPEECH SET (TESS) is a Canadian English dataset that consists of 2800 utterances. The speakers are two female actresses from Toronto Canada. The dataset is recorded at North Western University for an auditory test. Each recording consists of portraying seven emotions of happiness, sad, anger, disgust, pleasant, fear, and neutral.
  SIZE: 281.33 MB
  LINK: https://www.kaggle.com/datasets/ejlok1/toronto-emotional-speech-set-tess

- SURREY AUDIO-VISUAL EXPRESSED EMOTION (SAVEE) dataset provides audio utterances of British speakers. The speakers were four British male actors who spoke sentences showing six emotions: anger, sadness, disgust, happiness, surprise, and fear.
  SIZE: 162.57 MB
  LINK: https://www.kaggle.com/datasets/ejlok1/surrey-audiovisual-expressed-emotion-savee

- RYERSON AUDIO-VISUAL DATABASE of EMOTIONAL SPEECH AND SONG (RAVDESS) is an approved multi-modular database of emotional speech and song. There are 24 professional actors each uttering 104 unique intonations with emotions: happy, sad, angry, fear, surprise, disgust, calm, and neutral. The RAVDESS dataset is exceptionally rich in nature given that it doesn't experience gender bias, comprises a wide range of emotions, and at various levels of emotional intensity.
  SIZE: 590.35 MB
  LINK:
  https://www.kaggle.com/datasets/uwrfkaggler/ravdess-emotional-speech-audio

- CROWED SOURCED EMOTIONAL MULTIMODAL ACTORS DATASET (CREMA-D) is dataset consists of facial and vocal emotional expressions in sentences spoken in a range of basic emotional states (happy, sad, anger, fear, disgust, and neutral). 7,442 clips of 91 actors with diverse ethnic backgrounds were rated by multiple raters in three modalities: audio, visual, and audio-visual. Categorical emotion labels and real-value intensity values for the perceived emotion were collected using crowd-sourcing from 2,443 raters.
  SIZE: 605.9 MB
  LINK: https://www.kaggle.com/datasets/ejlok1/cremad

Data must be cleaned to perform any meaningful analysis. The dataset thus collected was inspected for its quality. Some of the data quality issues addressed for this experimentation include:

- Missing Value Analysis: Due to several influencing factors, a few or more data rows can contain no values for specific features. These values are termed 'missing' from the dataset. A large number of missing values can provide insights into the data. For example, if a particular feature has most of its values missing for all data rows, then it can be inferred that the feature is likely uncommon and can be removed from the dataset.

- Outlier Identification: Outlier values are also considered as data modifiers because often the prediction algorithm used will be misled by the outlier values. Outliers also alter the statistics of the overall data such as mean, variance, and standard deviation.

- Null Value Handling: A common error that can occur in a dataset is the null value error. It is when the words 'null' or 'NA' is used in place of missing values as fillers. Null values are mostly treated and handled in a fashion similar to missing values.

- Invalid Data: A dataset can have values irrelevant to the data type, such as symbols and special characters. These values, despite being meaningless, can cause errors during processing. Depending on the amount of invalid data present, it can either be removed or imputed.

- Duplicate Data: A few features might be a duplicate of each other, with different names or units of measurement. Such features increase the dimensionality of the data with no further significance. Removal of duplicate features is highly recommended.

III. RESULTS

Below are the predicted values of all 4 models:

	Predicted Labels	Actual Labels
0	calm	fear
1	calm	neutral
2	calm	sad
3	calm	neutral
4	calm	fear
5	calm	angry
6	calm	fear
7	calm	fear
8	calm	disgust
9	calm	calm

Fig 3. Prediction chart of RAVDESS dataset

	Predicted Labels	Actual Labels
0	fear	angry
1	fear	neutral
2	fear	angry
3	fear	angry
4	fear	happy
5	fear	disgust
6	fear	neutral
7	fear	sad
8	fear	angry
9	fear	fear

Fig 4. Prediction chart of CREMA dataset

	Predicted Labels	Actual Labels
0	angry	neutral
1	angry	angry
2	angry	neutral
3	angry	disgust
4	angry	angry
5	angry	surprise
6	angry	surprise
7	angry	sad
8	angry	neutral
9	angry	surprise

Fig 5. Prediction chart of TESS dataset

	Predicted Labels	Actual Labels
0	neutral	disgust
1	neutral	neutral
2	fear	fear
3	happy	angry
4	happy	fear
5	neutral	disgust
6	angry	angry
7	disgust	disgust
8	happy	disgust
9	neutral	neutral

Fig 6. Prediction chart of Combined dataset

Table 1. Comparison table of all models

Model Name	Accuracy
RAVDESS	12%
CREMA	17%
TESS	13%
ALL COMBINED	63%

IV. CONCLUSION

In conclusion, in the field of machine learning or deep learning datasets plays a vital role for the accuracy of the model. A large size of the dataset can exponentially increase the accuracy of the model. Prediction of the machine learning model depends on the size of the dataset we have provided to train the model. Various ways can be used for increasing the dataset such as, collection of data, data augmentation, etc, in the combination with feature extraction. In this research, dataset in increased 3 times just after data augmentation and feature extraction.

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Optimization Of Flux For High Impact Strength And Low Heat Affected Zone Width In Saw

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***Abstract*—The fuzzy logic optimization technique has been used for selection of optimal flux for making low carbon steel welds of high quality. For desiging of fluxes response surface methodology was used and binary, ternary phase diagrams of steels were used..The HAZ width is very important in SAW as it affects the weld metal properties.The important weld mechanical properties are ultimate tensile strength and impact strength. The flux composition is very important in deciding the weld metal properties so an effort was applied to make optimized fluxes for good impact strength. and low weld HAZ.The optimal flux contains CaF_2 5%, FeMn 2% and NiO 5% The results obtained in this experimental study have been verified by doing confirmatory tests..**

Keywords— Optimization; Submerged arc welding; Fluxes; UTS; Impact strength; HAZ

I. INTRODUCTION

The invention of Submerged arc welding was done in USA. And it is a very old joining process.. Now this welding may be fully automatic and semiautomatic. With the development of this welding consumables this can attain a high speed welding process and high quality joints can be made. In SAW, the electrode is consumable and and it is fed through a nozzle [1]. A high welding current is used in SAW and the arc is created between the electrode and work piece. A very large amount of heat is generated in SAW and it melts the electrode, workspace and flux layer which is in contact. The arc produced melts the fluxand it forms a layer to protect the weld pool. The un melted flux also works as a protection from the atmosphere. The current used in shielded metal is low in comparison to SAW. The larger hat produced gives high weld deposition rate and thick plates can be welded easily. The quality of the joint may also be very high [2, 3]. The major applications of SAW are SAW are ship building, pressure vessels manufacturing , thick pipes, gas pipe lines and structural parts.. The submerged arc welding process is widely used for making heavy steel products [.4.]

The electrodes in SAW are in the form of bare electrode and no coating is done. The only coating on the electrode is done of copper to increase the conductivity of the electrode.. This welding is widely used because of availability of various combination of wires and fluxes in market.

Fluxes are responsible in affecting the arc properties and joint strength of the weld. [5]. The study to correlate the basicity index of the flux and parameters of welding parameters was performed by Pandey et.al 2010 [6]. They concluded that flux BI has an important role in deciding the elements transfer. The elements transfer is very important in this welding as it decides the properties of the welds. The transfer of elements to the weld may depend upon the composition of flux and slag. The transfer of elements can be vice versa. This transfer depends upon the flux composition and other welding consumables [7-10].In SAW the interaction of flux is very difficult to know and the temperature is also very high so the equilibrium conditions cannot be assumed to predict the weld metal transfer. Very little scientific work has been reported in this regard as it need hard work and it is very time consuming. More work can be done in this regard using scientific methodology and by proper design and manufacturing of fluxes. A large data base may be developed by doing more and more experimental work. This data base can be used for predicting the weld metal properties and elements transfer in SAW. The major challenge in structural applications for an engineer is to increase the impact strength while maintaining the HAZ width as low as possible. So in this work attempt has been made to optimize the flux for these two parameters. RSM design has been used so that scientific study can be done to develop the fluxes and its impact on mechanical properties of the welds.

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A. OBJECTIVE

The objectives of the study was to select an optimal flux for good impact strength and low HAZ in the weld.

B. MATERIAL AND METHODS

The material used was low carbon steel as it has variety of applications. The optimization was done by using fuzzy logic optimization technique. The fluxes in SAW are usually made by hit and trial experimentation. However this process becomes un scientific and more time consuming and costly. It is also very difficult to develop the new materials by this conventional method of developing the fluxes [5,6]. It is impossible t to explore all the possible combinations and optimal fluxes by conventional methods so a scientific method (DOE) has been used for experimentation.

Kumar et al. 2015 [11] in their research decided the optimal levels of NiO, MnO and MgO.They suggested the model based on fuzzy logic and found a single multi response performance index for impact strength and hardness based for SiO_2 fluxes. Roy et al.(2013 [12] in their research suggested grey based genetic algorithm for strength and hardness of the welds. The optimization was done for feed rate, stick out and travel speed. The desirability approach was used by Jindal etal.2013 [13] for optimization of UTS, Impact strength and hardness for HSLA steel. Adeyeye and Oyawale 2009[14] used the data obtained by Kanjilal in his experiments. They developed the mathematical programming optimization technique integrated with the xverted design used by Kanjilal.

Datta et.al 2008 [15] used the GRA approach in combination with the Taguchi method to obtain the slag –fresh flux mixture

ratio without compromising the features of weld bead geometry and HAZ width.

Experimental Procedure

The experimental procedure is as follows

1 Central composite design was adopted for designing and making of fluxes. Table no 1 depicts the designed matrix.

2 Flux constituents were mixed in the right proportion .

3 Agglomeration method was used for making the fluxes. The base components have been given in Table no 2

4 For doing the study beads on plates were made on thick mild steel plates of the given composition. The welding parameters were made constant and are given in Table no3.

5: Beads on plate were made one over the other to reduce the dilution.

6: The measured responses are given in Table 4 the machine used has been shown in figure 1. L,M,H represents low , medium and high values of input factors.

Table 1. Design matrix in coded form.

No. of Experiment	CaF_2 wt % A	FeMn wt% B	NiO wt % C
1	H	L	L
2	M	H	M
3	H	L	H
4	L	L	L
5	M	M	M
6	M	M	M
7	H	H	H
8	M	M	M
9	M	L	M
10	H	M	M
11	M	M	H
12	L	L	H
13	M	M	M
14	M	M	M
15	H	H	L
16	L	M	M
17	M	M	0
18	M	M	M
19	L	H	H
20	-1	+1	-1

Table2. Base constituents and additives of the flux

Flux	CaF_2 Gm	FeMn gm	NiO gm	CaO gm	SiO_2 gm	Al_2O_3 gm
1	120	30	30	486	695	139
2	75	120	75	453	647	130
3	120	30	120	453	647	130
4	30	30	30	519	742	148
5	75	75	75	470	671	134
6	75	75	75	470	671	134
7	120	120	120	420	600	120
8	75	75	75	470	671	134
9	75	30	75	486	695	139
10	120	75	75	453	647	130
11	75	75	120	453	647	130
12	30	30	120	486	695	139

Table 3. Welding Parameters

S. No.	Voltage (V)	Current (A)	Travel speed Cm/min.
1	30	475	20

Table 4. measured responses

Flux	Impact strength Joule	HAZ Width Mm
1	58	270
2	55	318
3	64	320.2
4	20	189.8
5	12	300
6	14	320
7	56	190.7
8	23	284.7
9	60	280.1
10	46	292.6
11	12	240
12	14	175.7
13	14	330.9
14	40	326.5
15	56	351
16	36	152.3
17	14	319.5
18	12	351
19	58	128.8
20	60	319.5

Fuzzy Methodology with GRA

In grey relational analysis the concept of higher the better or lower the better is considered but in this analysis the chances of error are there however the chances of error are minimized with the application of fuzzy logic optimization along with the application of GRA,. Fuzzy methodology can be applied for multiobjective optimization of parameter In a fuzzy logic sustem a membership function based on certain rules is applied to an engibe. The membership functions based on fuzzy logic and rules generates a fuzzy value and that value is converted in to multi Characterization performance index (MCPI) by a defuzzifier.. This structure of the two-input-one-output fuzzy logic unit is depicted in Fig. 2.The input are, Impact strength

and HAZ width and output is (MCPI).The fuzzy inference system has been given in figure2.

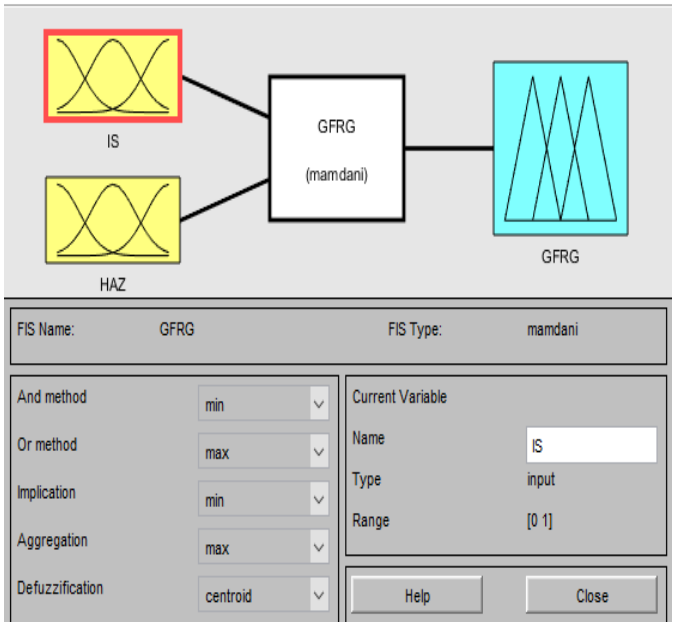

Fig.2. Fuzzy inference system

II. RESULT

The used fuzzy model consists of two inputs and one output which fuzzifies the input data using three triangular membership functions. These triangular membership have been used for the two inputs and one output. This has been depicted in figures 3(a), 3(b), 3(c) and 3(d) respectively. Using fuzzy logic rules in the Mumdani inference, multi characteristic performance index for each experiment value has been calculated using centroid method of defuzzification as shown in Table 5 (a) and (b).The observed results of output characterstics found in the form of MCPI shows that the vlue of this characteristic is maximum for experiment no3.So we can infer from this that the input parameters for flux no3 can give the optimized results. The results were also verified by doing the experiments and the results were found in the reasonable range. So the experiment no 3 can be suggested for high impact strength and low width HAZ.. The fuzzy base rules are given as follows.

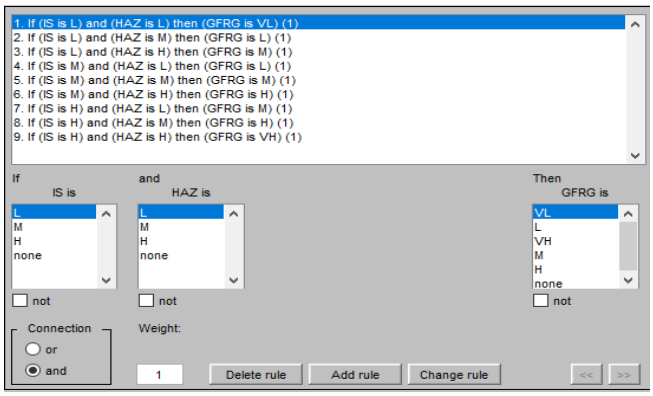

Fig. 3(a) Rule base for fuzzy system

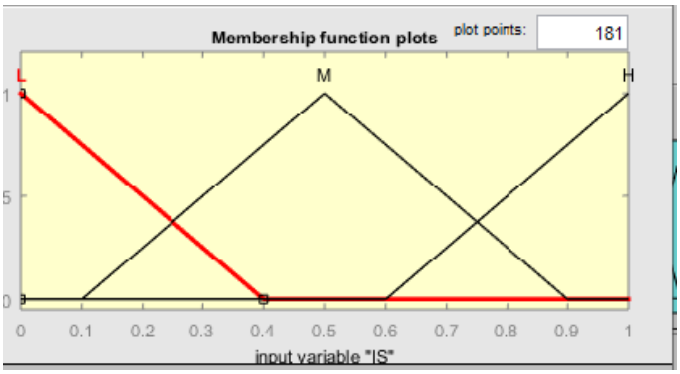

Fig. 3(b) Membership function for IS

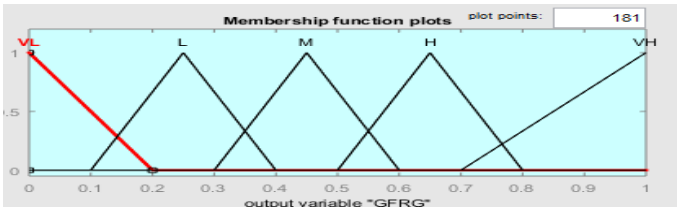

Fig. 3(c) Membership function for Output

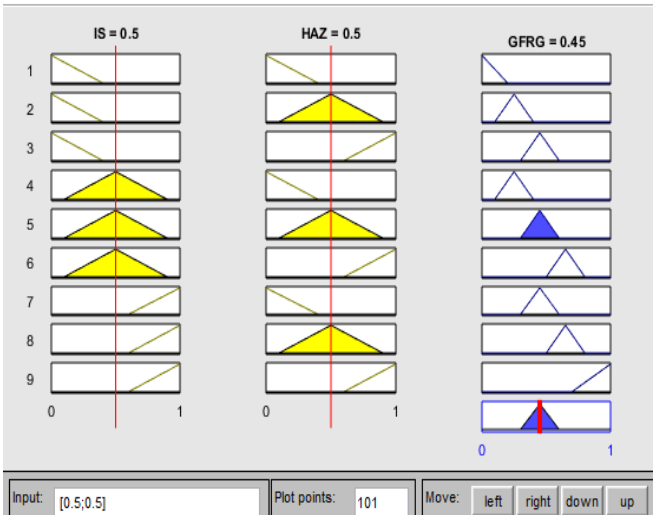

Fig. 3(d) Rule viewer GFRG

Table 5. Rank (a)

	HAZ (mm)				
Run Order	HAZ (mm)	Normalized value HAZ	Deviation	GRC (Grey relation coefficient)	Rank
1	3.45	0.5437	0.4563	0.5229	6
2	3.16	0.6047	0.3953	0.5585	9
3	4.38	0.3482	0.6518	0.4341	2
4	2.63	0.7161	0.2839	0.6379	17
5	2.19	0.8087	0.1913	0.7232	15
6	1.91	0.8675	0.1325	0.7906	13
7	2.35	0.7750	0.2250	0.6897	3

8	1.77	0.8970	0.1030	0.8291	7
9	2.17	0.8129	0.1871	0.7277	1
10	3.56	0.5206	0.4794	0.5105	18
11	1.28	1.0000	0.0000	1.0000	5
12	3.8	0.4701	0.5299	0.4855	20
13	1.75	0.9012	0.0988	0.8350	11
14	2.23	0.8003	0.1997	0.7145	12
15	5.1	0.1968	0.8032	0.3837	10
16	3.68	0.4954	0.5046	0.4977	19
17	2.25	0.7960	0.2040	0.7103	16
18	2.02	0.8444	0.1556	0.7627	14
19	2.64	0.7140	0.2860	0.6362	4
20	6.036	0.0000	1.0000	0.3333	8

Table 5. Rank (b)

		Impact Strength (Joule)				
Run Order	IS (J)	Normalized value IS	Deviation	GRC (Grey relation coefficient)	GFRG	Rank
1	58	0.8846	0.1154	0.8125	0.5865	6
2	55	0.8269	0.1731	0.7429	0.5459	9
3	64	1.0000	0.0000	1.0000	0.6500	2
4	20	0.1538	0.8462	0.3714	0.4566	17
5	12	0.0000	1.0000	0.3333	0.4808	15
6	14	0.0385	0.9615	0.3421	0.5188	13
7	56	0.8462	0.1538	0.7647	0.6359	3
8	23	0.2115	0.7885	0.3881	0.5827	7
9	60	0.9231	0.0769	0.8667	0.7202	1
10	46	0.6538	0.3462	0.5909	0.4500	18
11	12	0.0000	1.0000	0.3333	0.5997	5
12	14	0.0385	0.9615	0.3421	0.4056	20
13	14	0.0385	0.9615	0.3421	0.5401	11
14	40	0.5385	0.4615	0.5200	0.5297	12
15	56	0.8462	0.1538	0.7647	0.5417	10
16	36	0.4615	0.5385	0.4815	0.4500	19
17	14	0.0385	0.9615	0.3421	0.4797	16
18	12	0.0000	1.0000	0.3333	0.4995	14
19	58	0.8846	0.1154	0.8125	0.6199	4
20	60	0.9231	0.0769	0.8667	0.5621	8

III. CONCLUSIONS

1 Response surface methodoly has been adopted for design of welding fluxes and the manufacturing of fluxes was done by agglomeration method.

2 As we have to optimize the two output parameters and we desire high impact strength and low width of HAZ in the weld joints so, multi objective optimization has to be adopted .

3 This experimental analysis shows that the optimized flux constituents for high impact strength and low weld HAZ contains 5% calcium fluoride,, 2% ferro manganese , and 5% nickel oxide.

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Yolo Based Object Detection Techniques For Garbage Prediction

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Abstract*—In India, inappropriate waste management has long been a concern. Indian citizens don't know enough about properly sorting their waste into different categories. Along with grave waste management, this has led to serious environmental pollution, hazardous worker conditions at landfills, and deadly accidents. A key area of focus for computer vision system advancement has been accurate and efficient object detection. Using the aid of a cutting-edge object identification model, this study proposes an online web-app that can precisely determine the color of the dustbin in which an object should be thrown as well as whether it belongs in the dry or wet waste category. The chosen model is the result of a thorough investigation into existing object detection models that meet the requirements of this application, which aims to detect garbage objects in real time with a high degree of precision and minimal inference time. The study indicates that the YOLO class of object detection models is the most appropriate choice for this particular project. For this task, the three architectures of this class—YOLO V3, V4, and V5—have been selected. A rich dataset consisting of expected garbage objects is prepared. This dataset is designed to go through multiple preprocessing and augmentation stages before being used for training. This is done to shorten training times, create multiple versions of the dataset, and increase model performance. Using transfer learning, each of these dataset versions is utilized to train a model. The optimal combination of the dataset version and the object detection model is chosen, optimized, and implemented in a user-friendly, visually appealing web application that is made publicly available on the internet based on a number of performance metrics. This initiative will enhance waste management, make waste segregation incredibly simple, and stop accidents and potentially fatal illnesses from occurring at landfills and garbage dumps.

Keywords- Waste management, trash bin, object detection

I. INTRODUCTION

In India, the issue of trash has recently gained prominence. Up to 9,500tonnes of trash are produced daily in New Delhi, filling the three primary landfills, each of which can only hold waste for ten years. Delhi's Ghazipur landfill has reached its full capacity, 20-meter height in 2002, and it ought to have been closed by now. But it is still operating and has reached a height of 65 meters. In September 2017, two people were killed after the landfill collapsed. All of this is the consequence of dumping all kinds of wastes at landfill sites without segregating them. Trash dumps not only cause air, water and soil pollution, but also lead to severe health problems. People living close to landfill sites suffer from medical conditions such as asthma, cuts, diarrhea, tuberculosis, cholera and malaria. At local trash stations and landfill sites, solid wastes are still segregated manually by humans, making their ailing lives even more miserable. These awful news pieces come as a shock to everyone. Authorities have raised public awareness about the growing plastic pollution and waste management problems in India. Indian citizens need to start changing their behavior. The 3Rs – Reuse, Reduce and Recycle must be employed in daily activities. The Ministry of Environment and Forests has given guidelines to classify the municipal solid waste into three categories according to the way wastes are treated and processed. These three waste types are dry, wet and hazardous waste. In a three-bin system, waste bins come in three different colors. Green bins are for wet compostable wastes which are converted into manure and biogas. They may include fruit and vegetable peels and left-over food. Blue bins are for general dry wastes. Blue waste is not biodegradable but it might be recyclable and may contain paper, plastic, glass, metal, ceramic, textile and other non-recyclable waste objects. Black bins are for hazardous wastes such as batteries, e-waste, medicines and gadgets which can't be dumped in landfill sites as they might cause chemical reactions and lead to soil, air and water pollution. For household waste, there is a two-bin system in which the wastes are classified as either dry or wet waste. Wet waste includes all the organic waste, while dry waste consists of all the remaining litter, whether general or hazardous Segregation of waste is a crucial phase in the waste management process. When waste is thrown in the wrong bin, it might lead to other wastes at the wrong place.

For example, compostable wastes in a green waste bin may be transported to landfills if there are many non-recyclable wastes in the same bin. Hence, it is best to segregate the solid waste at the place where it is generated. It is often seen that at public places there are different trash bins available, but due to lack of awareness among citizens, each dustbin ends up with mixed waste. We believe that computer vision and machine learning can make waste segregation easier and more effective. This will undoubtedly aid in the reduction of pollution and make waste management and treatment easier at landfill sites. It has the potential to eradicate manual waste segregation by humans and also the health complications associated with it. In this study, we have proposed an online web-based system which can detect solid waste objects in real time using the device's webcam or camera, and decide the type of dustbin color code – blue, green or black in which the solid waste should be thrown at public places. It will also predict if it is dry or wet waste, which is useful for house ^{2} -hold waste segregation. Since this is an online web application that will run on the user's PC, the object detection model to be used has to be carefully chosen keeping in mind the model size, speed and accuracy. Hence, the YOLO class of models and a lightweight model based on SSD Mobile Net architecture are selected. A large dataset consisting of various common garbage items is created for training. The

dataset is preprocessed and augmented. This is done to set a common resolution for all the images in the dataset and to artificially create a larger dataset. This reduces the training time, enhances model's performance and creates different versions of dataset having different properties. The models are trained with each of these versions and then compared by evaluating performance metrices. The model with best metrics is finally implemented in this project.

II. RELATED WORK

Most of the research work done to tackle the problem of waste management till now involves the use of mechanistic models and IoT [1], [2], [3]. These systems not only take a lot of time to be constructed, but are also expensive, inefficient and inaccurate. All such proposed models have a major drawback that they cannot be used for managing mixed waste, but can work for wastes of one category only. Some of them such as [3] have a limitation of size. Only those solid waste objects which can comfortably fit into the system can be used. Deep learning is a major breakthrough in the field of artificial intelligence. Reviews of previous research models done by scholars have suggested that most waste management problems are complex, and traditional methods don't provide an adequate solution for them. They have stated that artificial intelligence methods have a great potential to provide an alternative effective approach to build systems that can operate in the real world and make waste segregation easier, reliable and more accurate [4]. Many existing machine learning models for waste management are based on image classification, but their main drawback is that they only classify one single object in an image [5] - they can only tell if the object is dry or wet [6], or biodegradable or non-biodegradable [7], [8], [9], or identify the class which the object belongs to [10]. But in real world situations, garbage piles have several waste objects belonging to different categories at one place, and hence image classification is not successful in such cases. We have therefore implemented object detection in our proposed solution which is capable of detecting multiple waste objects within the same image. Studies have shown that waste segregation is a task which needs an accurate and fast model for detection of objects. Many scholars have proposed a model based on the Convolutional Neural Network (CNN) [11], [4] or the Single Shot Detector(SSD). The former can be accurate, but since it requires a lot of resources to operate, it gives results after a long delay and can only reach up to a speed of 5-7 FPS (Frames per Second). The latter is a newer and powerful object detection model which achieves a great balance between speed and accuracy [12]. Its implementation is more straightforward than CNNs and we can enjoy a much faster speed of 22-46 FPS with precise predictions [13]. Despite these benefits, it is still a poor choice for applications such as waste object detection because it requires even more speed and accuracy, and SSD fails to provide that. We have therefore utilized a suitable and state-of-the-art object detection model called You Only Look Once (YOLO). It is a highly accurate, superfast and light- weight solution [14] capable of detecting objects at a rate of 40-90 FPS, and is just the right choice for this project. The YOLO object detection algorithm has gained significant popularity since its introduction in 2015 because of its fast inference speed, high accuracy, small size and ease of implementation in projects. It is also the most popular algorithm used for real time object detection. There is a rising trend in the number of academic papers published every year for YOLO, which shows exponential growth [15]. The existing solutions only work for static images [16], but our proposed system is completely a web-app that makes real time predictions and is hence more accessible. In some previous attempt to build a system for trash bin prediction, studies have used Microsoft's COCO (Common Objects in Context) dataset and SSD model pretrained on it, or different Kaggle datasets [17]. Their major drawback is that such datasets only include common objects, but doesn't specifically include any garbage objects such as plastic wrappers, used pens, used egg shells, expired medicines, small electronic items such as corrupted pen drives, adapters, metal cans, tetra packs, etc. Hence, we have created a high-quality and robust dataset dedicated only to common domestic and household garbage objects in order to enhance the usability and versatility of the web-app.

III. DATASET PREPARATION

A. DATASET COLLECTION

To train and compare the various object detection models, a dataset consisting of training, validation and testing images has been prepared. Since the application is waste object detection, a large dataset of several garbage objects is needed. To achieve this, several high-quality images of common household and domestic garbage items, such as dry wastes including plastic wrappers, tetra packs, pens, egg trays, optical disks and hazardous wastes such as batteries, pen drives, electronic adapters and expired medicines along with common household wet wastes have been collected. To ensure a detailed and robust dataset, several images are collected for each class from various angles, rotations, environment settings and lighting conditions. Further- more, images of all resolutions, ranging from 200px by 200px to 6000px by 6000px and up to 25 Mega Pixels, with a total of 500 images are selected. Table 1 shows some basic parameters of the dataset collected.

Table 1. Basic Dataset Parameters

Parameter	Number of Images	Minimum Image Size (MP)	Maximum Image Size (MP)	Average Image Size (MP)	Median Image Ratio
Value	500	0.03	25.17	0.70	1024px by 683px

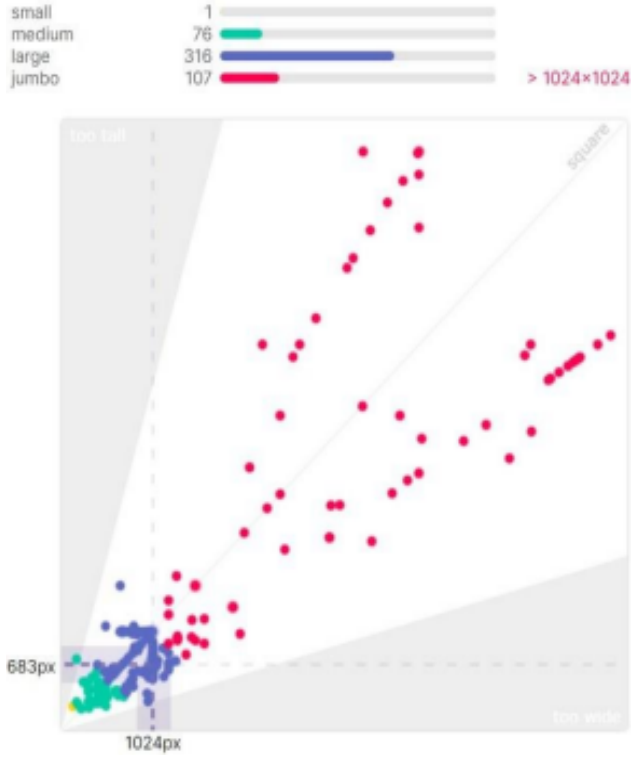

Fig. 1. Graph showing size distribution of dataset images. Majority of images are large in size, close to the median image ratio, as shown by blue data points.

Table 2. Classes of objects used

S.No.	Object Classes	Number of Images	Number of Annotations	Trash Bin Color	Waste Type
1.	Metal Can	25	53	Blue	Dry
2.	Plastic Wrapper	47	64	Blue	Dry
3.	Egg Shells	36	77	Green	Wet
4.	Expired Medicines	47	56	Black	Dry
5.	Batteries	11	54	Black	Dry
6.	Electronic Adapter	50	60	Black	Dry
7.	Pen Drives	40	54	Black	Dry
8.	Calculator	53	47	Black	Dry
9.	Optical Disk	43	52	Blue	Dry
10.	Egg Tray	51	52	Blue	Dry
11.	Pen	34	93	Blue	Dry
12.	Tetra Packs	36	54	Blue	Dry
13.	Lemon Peels	51	51	Green	Wet

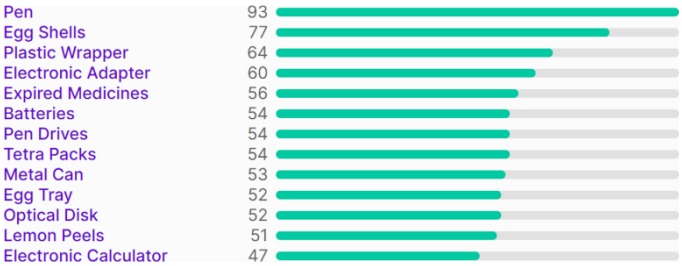

Fig. 2. Class balance visualization

B. GROUND TRUTH ANNOTATIONS

The next step in dataset preparation is the preparation of ground truth annotation of the dataset. Ground truth annotation is the manual outlining of each image in the un- processed and raw image dataset. This is done in order to have an ideal detection data so that the automatic bounding boxes around the image by different object detection models can be compared against it and the accuracy and errors in the model can be evaluated and visualized. The popular python-based open-source software labeling has been used to perform ground truth annotations. It provides an easy way to label any number of images for our garbage object detection project. After uploading the 500 dataset images, they were annotated into the three categories of dustbin colors.

Labeling supports only two output formats – PASCAL VOC and YOLOtxt(YOLO darknet). However, for models such as YOLO V5 and SSD MobileNetV2, we need annotations in YOLO V5 PyTorch and Tensor Flow TF Records format. This conversion is done using the Roboflow computer vision service. After annotating the 500 dataset images, a total of 767 ground truth annotations were obtained. This is due to the fact that an image can have more than object that can be annotated. Table 2 depicts the different classes of objects, their number of images, annotations and bin color.

Figure 2 shows the class balance of the dataset representing the number of annotations of each type of garbage object. It clearly shows that the dataset is very balanced, which is an important aspect to consider when training any object detection model.

C. DATASET PREPROCESSING AND AUGMENTATION

The original and raw dataset contains a heterogeneous mixture of images. Each image has different dimensions, aspect ratio and size. If used in its raw form, the dataset will lead to extremely inefficient training of the models and poor accuracy and inference time. It is therefore essential that we convert the raw dataset into a homogeneous set of images having common parameters such as dimensions. This will significantly reduce the model training time and improve performance. Hence, each image in the dataset is resized to 416px by 416px. This is the most common default input size of most object detection models. After preprocessing, the dataset images are augmented. Augmentation of the dataset is an excellent way to enhance the size of the training dataset. Augmentation refers to artificially generating a synthetic dataset using the preprocessed dataset .The new dataset consists of different versions of the same image having some degree of rotation, cropping, saturation, brightness, shear, cutout, mosaic, etc. We have implemented two different augmentation schemes on our dataset – flip, crop, rotate and shear, noise and mosaic. In the first scheme of flip, crop and rotate, the images are flipped vertically and horizontally, cropped to a maximum of 22% zoom, and rotated in both clockwise and counter-clockwise direction. In the second scheme of shear, noise and mosaic, the dataset is given 20 degrees shear both vertically and horizontally, added noise of up to [5] 8% of pixels, and grouped together to give a mosaic effect. The final size of the dataset

after applying the augmentations is 1500 images. Figure 3 depicts two augmented images.

Fig. 3. Original image (left) and augmented image (right) after applying flip, crop, rotate augmentation scheme

D. MODEL TRAINING

*1) Model selection :*The selection of an object detection model to be used for any task largely depends on the application it is applied in. This study aims to build an online web-app for garbage object detection and to identify the correct trash bin for it. This task requires a model having high precision because waste item misclassification will lead it to the wrong trash bin and will hence not solve the problem of improper waste management and environmental and health complications associated with it. It is therefore desirable that object detection model used should be state of the art, capable of detecting all sizes of objects with equal precision. This is contrary to the case in which some object detection models are only able to accurately detect either only small or large objects with good accuracy, but not both with equal accuracy. Such a model must be avoided as the garbage object may be big or small, and may be placed at different distances from the camera by different users. We therefore require a model with high Mean Average Precision or MAP value.

The next important requirement is that the model must be able to be deployed on the web. This means that the model should be in such a format that it can be easily embedded in a web application and make real time detections in the browser. And in order to make predictions in the browser, the model may be downloaded first locally on the browser. A faster internet speed means less time to load the model, quicker detection results and less lags. But since all the users of this system may not have a fast internet, the size of the model should be small enough that it can be downloaded with quickly even with average internet speeds. It is therefore essential that the model size must be less. The smaller the model, the faster will be the loading time. The common formats of models which can be used on the web are Tensorflow, Tensor- flow.JS, Darknet and PyTorch. Keeping above parameters in mind, seven different object detection models have been chosen for the task. These are shown in Table 3.

Table 3. Object detection models chosen for training

SNo.	1.	2.	3.	4.	5.	6.	7.
Model	SSDMV2	YoloV3t	YoloV3	YoloV4	YoloV5n	YoloV5s	YoloV5m
Format	TFlow	Darknet	Darknet	Darknet	PyTorch	PyTorch	PyTorch

2) Metric terms: After collecting the dataset images, annotating them and creating a larger dataset using different augmentations, this section aims to cover the training and evaluation of the models. There are several measures and terms used in metrics evaluation. These are as follows: Intersection Over Union (IOU): It is used to measure how good a detected bounding box is and how close it is to the actual group box. Its value lies between 0 and 1. An IOU value of 1 means a perfectly detected bounding box and an IOU value of 0 means a co incorrect detection. An IOU threshold value is always set during metrics evaluation to determine if a prediction is valid (true positive). This threshold value can be set based on the application the object detection model is applied in. It is the ratio of the inter union of area of the ground truth and detected bounding boxes as in: Here Bp and $Bggt$ are the areas of predicted and ground truth bounding boxes respectively.

- False Positive (FP): is not a valid detection because the IOU is less than the threshold set.
- True Positive (TP): is a valid detection where IOU is greater than or equal to the threshold set.
- False Negative (FN): It is a condition in which there is no detection by the model at all but the ground truth is present.
- True Negative (TN): It is an undesired detection by the model. It is not required or present as ground truth, but the model is unnecessarily making the prediction.
- Precision: It is the ratio of valid detections to all detections. It represents the correct predictions by the model out of total predictions. The more the invalid detections, lesser will be the precision. Equation (1) defines precision:

$$Precision = \frac{TP}{TP + FP} = \frac{TP}{All\ detections} \quad (1)$$

3) Recall: It is the ratio of the correct predictions by the model to the total number of actual Training and evaluation. The seven selected object detection models are trained on an Nvidia Tesla T4 GPU with 16 GB RAM. Due to the different architectures of the models, different models require different training times, with each model generally requiring up to several hours to train completely. Based on the training, several different metrics, namely precision, recall, F1 score and mean Average Precision

(mAP) are calculated for each of the model and for each of the augmented dataset. Table 4 shows metric parameters of all the models, where augmentation denotes the flip, crop, rotate scheme and augmentation 2 denotes shear, noise and mosaic scheme.

Table 4. Metric parameter evaluation of models

	Precision	65.0	60.2	61.4	77.5	59.2	64.9	58.3
Augmentation 1	***Recall***	*42.4*	*51.7*	*50.5*	*67.1*	*50.6*	*61.1*	*52.8*
	F1 score	*51.0*	*56.0*	*55.0*	*72.0*	*54.0*	*63.0*	*55.0*
	mAP_0.5	*53.0*	*58.0*	*53.2*	***74.0***	*55.3*	*61.5*	*56.8*
	Precision	55.5	59.9	61.9	78.3	62.6	68.1	81.6
Augmentation 2	**Recall**	44.3	58.7	48.6	65.1	50.3	50.4	44.0
	F1 score	49.0	59.0	54.0	71.0	55.0	58.0	57.0
	mAP_0.5	46.6	59.1	51.7	73.6	56.2	58.2	62.3

As shown in Table 4, the Yolo V4 achieved the maximum mean Average Precision value of 74% on the first augmentation scheme of flip, crop, rotate. Whereas, all the models in the second augmented dataset achieved lower mAP value than their corresponding values in the first augmentation.

4) Fine-tuning Yolo V4: Since Yolo V4 achieved the highest basic accuracy among all the seven object detection models, it is further fine-tuned to perform even better. The fine-tuning is done by varying the hyperparameters of the Yolo V4 configuration files. In the case of Yolo darknet, fine-tuning by freezing the convolutional layers speeds up the training process, but it reduces the accuracy, hence, it is avoided. We have therefore fine-tuned the learning rate and the subdivisions in the configuration of the model. The learning rate represents the amount of change in the weights of the model as a response to error, while the subdivisions represent the size of the mini batch that is processed by the GPU at once. The model is fine-tuned five times and the results are shown in Table 5. The best accuracy of YOLO V4 is achieved at a learning rate of 0.0017 with 16 subdivisions giving a mAP value of 79.5%. These weights are implemented in the web-app. Figure 4 shows comparison of YOLO V4 accuracy before andafter best fine - tuning.

Table 5. Results after fine-tuning Yolo V4

SNo.	Precision	Recall	F1 score	mAP_0.5
1.	76.2	68.9	72.0	77.3
2.	80.3	75.3	77.0	**79.5**
3.	74.6	73.2	74.0	74.2
4.	81.5	73.4	76.0	78.0
5.	85.6	60.3	67.0	73.9

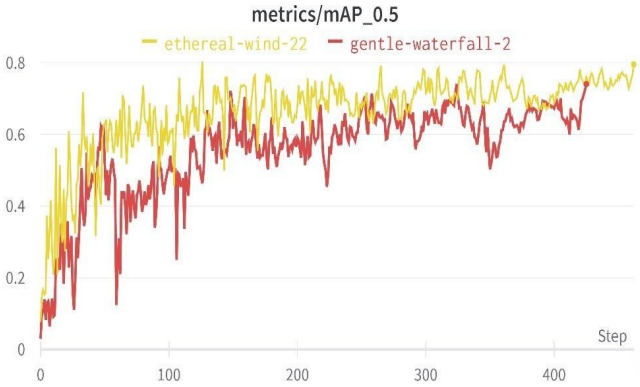

Fig. 4. Accuracy comparison of YOLO before and after fine-tuning (yellow)

IV. CONCLUSION AND FUTURE SCOPE

This study proposes a fast and accurate garbage item detection web application that detects waste items in real time and predicts the category of dustbin – green, blue or black, as required in public three-bin system. For household two bin system, it predicts whether the item is dry or wet, corresponding to bio-degradable and non- biodegradable respectively. First, a rich dataset consisting of waste items from 13 categories of objects is collected. These classes, such as medicines, adapters, tetra packs, etc. are specifically chosen because they are not included in any of the popular pre-existing datasets such as Microsoft's COCO dataset.

After collecting 500 images, the objects in each image are manually annotated using labeling, and exported to appropriate formats such as Yolo Txt, Yolo V5 PyTorch and TensorFlow TF records. Ground truth annotations are done in order to have an ideal detection data so that the automatic bounding boxes around the image by different object detection models can be compared against it and the accuracy and errors in the model can be evaluated and visualized. The annotated dataset is then preprocessed and resized to 416 px by 416 px. This is the most popular dimension size of the input images as it is small and square and hence will require less training time. The resized images are then augmented using two schemes – flip, crop, rotate and shear, noise and mosaic. The final size of the dataset is 1500 images. This is done to improve model performance as the number of training images are increased. For the selection of appropriate model, many models that can fit into this application are surveyed. Selection is done on the basis of accuracy, inference time, and the [8] ability to be embedded in a web application. Seven state-of-the-art object detection models are chosen for training. These models are trained on each of the augmented dataset and are evaluated using several metric parameters, the most important being the mean Average Precision. Results show that the Yolo V4 outperformed all the other models, and has the highest accuracy of 74% in the flip, crop, rotate augmentation scheme. Yolo V4 is further fine-tuned five times by varying the hyper parameters in the con - figuration file during training. The learning rate and subdivisions are changed to fine- tune the model. The best accuracy achieved by Yolo V4 is of 79.5% at 0.0017 learning rate and 16 subdivisions. These weights are finally used and integrated in the web application. A lot of work has been done on the frontend and backend of

the web application. However, there are some drawbacks too. One of the main disadvantages of this application is the constraint on the size of the dataset. If the dataset is made too large and more classes of garbage objects are added to it, it would mean putting in even more high-quality images in the dataset. Also, each of the images need to be manually annotated. Though this will create a very rich dataset, enhance the usability of the application and consequently produce a very accurate model, it will be extremely time consuming to do the manual annotation. Even if the all the data is annotated, there is a limitation of GPU. We have access to Nvidia Tesla T4 GPU. However, such a large dataset would require an Nvidia Tesla V100 GPU, which is extremely expensive. Hence, training of a large dataset is not possible with the current resources. A better GPU can enable us to build a larger dataset for our application so that the models can generalize better.

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A Critical Review On Piezoelectric Energy Harvesting Shoes

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Abstract - Piezoelectric energy harvesting has played an important role in powering low power electronic systems and devices in the absence of availability of conventional power supply. The increasing demand for energy in growing population across the world has demanded the need for generation of electricity through renewable energy sources. Here, it is aimed to provide a comprehensive review of the piezoelectric technologies for the generation of energy that can be implemented using the load from the footstep vibrations. A discussion on various mechanisms and designs utilized in piezoelectric energy-harvested shoes is provided. Electrical circuits for optimization are further discussed as the generated energy carries low current and reasonable voltage. Lastly, the future aspects of the implementation and use of this technology in the form of shoes are presented.

Keywords— Piezoelectric energy harvester, Piezoelectric shoes

I. Introduction

Electrical energy is a crucial source of power for a wide range of equipment and devices in our daily lives, from entertainment gadgets to life-saving medical devices. To meet the energy requirements for these devices, various harvestable energy sources are available, each with its own unique advantages and applications [1, 2]. Here are some common examples such as flowing water, waste heat, Electromagnetic Waves, Vibration and Mechanical Energy, Wind Energy, Biomass, Geothermal Energy, Tidal and wave energy and Nuclear energy.

Piezoelectric materials are indeed a special class of materials with the unique ability to convert mechanical strain or vibrations into electrical potential and vice versa. This property makes them highly valuable in a wide range of transducer devices and energy-harvesting applications. Here are some key points to highlight:

A. ***TRANSDUCER DEVICES:*** Piezoelectric materials are commonly used in transducer devices, including sensors, filters, transducers, accelerometers, and actuators. They can accurately convert mechanical signals into electrical signals and vice versa, which is vital in a variety of applications where sensing and control are required.

B. ***ENERGY HARVESTING:*** Piezoelectric materials have gained recognition for their energy harvesting capabilities. They can capture energy from various sources, such as vibrations, kinetic motion, and deformation, and convert it into electrical energy. This makes them particularly useful for powering electronic devices in remote or energy-constrained environments.

C. ***DIVERSE ENERGY SOURCES:*** Piezoelectric energy harvesting can tap into a wide range of energy sources, including industrial machines, vehicles, human and animal movements, roadways, floors, and environmental sources like flowing water and wind. This versatility allows for creative and sustainable energy solutions.

D. ***APPLICATIONS:*** Piezoelectric based energy harvesters have found applications in various fields. They are used to power portable devices, wireless sensor nodes, and medical implants. For example, in wearable technology, piezoelectric materials can capture the energy from the wearer's movements to charge or extend the battery life of the device.

E. ***TRANSDUCER DEVICES****:* Piezoelectric materials are commonly used in transducer devices, including sensors, filters, transducers, accelerometers, and actuators. They can accurately convert mechanical signals into electrical signals and vice versa, which is vital in a variety of applications where sensing and control are required.

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H. ***APPLICATIONS****:* Piezoelectric-based energy harvesters have found applications in various fields. They are used to power portable devices, wireless sensor nodes, and medical implants. For example, in wearable technology, piezoelectric materials can capture the energy from the wearer's movements to charge or extend the battery life of the device.

I. ***SUSTAINABILITY****:* Piezoelectric energy harvesting contributes to sustainability by converting wasted mechanical energy into electrical power. It can help reduce the reliance on traditional power sources and lower the environmental impact of electronic devices.

J. ***CHALLENGES****:* While piezoelectric energy harvesting has many advantages, it also presents challenges related to the efficiency of energy conversion, material selection, and integration into specific applications. Researchers are continually working on improving the technology to

maximize its potential. Piezoelectric energy harvesting contributes to sustainability by converting wasted mechanical energy into electrical power. It can help reduce the reliance on traditional power sources and lower the environmental impact of electronic devices.

Piezoelectric effect is linear relationship between electrical (e.g., electric field, and electric displacement) and mechanical (e.g., stress, and strain) field quantities. The strain charge form of piezoelectric constitutive law is given as,

$$S_{ij} = s_{ijkl}T_{kl} + d_{ijk}E_k \quad (1)$$

$$D_i = d_{ijk}T_{jk} + \epsilon_{ij}^T E_j \quad (2)$$

Alternatively, in stress charge form,

$$T_{ij} = C_{ijkl}S_{kl} - e_{ijk}E_k \quad (3)$$

$$D_i = e_{ijk}S_{jk} + \epsilon_{ij}^S E_j \quad (4)$$

where, T, S, D, and E are mechanical stress, mechanical strain, electric displacement and field. s, C, d, and e are the mechanical compliance, stiffness, and piezoelectric coefficients' tensors in strain-charge forms respectively. While, ϵ^T, and ϵ^S are the dielectric permittivity matrices at constant strain and stress.

This review focuses on different prototype of shoes embedded with piezoelectric materials for harvesting human biomechanical energy. A variety of shoe prototypes with different setups have been explored for harvesting energy useful for health applications, low power electronics etc.

II.VARIOUS DESIGNS OF PIEZOELECTRIC SHOES

The human body expends a significant portion of energy while performing different daily activities. Some of these activities involve breathing, speaking, arms lifting, walking, eating, etc. A valuable insight into the challenges and considerations involved in harvesting energy from the human body while avoiding interference with normal activities and metabolic costs. Indeed, designing energy harvesters for the human body is a complex task that requires a deep understanding of the body's biomechanics and energy flow.

However, all the strain and kinetic energies cannot be used for energy harvesting. A rule of thumb in designing harvesters scavenging energy from the human body is that they should not intervene in the normal activities and add to the metabolic cost. These restrictions make it necessary to determine the energy flow in body motions and analyze the available energy can be used for harvesting. It is well established fact that the muscles result in both positive and negative work in each motion. The shortening contraction of muscles results in the positive work while the lengthening relaxation of the muscles yields negative work [3,4]. Therefore, it is necessary to understand how the body and muscles motion can be used for harnessing energy. In this regard, researchers have placed effort in evaluating the energy associated with several body motions [5,6] such as breathing (~ 1 W), arms lifting (~ 60 W), walking (~ 67 W) etc.

Table 1 lists down the energy associated and the negative work done by muscles during different body joints.

Table 1. Energy in different kind of human motions for energy harvesting.

Joint	Work (J per Step)	Power(W)/max torque (Nm)	Negative Work %
Heel strike	1-5	2-20/-	50
Ankle	33.4	66.8/140	28.3
Knee	18.2	36.4/40	92
Hip	18.96	38/40-80	19
Elbow	1.07	2.1/1-2	37
Shoulder	1.1	2.2/1-2	61

One of the commonly explored methods to harness the energy from human motion is piezoelectric energy harvesting. The advantage associated with these harvesters is that they can be designed to be flexible with smaller deformation requirements. Moreover, they can be integrated within shoes with ease and without interfering in motion. Energy harvesting from shoes can be carried out by the three types of excitations: deformation due to relative motion between the ground and foot, acceleration (swing) and stretching of the sole of the shoe. A variety of piezoelectric energy harvesters employed in shoes have been explored for harnessing energy from one or combined action of these excitations. Here, we review only those studies which have put forward prototypes or at least proof of concept of the piezoelectric shoe with year-wise development and improvement in the design, efficiency, and power output.

One of the pioneering and foremost work in this field was carried out back in 2001 at MIT Media Lab [7]. The research evaluated the performance of three devices that can be integrated into a shoe for harnessing energy while walking. Two of these devices were piezoelectric based, which are now discussed. Firstly, the energy was harnessed by bending the shoe sole in which the piezoelectric foils were laminated together in the shape of an elongated hexagon to form a stave. This "stave" is a bimorph built around a plastic substrate and eight layers of 28 micro meter PVDF sheets which were stacked on either side with epoxy as a binding agent. Upon bending of the stave, the PVDF sheets on the outer surface experienced a tensile force while those inside experienced compression, yielding and output voltage due to dominant d_{31} mode. Silver inked electrodes from all the PVDF sheets were connected in parallel resulting in an overall capacitance of 330 nF. The PVDF stave is presented in Fig. 1(a)

Utilizing pressure generated during a heel strike of the shoe is another promising means to harness energy. It consists of a uniform strip of spring steel affixed over a piezoceramic patch for better flexibility, as shown in Fig. 1(b). This module can be easily integrated into the shoe sole using a mount, which presses the unimorph plate against a rigid plate. On release, the plate returns to its original position.

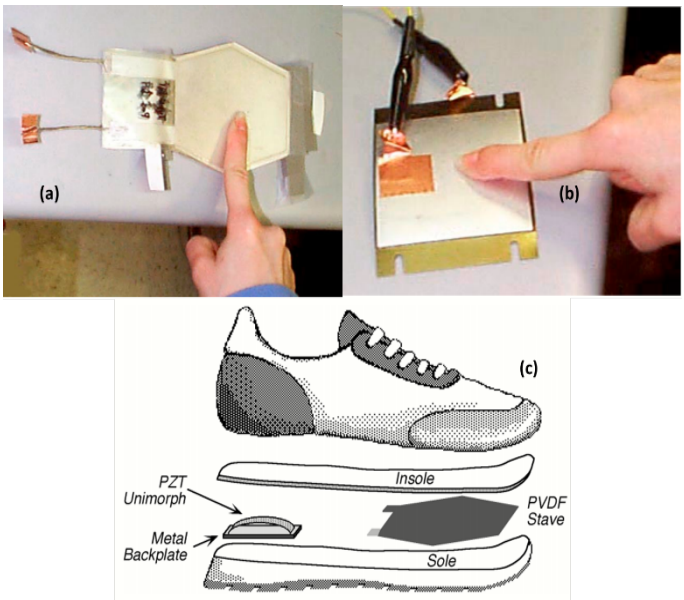

Fig.1(a). Image of the PVDF based insole stave (b) Thunder PZT unimorph under test and (c) Exploded view showing the integration of piezosole into the shoe.

Further, to explore the power output, these modules were installed in sneakers. PZT and PVDF elements were placed between the removable insole and rubber sole, as illustrated in Fig. 1(c). To ensure maximum power output, the piezoelectric generators were terminated with 250 kΩ resistors. Fig. 2(a) shows the output voltage recorded across the load resistor the foot hitting the ground at a frequency of around 1 Hz. Voltage peaks as high as 60 and 150 V were recorded using PVDF stave and unimorph, which can indicate the footfall. It was interesting to note the polarity switches in PVDF during toe lift as the sole unbends, while the PZT shows a positive spike during compression of unimorph due to heel strike. Further, a maximum of 20 and 80 mW of power were recorded by the stave and unimorph as shown in Fig. 2(b). This leads to 1 and 2 mJ/step of average energy transfer for both the cases.

In addition, one simple application of these systems was demonstrated through a self-powered active RF tag that was capable of transmitting a wireless code (ID) during walking. This RF tag enables the user to send their identity to nearby neighborhoods while passing through and allows the buildings to identify and locate its residents and send any relevant information. The RF tag uses the power produced by these piezoelectric modules while walking and running. The power conditioning circuitry used in the tag consists of a full-wave rectifier, capacitor and an SCR style switch for accumulating the charge in several steps and supply it to the tag electronics. Depending on the walking style of the user, these shoes were found to transmit the ID every 3-6 steps using an RFID section.

The research opens a new area of implementation of piezoelectric materials for energy harvesting from walking and even presents the implementation in real-time. However, it suffers from material selection as the lead-based materials are toxic in nature. Therefore, there is a scope of material replacement with some other lead-free materials. It further warrants the life prediction of these devices under continuous loading and unloading and the frequency of the voltage pulses is low to be applied in advanced circuits such as synchronous charge extraction [] for the storage of energy.

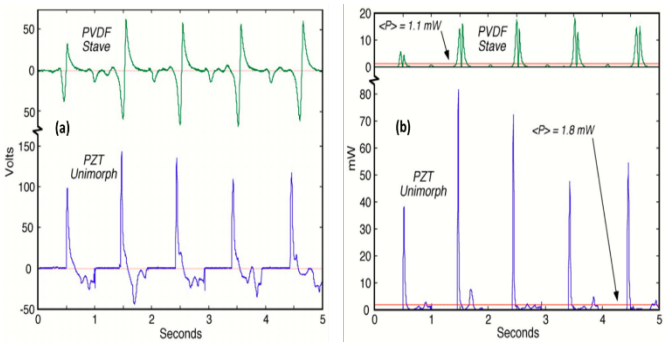

Fig.2. Comparison of (a) the output voltage across 250 kΩ load obtained and (b) the instantaneous and mean power output obtained from PVDF stave and PZT unimorph configurations [7].

Although research papers continued to be published in literature after this device was reported, no successful implementation or installation in the form of prototype appeared. However, in 2009, C.S. Howells at Power Technology Branch at the US army presented the heel strike concept in units in which an electric generator utilized the piezoelectric materials to convert mechanical energy to electrical energy [8]. The generator was developed with a motivation for military applications. The objective was to produce 0.5 W of power at a step rate of 1 Hz so that devices such as GPS receiver can be powered. The complete heel-strike system consisted of two major components, namely the heel strike generator and the power conditioning circuitry. The heel strike generated a mass of 455 gm with dimensions of 8.89 ×7.94 × 4.29 cm^3, as shown in Fig. 3(a). The generator unit had four PZT-5A stacks with a lead screw, bearing, bimorph configuration, and rotary cam as shown in Fig. 3(b). Thereafter, the AC voltage obtained from the generator is fed to the power conditioning circuit for rectification and a capacitor is charged. The discharging through a DC-DC convertor and finally a regulated 12 V DC output pulse is obtained, as presented in Fig. 4(a).

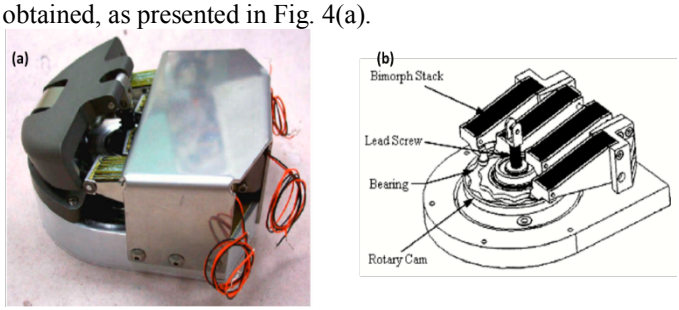

Fig.3(a). Photographs of the proof-of-concept of heel strike generator and (b) schematic with different components [8]

Performance tests were carried out for the heel strike unit at ambient conditions to estimate the output power with partial compression to find out if it is sufficient for military and commercial applications. The generator was tested at various compression levels (25%, 50%, 75% of full compression). The objective behind using different compression levels was to check the viability of the unit under different loads as the compression of the heel strike generator is different for different persons. In the test stand, a cam attached to a motor shaft was used to compress the generator. To achieve different compression levels, different cam sizes were used during the testing. The power was delivered to power circuit and then dissipated through a variable resistor. A series of resistive loads were applied at different compression levels and output parameters such as current,

voltage and power were recorded using a Data Acquisition System (DAQ). The average power was found to be 0.0903 W per compression with standard deviation of 0.0059W.

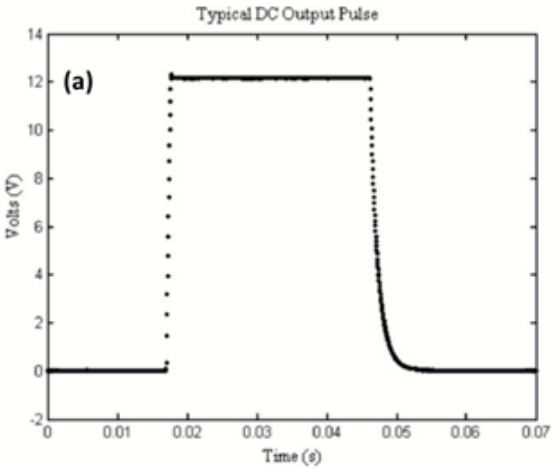

Fig.4. Typical output DC pulse obtained from the generator.

Several other algorithms / surveys are also available in literature with in-depth studies on energy harvesting devices during walking / physical exercise [9-12]. The electroactive films were positioned on the shoe sole, as shown in Fig. 5(a) and (b). The positions were selected such that the larger pressure is exerted during walking. The basic tests were conducted by simple jump and the output voltage waveform has been presented in Fig. 6(a). A rectifier circuit was used to obtain a single polarity voltage for energy storage purposes. The conditioning circuit used four Schottky barrier diodes having a forward bias voltage of 0.33 V. The piezoelectric polymeric layer and power circuit was installed in the shoe, as shown in Fig. 5(b). The tests were performed while walking and the rectified voltage waveform for a single step is presented in Fig. 6(b). In order to further enhance the generation of power, a coupling of electrostatic generator with the unit is made. The generator unit consisted of a dielectric material sandwiched between two metallic plates and the thickness of the dielectric changed with pressure while walking. In addition, a thin-film rechargeable lithium ion battery was also employed to store the energy generated during the process. The average energy generated while running in combination with the electrostatic generator was recorded for different load resistances as presented in Fig. 6(c).

Fig.5. Photograph showing (a) the position of the electroactive films on the shoe sole (b) the harvester integrated into the shoe along with electronic circuit

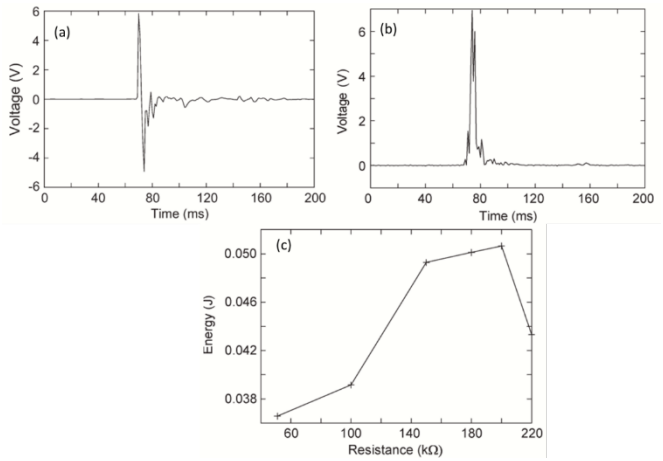

Fig.6(a). Voltage waveform obtained from the sample during a simple jump, (b) Voltage waveform obtained from the generator after rectification during a step while walking and (c) Average energy generated by the generator across different resistive loads during running [13]

This was the first study of its kind which utilized the piezoelectric polymer due to its high compliance and easy molding capacity. However, from the results it was concluded that the energy obtained is not sufficient for the desired applications.

III. CONCLUSIONS

The study puts forward the design and modeling of the harvester with different piezoelectric stacks and evaluated them on a treadmill with a smooth surface with no undulations and should be tested by walking on actual road. This may result in better power output due to the large ground reaction force on uneven roads.

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Smart CCTV Camera

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***Abstract*- One of the most important components of human life at this time is security. This paper aims at improvement of security system based on Camera-Based CCTV present in number of locations. This kind of surveillance is quite important and crucial. Due to intricate tasks, homes are frequently left unattended. When most people are away from home, they employ CCTV (Closed Circuit Television) cameras to protect their homes. The videos obtained from surveillance are very useful in investigation and prevention of criminal. Traditional video surveillance is less effective because the camera merely records without analyzing items.**

***Keywords* - Structural Similarity, Machine learning, Waterfall model, Data learning.**

I. Introduction

Rapid technological advancement has increased the possibility of intrusion. A person can monitor his property by using security cameras. The majority of businesses and government agencies are employing such security cameras in order to protect their assets and businesses from terrorism and illegal entrance. Security cameras have grown much more modern, reasonable, smaller, and straightforward in recent years. The surveillance and monitoring of public human qualities is one of the most attractive subjects of research nowadays. CCTV surveillance systems can be used for a wide range of applications and have a wide range of features. It is critical for the company to be able to comprehend what is going on in order to improve the surveillance system's technology. The majority of people currently protect their homes by installing security CCTV systems (Closed Circuit Television). This security technology is less effective because traditional CCTV mostly records incidents without describing what transpired during the filming. [1] To overcome some of the drawbacks associated with traditional CCTV systems, we have compiled this project which has integrated the following features:

- 1. Monitor
- 2. Identify the family member
- 3. Detect Noises
- 4. Visitors in-room detection

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II. Aim and Objective

To create an application that builds upon the basic functionality of a normal CCTV to make it smarter with some intelligent features like visitors count, noise detection, face detection, anti-theft detection, etc.

III. Software and hardware requirements

As this is a piece of software, it will need to operate on some sort of hardware and operating system, hence the following are the system requirements:

It can operate on any platform, including Windows, Linux, and Mac OS. Python3 is required for this to work. Python must be installed on your system. OpenCV, skimage, numpy, and tkinter are some of the python packages available.

In terms of hardware, there aren't many prerequisites, however the following are required:

- Working PC or Laptop
- Webcam with drivers installed
- Flashlight/ LED if using this at night.

IV. Research Methodology

The deep dive into the different features of the smart surveillance system is given below:

A. Monitor Feature: This feature helps in identifying what object has been stolen from the given frame as shown in display by the webcam, this reflects that there is continuous monitoring of frames and identify any steal by thief [1]. Structural similarity is used to create differentiation between two frames obtained from videos [2]. The effect of noise is on both frames is observed, once when there is no noise and later when noise is over.

SSIM method is used to two photographs and finds their similarity index. There is lot of data present on this technique as it quite prevalent in this field from a long, but quite limited is known in detail, especially when talked about gradient-based implementation as SSIM is used as a loss function. [2] SSIM extract the three basic features of any image:

- Luminance
- Contrast
- Structure

These features help in comparing any two images by calculating SSIM. The range of SSIM lies between -1 to +1, where, +1 means identical images and -1 for not identical images [1]. Luminance is equal to the average of all the pixel values. To perform the structural comparison, the input signal is divided by calculating its standard deviation, this results in more robust comparison giving an output with unit standard deviation [3]. Fortunately, with the help of python skimage resource, there's no need to repeat mathematical calculations since it includes pre-build features. So, just feed two images that one needs to compare and a masked image with score is received at the output.
Determine whether or not the Family Member feature exists, this capability is a highly helpful component of our tiny project since it allows us to determine whether or not the individual in the picture is identifiable. [3] It does this in the following steps:
a) Look for the people in the frames.
b) Predict the individual using a previously trained model using the LBPH face recognizer algorithm.
So, this is break down into the given categories:
a) Recognizing people in the frames
This is accomplished using Haar Cascade classifiers, available in the Python openCV package. This classifier works on Haar features is a boosting ensemble learning. Adaboost classifiers are normally used, also Real Adaboost, Gentle Adaboost or Logitboost are used [4]. These classifiers are trained on a few hundred example photos of images that include the item we're looking for, as well as images that don't.
There are several characteristics that can be found on the majority of human faces. A dark eye area in comparison to the upper-cheeks as compared to the eyes, a brilliant nose bridge area precise placement of the eyes, mouth, and nose. The traits are referred to as Haar Features [5]. This is how the feature extraction method will work. These convolution kernels are comparable to Haar features, which are used to identify the presence of that feature in a given picture. The openCV module in the Python language contains an inbuilt method called cascade classifier that we utilized to detect for all of this.
b) Face recognition using LBPH
Once the faces in the pictures are recognized, the next step is identification and figure out whether they are part of the dataset used on which the LBPH model is trained. There are four parameters in the LBPH:
Radius: The radius is the area around the center pixel which generates the circular local binary pattern. Generally, it is set to 1. Neighbors are the sample points used to create the pattern.
Grid X: In this grid the total number of cells which are present in horizontal direction should have fine grid, normally set to 8.
Grid Y: This grid contains the number of cells present in the vertical direction [6].
Extracting the Histograms: Once the grid X and Grid y are obtained on any image, a model is trained. For predictions same process is applicable on the models. Histograms of models are compared with previously trained models. This is how process works.

B. Noise Detection.
This feature is used to locate sounds in the frames, and it's something you'll see in most CCTVs, but we'll look at how it works in this module [7]. To put it another way, all of the frames are constantly inspected and noise-checked. In the next frames, noise is examined. Simply put, we compute the absolute difference between two frames and examine the difference between two pictures, as well as contours (the borders of two images), and if there are no boundaries then no motion and if there is any there is motion. As you may be aware, all pictures are just integer/float values of pixels that indicate the brightness of each pixel, and each pixel has the same brightness values [8]. As a result, we just make an absolute difference because taking negative makes no sense.

C. Detection of visitors in the room
This is the function that detects if someone has entered or exited the room.
As a result, the stages are as follows:

- It looks for noise in the frame first.
- Then, if any motion occurs, it is determined from which side it occurred, either left or right.
- Finally, if it detects motion from left to right, it will mark it as entered and capture the frame.

Alternatively, vice versa.
As a result, there isn't any complicated arithmetic going on with this particular feature. To determine which side the motion occurred from, we first detect motion, then draw a rectangle over the noise, and last, we check the co-ordinates to see if those points are on the left side, in which case it is categorized as left motion. [9] The process model that was employed was the waterfall model. We utilized the waterfall model for this model because it was a small project.
The benefits of using the waterfall methodology -
a) It's ideal for projects.
b) It is simple to follow.
c) For small tasks, there is good tracking.
d) Time management is excellent.
The fundamental software development life cycle model is the waterfall model. It's straightforward but idealistic. This model was formerly highly popular, but it is no longer in use. But it's crucial since the waterfall model is the foundation for all other software development life cycle models [10]. The life cycle is divided into phases in the traditional waterfall paradigm. This paradigm assumes that one phase can begin after the preceding phase has been completed. That is, one phase's output will be used as the input for the next. As a result, the development process may be viewed as a waterfall with a sequential flow. The phases do not cross over in this case.

VI. Results and Output

Smart surveillance is definitely a pressing need to supplement present surveillance technologies with better tools to aid the efficacy of human operators [10]. Smart surveillance systems

will totally replace traditional surveillance systems when low-cost computing, video infrastructure, and improved video analysis technologies become more widely available. The "degree of smartness" of such systems will be determined by the level of security they provide.

VII. Future Work

This idea can be widely used because of technological advancements such as the ability to have a tiny size yet great computing power. Here are some ideas for future development on this topic like creating a portable CCTV system, including night vision capabilities in the design [10].

If you have a high-power device, you can add deep learning. There are other features such as deadly weapon detection, accidental detection, fire detection, and much more. Making a stand-alone program that doesn't require any additional software, such as python [11]. Adding data learning support to this project would give it a much broader reach since we would be able to add a lot more features to it.

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Review on application of Internet of Things in smart home appliances

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***Abstract*— This paper presents an overview of the uses of Internetof Things in Home Appliances and its need in present time. Thirty papers have been reviewed in total. They are categorized into different categories based on their applications. This application has attracted many researchers because of its importance in present time and how it makes life easier which led to many improvements in terms of its application in different areas. This paper discusses the progress and importance of Internet of Thingsin home appliances and in general life.**

Keywords*— Blynk Iot, Security, face recognition, Arduino board, qToggle, Raspberry Pi boards, sensors, MQTT, NodeMCU, Node-RED Technology, Wi-Fi ESP8266 microchip, LDR, ThingSpeak, Remote Control, Automation, Machine Learning, Big Data, and cloud computing, ESP32 Wi-Fi module, ILM, NILM, Sinric Pro, CoAP, 6LoWPAN.

I. INTRODUCTION

The Internet of Things (IoT) is a network of physical objects that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging datawith other devices and systems over the internet. These devicesrange from ordinary household objects to sophisticatedindustrial tools. IoT devices can collect data about their environment, such as temperature, humidity, motion, and sound. They can also be programmed to perform specific actions, such as turning on lights, adjusting thermostats, or sending alerts. IoT is transforming many industries, including healthcare, manufacturing, transportation, and retail. For example, IoT-enabled medical devices can track a patient's vitalsigns and send them to their doctor in real time. IoT-enabled sensors in factories can monitor machine performance andpredict maintenance needs. IoT-enabled traffic signals can adjust their timing to reduce congestion. And IoT-enabled retailsystems can track customer behavior and send personalized recommendations. IoT is still a relatively new technology, but it is rapidly growing and has the potential to revolutionize manyaspects of our lives.

The papers have been categorized as follows:

1) Smart home using Iot
2) Iot based home appliances control.
3) Smart-home Technologies to assist older people to live wellat home.
4) An IoT-based home automation system
5) IoT based Voice/Text Controlled Home Appliances
6) Real-time IoT Based Energy Efficient Framework forHome Appliances.
7) Iot based approach for load controlling and smart homecontrolling system.
8) IOT: Security and Privacy in future home appliances.
9) Smart home system based on sensor technology

USAGES AND ADVANTAGES

A. Why IoT Automation is Important Today:

1. Efficiency: IoT automation optimizes resource use and reduces waste, allowing people to accomplish more with lesseffort.

2. Convenience: IoT simplifies daily life by automating tasks and providing remote control, which is particularly relevant as people seek ways to simplify their routines.Energy conservation: IoT automation helps conserve energyand reduce carbon footprints, aligning with sustainability goals.

3. Security: IoT enhances home and personal security, whichis crucial in a digitally connected world where cyber threats are prevalent.

4. Data-driven decisions: IoT generates valuable data that can be used for informed decision-making in various aspects of life, from home management to business operations.

5. Compatibility: IoT devices are designed to work together, creating an ecosystem of interconnected devices that improve overall functionality and user experience.

B. Disadvantages of previous methods:

Limited control: IoT appliances can be controlled remotely using smartphones, tablets, or other devices. This allows users to operate their appliances even when they are not home. Energy waste: IoT appliances can be automated to optimize energy consumption. For example, a smart thermostat can learn user habits and adjust the temperature accordingly. Security vulnerabilities: IoT appliances can be equipped with advanced security features, such as encryption and authentication. This helps to protect them from unauthorized access and manipulation. Lack of insights: IoT appliances can collect data on usage patterns and efficiency. This data can be used to make informed decisions about energy consumption and other aspects of appliance use.

Inflexibility: IoT appliances can be programmed to adapt to changing circumstances and user preferences. For example, a smart sprinkler system can adjust its watering schedule based on weather conditions.

C. Advantages of IoT in home appliances:

Remote Control: IoT allows users to remotely control home appliances through smartphones or voice commands. This convenience is especially useful for turning devices on or off before arriving home or while away.

Energy Efficiency: IoT devices can optimize energy consumption by monitoring usage patterns and adjusting appliance settings accordingly. This leads to reduced energy bills and a smaller environmental footprint.

Automation: IoT enables automation of routine tasks. For example, smart thermostats can adjust heating or cooling based on occupancy and weather conditions, saving energy and improving comfort.

Security: IoT devices can enhance home security. Smart locks, cameras, and alarms can be integrated into a single system that can be monitored remotely, providing peace of mind.

Data Insights: IoT collects data on appliance usage and patterns. This data can be analyzed to identify trends and optimize appliance performance, leading to longer lifespans and cost savings.

Convenience: IoT devices make life more convenient. For instance, a smart refrigerator can track food inventory and suggest recipes based on available ingredient.

II. REVIEW PAPERS

This research paper **[1]** introduces an IoT-based Smart Home system designed to enhance security and automation. The system incorporates face recognition for door access control and various sensors for monitoring the home environment. It utilizes the Blynk IoT platform and exhibits impressive device control accuracy, achieving a rate of 100%, and reasonably good face recognition performance, with a rate of 77%. Notably, the system demonstrates practical real-world applicability with low latency, typically around 2 seconds, which renders it suitable for everyday use.

However, there are limitations due to the use of Raspberry Pi 3 and the free version of Blynk. It is suggested that upgrading to more robust hardware and a premium Blynk subscription could substantially enhance system speed and functionality.

This paper **[2]** examines the design of an IoT-based home automation system that leverages Wi-Fi technology. The system is comprised of an Arduino board, a Wi-Fi module for communication, and remote control via a smartphone using a web page server. Home appliances are connected to the Arduino via relays, allowing users to control their appliances remotely, even when they are not at home. The technology also finds applications in industrial automation for controlling equipment and machinery, military use for monitoring enemy activities, and home automation for managing various electrical appliances such as TVs and fans.

This paper **[3]** delves into the dynamic realm of the Internet of Things (IoT) with a specific focus on retrofitting existing appliances to imbue them with smart capabilities, thereby augmenting daily life and productivity. It provides an overview of IoT's architecture, protocols, and potential applications, underscoring its adaptability in fields like home automation, smart agriculture, and industrial control. The prototype presented in the paper demonstrates the ability to remotely monitor environmental conditions and control appliances using existing WIFI infrastructure, which has the potential to enhance the quality of life and work.

Additionally, the paper suggests that further efficiency improvements can be achieved through emerging protocolssuch as CoAP and 6LoWPAN. Overall, it offers valuable insights into the transformative potential of IoT and its practicalimplementation.

The research paper **[4]** introduces an innovative home automation solution powered by IoT technology. It effectively tackles the inconvenience associated with manual appliance control, providing users with a cost-effective, adaptable, and responsive system. The use of NodeMCU ESP8266 and the Sinric Pro web server for wireless communication and relay control is noteworthy. Experiments conducted confirm the practicality and reliability of the system. In summary, this paper contributes to the expanding realm of smart home technology by presenting an accessible and efficient solution for remote appliance management.

This academic paper **[5]** provides a compelling analysis of how IoT technology is bringing about significant changes in the kitchen and furniture manufacturing industry. It underscores the potential of IoT to improve safety, energy efficiency, and user experiences in this sector. However, the paper also acknowledges challenges such as interoperability issues and the necessity for new business models. It places a strong emphasis on the evolving focus on continuous customer engagement and the significance of forming partnerships within the IoT ecosystem. In essence, this paper offers a comprehensive

The paper **[6]** presents an innovative solution that leverages Internet of Things (IoT) technology to assist the elderly in their daily routines. Given the increasing aging population in Malaysia, this approach aims to provide support for elderly individuals in managing household tasks such as lighting and ventilation. IoT-based pulse sensors are used to monitor the elderly individuals' pulse rates, allowing for controlled automation of home appliances. This system, which incorporates sensors, microcontrollers, and communication with the Blynk server, minimizes the physical effort required by the elderly, ultimately enhancing their quality of life. Importantly, it offers a user-friendly automation solution that doesn't demand extensive technical knowledge. Although initially limited to Malaysia, this technology holds potential forbroader applications in elderly care.

This paper **[7]** serves as an introductory overview of a research study that focuses on assessing the effectiveness and feasibility of smart-home technologies in facilitating independent living for older adults. It highlights the global rise in the aging population and the associated challenges faced by healthcare systems. Smart-home technologies are introduced as a potentialsolution to promote and enhance the quality of life for older adults.

Furthermore, the paper alludes to various aspects and fields connected to smart-home technologies, including robotics, sensors, telehealth, and safety.

The research paper **[8]** delves into a system that revolves around the creation of an affordable and dependable home monitoring and control system. This system is designed to be operated remotely through an Android smartphone application. Its core purpose is to enhance the quality of life at home by minimizing manual efforts, boosting energy efficiency, and saving time. Notably, it offers valuable assistance to individuals with disabilities, aiding them in leading more independent lives.
The system is composed of key components, including an Android smartphone, an Arduino Uno board, a Wi-Fi module, and a relay circuit, with the Wi-Fi technology playing a pivotal role in enabling remote control of devices.

This paper **[9]** presents qToggle, a versatile home automation system designed to address the increasing demand for smart home solutions. qToggle employs an adaptable API to connect a wide range of sensors and actuators, making it a flexible choice for home automation. The system primarily relies on ESP8266/ESP8285 chips and Raspberry Pi boards, ensuring a cost-effective and user-friendly approach. The accompanying smartphone application further enhances control over home appliances and sensors. In essence, qToggle lays the groundwork for a comprehensive smart home system with potential for expansion and improvement to cater to evolving automation needs in the future.

The paper **[10]** explores the application of the Internet of Things (IoT) in the context of home automation. The authors introduce a system in which home appliances are linked to an Arduino UNO and controlled through a WiFi module, specifically the ESP8266. This setup allows for remote monitoring of the appliances via an Android app and the logging of their status in a cloud server. The primary objective of this system is to reduce electricity expenses by efficiently monitoring and controlling home appliances.
The authors conduct a literature survey, reviewing existing research within the IoT and home automation domain. Additionally, they present the results of their experiments, which validate the successful implementation of the proposed system. In their conclusion, the article asserts that the integration of IoT into home automation can enhance efficiency, save time, and foster an improved living environment. Furthermore, the authors suggest that future work could explore the application of this system in various industries, employing different microcontrollers such as the Raspberry Pi.

This paper **[11]** presents a remote home automation system that empowers users to control and oversee various appliances through a mobile application. The system capitalizes on Internet of Things (IoT) technology, utilizing an Android smartphone as a transmitter and an MQTT-based broker for communication. It offers an economically viable solution for appliance control, bolstering security, and enhancing convenience. While the paper offers a thorough overview, it would be advantageous to include additional technical details on implementation and considerations related to security.
In summary, the paper underscores the increasing demand for automated home systems and suggests potential avenues for future development, such as the incorporation of biometrics and more advanced appliance integration.

The research paper **[12]** introduces an innovative Voice/Text controlled Home Application that harnesses the power of the Internet of Things (IoT) to transform standard residences into intelligent, automated environments. The paper details the process by which users can remotely control home appliances using either voice commands or text messages, schedule appliance operations, and receive real-time status updates. Thisis achieved through the utilization of Node-RED Technology and a NodeMCU device. Notably, the paper underscores the cost-effectiveness of this solution, which broadens its accessibility to a diverse user base, including elderly and differently-abled individuals.

In conclusion, the paper suggests potential future enhancements, such as integrating gas leakage detection and automatic water tank filling. In summary, this research paper offers a practical and cost-effective approach to smart home automation. Its commendable potential to enhance the quality of life for elderly and differently-abled individuals is noteworthy. Nonetheless, to provide a more comprehensive understanding, the paper would benefit from including more detailed technical specifications and a discussion of potential challenges or limitations in real-world implementations.

The research paper **[13]** introduces an innovative Voice/Text controlled Home Application that leverages the Internet of Things (IoT) to convert regular homes into smart and automated environments. The paper details how users can remotely manage home appliances using voice commands or text messages, schedule appliance operations, and receive status updates by employing Node-RED Technology in conjunction with a NodeMCU device. Notably, the paper underscores the cost-effectiveness of this solution, making it accessible to a broader user base, including elderly and differently-abled individuals.

In conclusion, the paper suggests future enhancements, such as incorporating gas leakage detection and automatic water tank filling. In sum, this research paper presents a pragmatic and budget-friendly approach to smart home automation. Its potential to enhance the quality of life for elderly and differently-abled individuals is laudable. However, for a more comprehensive understanding, it would be beneficial to include more detailed technical specifications and discuss potential real-world challenges or limitations.

This scientific article **[14]** explores the critical role of appliance load monitoring in enhancing energy efficiency within the context of smart homes and the broader smart grid. It introduces two key methods for managing this process: intrusive load monitoring (ILM) and non-intrusive load monitoring (NILM). ILM entails attaching low-end metering devices to individual home appliances, while NILM necessitates only a single point of sensing. While ILM solutionscan be more costly, they offer superior efficiency and reliabilitycompared to NILMs.
The article introduces a novel ILM approach grounded in an Internet of Things (IoT) architecture. This architecture is comprised of various layers, including the appliances layer, perception layer, communication network layer, middleware

layer, and application layer. The primary function of the appliance recognition module is to label sensor data, enabling the implementation of various home applications.
Furthermore, the article offers insights into related studies and outlines the system's design and operational processes. It provides a comprehensive overview of the subject, shedding light on the importance of appliance load monitoring and its potential to enhance energy efficiency within smart homes and the larger smart grid.

The paper **[15]** delves into the realm of security concerns within the context of the Internet of Things (IoT) and outlines a conceptual framework and architecture for future home appliances. It places a particular emphasis on mitigating issues such as Man in The Middle Attacks (MITM), physical breaches, cloning, data tampering, and routing attacks. The proposed architecture takes into account the security requirements recommended by the Internet Engineering Task Force (IETF) to ensure the successful deployment of IoT.
The paper conducts a comprehensive evaluation of existing solutions and suggests a model that integrates layered security principles, drawing from prior research. This model introduces the use of biometric parameters for generating private keys and incorporates concepts from intrusion detection systems. The overarching goal is to safeguard the confidentiality, integrity, availability, and control of IoT devices within smart homes.

This article offers an in-depth analysis of security concerns in the IoT domain and provides innovative solutions to address these concerns. Future research will center on performance management, further enhancing the robustness and efficiency of the proposed security model.

This paper **[16]** outlines the development of a smart home system that utilizes networked low-power sensors. The system encompasses environmental sensing, data analysis, and user customization, featuring a Raspberry Pi server and Bluetooth communication. Users can easily manage the system through a user-friendly Android app. Notably, the system offers key benefits such as sensitivity, security, and configurability, making it an elegant solution for home automation.
The paper underscores the importance of smart homes in enhancing care for elderly and disabled individuals, facilitating independence and promoting health maintenance. It delves into various technologies, including Bluetooth, microcontrollers,and mobile apps. Moreover, the system's scalability allows it to accommodate additional sensors and devices, providing a comprehensive approach to improving the living environment and enhancing energy efficiency.

This paper **[17]** introduces an economical and efficient smart home automation solution that capitalizes on Internet of Things (IoT) technology. It utilizes an ESP32 Wi-Fi module and a custom-made private web server for the supervision and management of household appliances. The authors underscore the rising demand for home automation and its potential to elevate our quality of life.

They furnish a comprehensive examination of the system's architecture, hardware components, and even offer a cost analysis, illustrating its cost-effectiveness.
This system boasts several noteworthy advantages, including energy conservation, the capability for remote control, and the ability to monitor power consumption. Consequently, this paper stands as a significant contribution to the realm of IoT-driven home automation, offering a pragmatic and accessible solution for modernizing residences. Its affordability and user-friendly interface render it an appealing choice for individuals seeking to embrace the conveniences of a smart home.
This research paper **[18]** delves into the realm of smart homes and their diverse applications. It explores how the Internet of Things (IoT), in conjunction with other technologies like Machine Learning, Big Data, and cloud computing, can be harnessed to augment the intelligence of our living spaces.
Smart homes are meticulously designed to heighten convenience and energy efficiency. They enable remote control and automation of an array of household appliances and systems. For instance, sensors play a pivotal role in detecting potential hazards such as kitchen fires and promptly notifying residents. Water tank levels are monitored and regulated to prevent overflows, and energy-saving measures are implemented by automating lights and devices when they're notin use.
The paper underscores a variety of smart home approachesand applications, including:

1. Gas Leakage and Fire Detection: Employing sensors and Raspberry Pi technology to identify and alert users about gas leaks and fires.
2. Smart Home Energy Management: The monitoring and regulation of energy consumption within the household.
3. Smart Water Management: Monitoring water levels and quality in tanks.
4. Home Automation: Enabling remote control of lightingand appliances.
5. Smart Firefighting Drones: The utilization of drones equipped with fire extinguishing capabilities to combat fires.

These technologies are seamlessly integrated into a smart home ecosystem, where devices communicate with one another and can be controlled via mobile applications. The paper places a strong emphasis on the potential benefits of these systems, particularly in the domains of energy conservation and heightened safety. This paper **[19]** offers an extensive examination of IoT-drivendomestic appliances, accentuating their potential to simplify and enrich human life. It encompasses IoT architecture, the advantages it brings, and the fundamental operational principlesof these devices in the realm of home automation. The review underscores the burgeoning relevance of IoT in today's fast- paced world and its adaptability across diverse sectors, spanning industry, commerce, and healthcare. Furthermore, it delves into the amalgamation of artificial intelligence with IoT,providing valuable insights into how the collaborative utilization of these technologies can collectively enhance comfort and convenience. In summary, this paper delivers valuable information regarding the extensive impact of IoT andits pivotal role in shaping a more efficient and interconnected future.

III. APPLICATION, SYSTEM AND METHODS IN SMART HOME TECHNLOGY

IOT is used to make Smart home and Smart homes, bring significant benefits to society, with a special focus on improving the lives of the elderly and disabled population.
Smart Home Systems: Smart home systems as residential setups utilizing a Home Controller to amalgamate diverse home

automation systems.
It delves intotechnologies such as Powerline Carrier Systems (PCS) and discusses relevant protocols like X10 and Lon Works.

Smart Home Technology: Various smart home communication technologies, including X10, ZigBee, Z-Wave, and Insteon are used. It elucidates the operational principles of these technologies and outlines their distinct advantages.

Installing a Smart Home: IOT for Smart home required practical guidance on the planning and design of smart homes, taking into account critical factors such as budget constraints and potential for future expansion.

IV. BENEFITS AND RISKS OF SMART HOME TECHNOLOGIES

1) Potential users recognize the advantages, such as energy, time, and cost savings, but express concerns regarding overreliance on technology.
2) Early adopters hold similar perspectives, valuing the benefits but approaching adoption with caution, being well-informed about potential drawbacks.
3) Industry marketing campaigns emphasize the energy-saving and security aspects of smart home technology.
4) Policymakers can play a pivotal role in encouraging the widespread adoption of smart home technology by establishing industry standards and robust privacy guidelines.
5) Building and maintaining consumer confidence is paramount, with a special focus on safeguarding data security, which is crucial for the long-term success of smart home technology.

V. CONCLUSIONS

The Internet of Things (IoT) is rapidly revolutionizing household appliances, enhancing their intelligence, efficiency, and convenience. IoT-enabled home appliances offer remote control and monitoring, empowering users to economize on energy consumption, bolster security, and elevate their overall quality of life. One of the prominent advantages of IoT home appliances is the potential for energy conservation. For instance, smart thermostats possess the capability to learn users' heating and cooling preferences and autonomously adjust the temperature, culminating in substantial energy savings, particularly when calculated over the span of a year.
As the IoT landscape continues to evolve, we can anticipate a proliferation of ingenious and practical IoT home appliances in the forthcoming years.

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Gain enhancement of a Stacked Rectangular Dielectric Resonator Antenna

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Abstract— **This work presents a method of enhancing the gain using stacked rectangular dielectric resonator antennas (RDRA). The purpose of stacked RDRA with z form slot is to increase impedance and AR bandwidth. Higher gain is achieved with metal-coated stacked RDRA with Z shape slot. The designed antenna operates in the range of 5.02 GHz to 10 GHz. A measured gain of 11.9 dB is provided by stacked DRA coated with metal.**
Keywords— Metal coated ,Stacked dielectric resonator antenna, High gain.

I. INTRODUCTION

Over the past ten years, dielectric resonator antennas (DRAs) have drawn a lot of attention in the field of antenna design [1-3]. Its tiny size, strong radiation potency, and low ohmic losses make it even more likely that they will function at higher frequencies, such as those used in satellite and radar applications. Broadband, and compact antenna designs are essential for modern wireless communication systems. There are numerous methods for improving gain and the axial ratio bandwidths of single feed DRAs that are reportable in [4]–[13]. It has been demonstrated that the rotated-stacked technology is an effective means of increasing the axial ratio bandwidth in [4] [5]. However, because DRs are made up of numerous layers with different rotation degrees, assembling such antennas is challenging. Although it has been used to increase bandwidth in [6]–[8], a large antenna size is also a byproduct of the dual-mode operation that is inherent in all or any microstrip fed high ratio (height-to-width or height-to-length ratio) DRAs. Changes in cross-slot and traveling-wave slot are used in [9] [10]. Unfortunately, it is difficult to appropriately evaluate and build this type of antenna. Various techniques have been suggested to increase the gain [14–16]. The gain of a cross DRA was increased to more than 9 dBi using a surface-mounted short horn [14]. A very high rectangular DRA was used to excite the higher-order TEδ15 mode in order to achieve a maximum gain of 9.1 dBi [16]. These methods do, however, make the DRAs more complex or higher. Space-constrained applications should not use high profile DRAs. A replacement moderately dense material patch antenna (DDPA) has recently been studied in [21]–[25], and the results show that, when compared to microstrip patch antennas, the material patch antenna will provide stronger radiation potency, a broader bandwidth, and a similar gain.

This paper presents a novel design technique of metal coated stacked DRA for gain enhancement. DRA is fed with z shape slot. Three different antenna designs investigated are shown in Fig. 2. The first design(antenna1) proposed z shape slot fed DRA. The second design (antenna 2) consists of stacked DRA with Z slot and the third design (antenna 3) consists of metal coated stacked DRA. The various proposed DRA structure are analyzed using Ansoft high frequency Simulator HFSS. Moreover, the antenna arrangement is straightforward and requires a single feeding. One easy method to increase gain is to apply conductive coating at the DR. The prototype of antenna is developed in lab and tested on Vector Network Analyzer.

II. ANTENNA STRUCTURE

The geometry of proposed antenna is shown in Fig.1. The design consists of FR4 epoxy substrate with permittivity 4.4 and dimensions (lg *Wg) with height 0.8mm. The permittivity of ceramic material used for DRA is 12.8. For impedance matching stub of length s is used. SMA connector is used for RF excitation. Fig.1(a) shows geometry of DRA with Z shape slot. Z shape slot is made by three rectangular shape slot of same dimensions. The schematic design consists of three rectangular DRA is shown in Fig 1(b). Two DRAs are made up of same permittivity material with same cross section area and height to form stacked DRA. The breadth of middle DRA is double of that other two DRAs to enhance the bandwidth. The total height of stacked DRA is the combination of the height of two DRA. From the micro strip line to DRA, the field is connected via a Z-shaped slot in the ground plane at the substrate's top. In the third design DRA is coated with conductive material. This metal coating represents an innovative approach to improving gain. The metal coating directs the beam from an antenna in the desired direction, acting as a parasitic element. Table I provides an overview of all the antenna's optimum dimensions.

The geometry of antenna is determined using equations developed from DVM model. The resonant frequency of DRA is given by:

$$k_x^2 + k_y^2 + k_z^2 = \varepsilon_r k_0^2$$

$$f_o = \frac{c}{2\pi\sqrt{\varepsilon_r}}\sqrt{k_x^2 + k_y^2 + k_z^2}$$

$$k_x = \frac{\pi}{a} \;\; ; \; k_y = \frac{\pi}{b}$$

$$k_z \left(\tan\frac{k_z d}{2}\right) = \sqrt{(\varepsilon_r - 1)k_0^2 - k_z^2}$$

In this example, c represents the velocity of light, ε_r indicates the dielectric constant of the dielectric resonator antenna, and k_0, k_x, k_y and k_z are the wave numbers along the x, y, and z directions.

The following equation has been utilized as the basis for defining slot dimensions since the aperture coupling technique of excitation of DRA is used:

Slot length,

$$L_S = \frac{0.4\lambda_o}{\sqrt{\varepsilon_e}}$$

Where λ_o the wavelength and the following is the definition of effective permittivity:

$$\varepsilon_e = \frac{\varepsilon_r + \varepsilon_s}{2}$$

Where the dielectric constants for the substrate and rectangular dielectric resonator are, respectively, ε_r and ε_s .

Slot width,

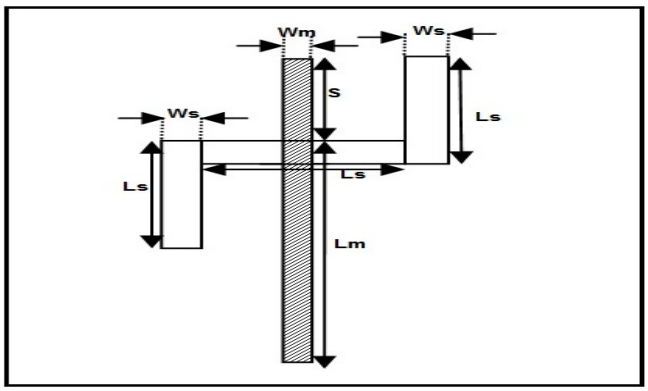
$$W_s = 0.2L_s$$

Stub length, $s = \frac{\lambda_g}{4}$

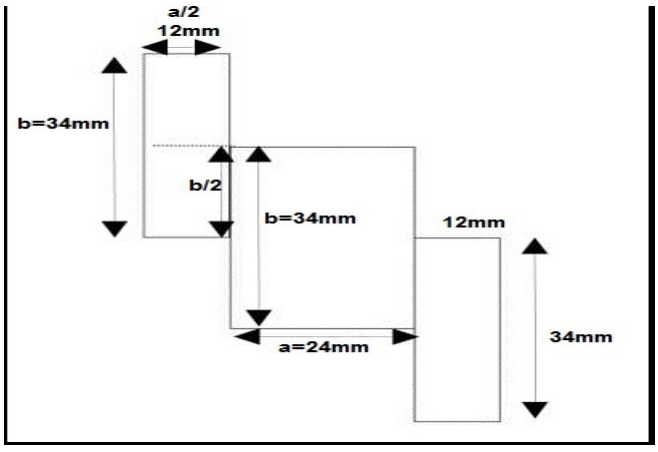
Where the guided wave in the substrate is λ_g ..

III. RESULTS

The high gain antenna is designed, fabricated and tested for demonstration. The three geometries of antenna are proposed and investigated.



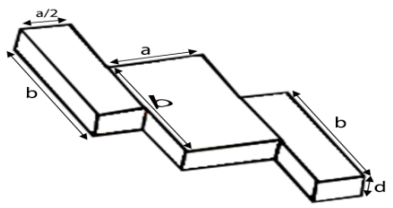
(a)



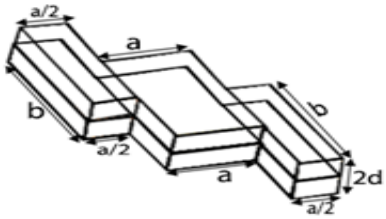
(b)

Fig 1(a-b) Geometry of proposed R DRA

The first antenna structure (antenna 1) contains three rectangular DRA with z shape slot. Z shape slot is made by 3 rectangular shape slots of same dimensions. The second antenna structure (antenna 2) contains 3 stacked rectangular DRA with z shape slot. In the third structure (antenna 3), the design consists of 3 stacked rectangular DRA with z shape slot coated with conductive material as shown in Fig.2.



(a)



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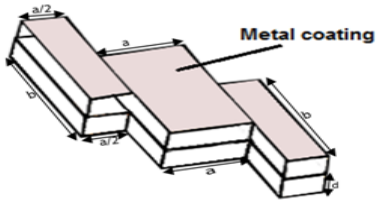


(c)

Fig. 2. Three antenna design (a) DRA, (b) Stacked DRA, (c) Metal coated Stacked

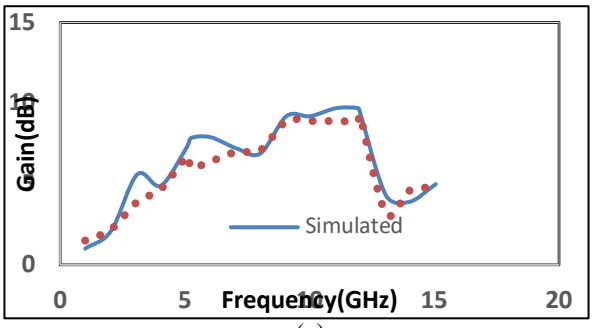
TABLE I: Design Dimensions

Elements	Dimensions	Elements	Dimensions
a	24mm	Lg	80mm
b	34mm	Wg	80mm
d	6mm	Ls	13mm
s	2.1mm	Ws	1.5mm

It has been verified that by metal coating the stacked DRA high gain can be realized. The antenna's structural complexity is not increased by the conductive coating since it may be accomplished by pasting easily accessible copper tape.The gain can be further enhanced by making use of DRA material with high permittivity. Anechoic Chamber and Vector Network Analyzer have been used to test and develop the antenna prototype.

The simulated and measured gain of all three antenna structure is shown in Fig 3. Table II shows the comparison of gain of three antenna structures , simulated and measured gain is 9.7 dB and 8.9 dB. Stacking enhanced the simulated and measured gain of (antenna 2) to 10.7 dB and 9.8 dB. The conductive coating on (antenna 3) enhances the simulated and measured gain of an antenna to 12.7 dB and 11.9 dB.

Fig.4 shows measurement setup of return loss with the variation of frequency in the specified range through VNA by connecting the SMA connection for providing feeding power to the DRA. E field pattern are shown in Fig.5.



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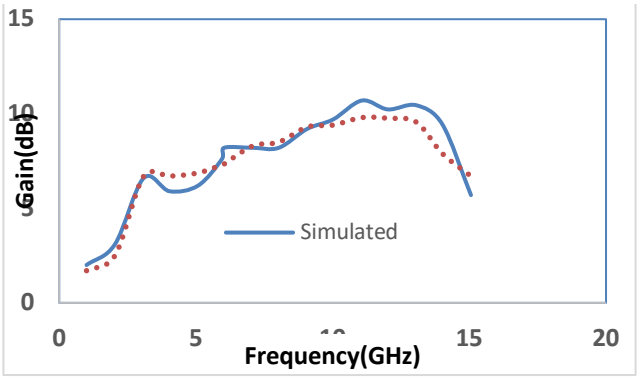

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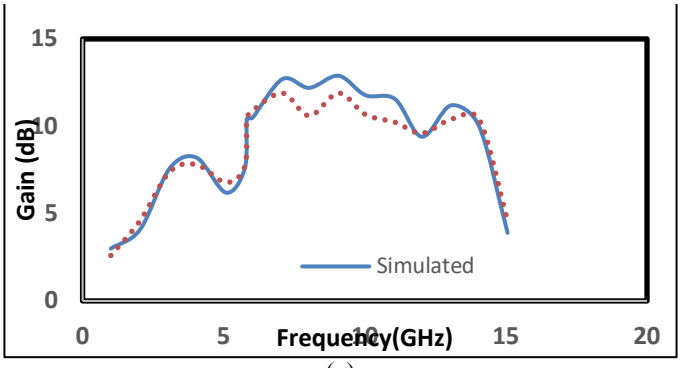
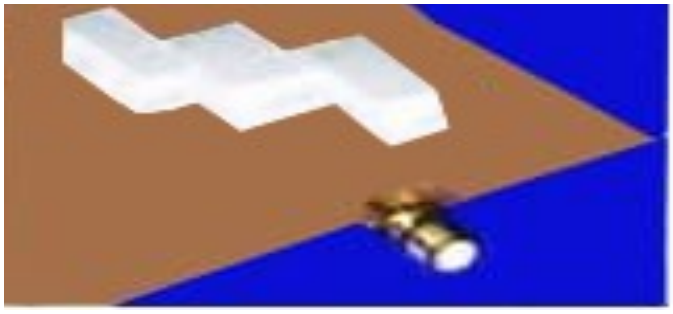
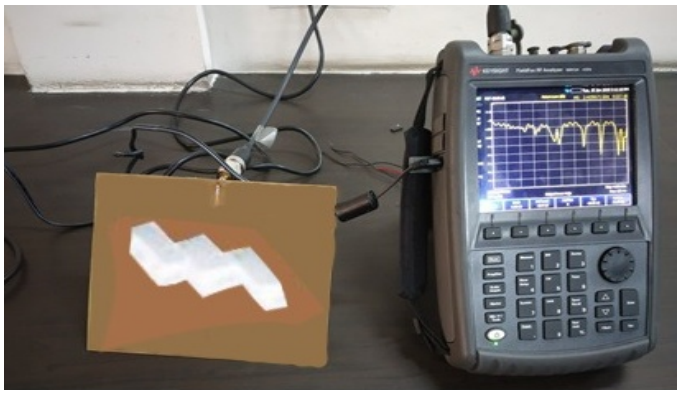


(c)

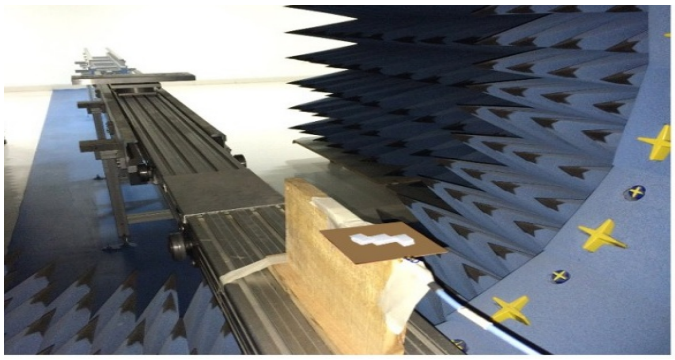
Fig. 3. Gain performance of (a) Antenna 1,(b) Antenna 2, (c) Antenna 3



(a)

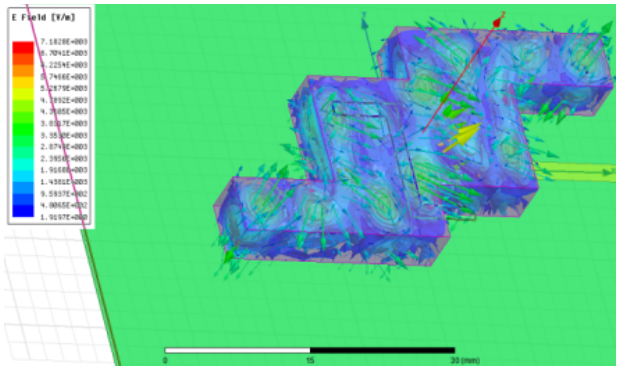


(b)

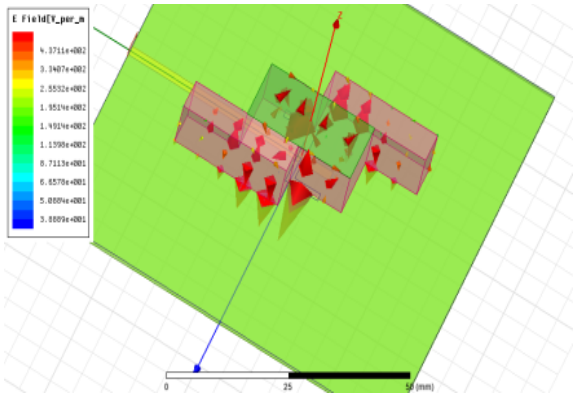


(c)

Fig 4(a-c) Fabricated Proposed Design of RDRA



(a)



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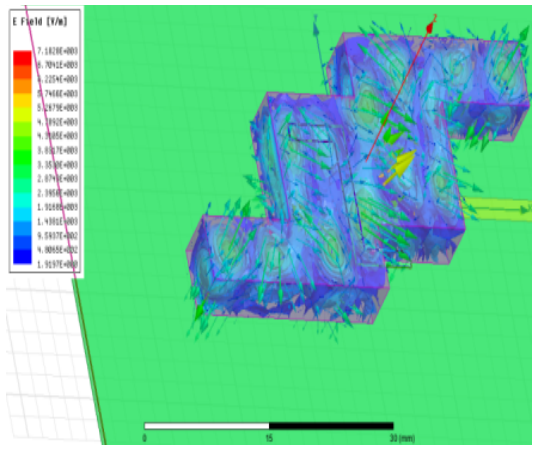

(c)

Fig.5. E field pattern at the top surface of DRA (a) Antenna 1,(b) Antenna 2 ,(c) Antenna 3

TABLE II: Comparison of Gain

	Gain	
	Simulated(dB)	Measured(dB)
Antenna 1	9.7	8.9
Antenna 2	10.7	9.8
Antenna 3	12.7	11.9

IV. Conclusion

Stacked RDRA with z form slot is designed to enhance the gain. Metal coated stacked RDRA with Z form slot ends up in higher gain. Metal coated stacked DRA provides the measured gain of 11.9 dB. The proposed design of RDRA can be used in C and X band application such as surveillance, weather radar, satellite communication and wireless computer network etc.

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Human Motion Recognition using deep learning: A Comprehensive Review

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Abstract—**Human motion recognition is a fundamental task with a wide range of applications, from healthcare and sports analysis to robotics and security. Over the past decade, deep learning has revolutionized this field, enabling more accurate and robust human motion recognition systems. This review paper provides a comprehensive overview of the state-of-the-art techniques, datasets, challenges, and applications in human motion recognition using deep learning methods. It covers key aspects of the field, including data preprocessing, model architectures, training strategies, and recent advancements. The aim is to offer a valuable resource for researchers and practitioners interested in the domain of Human Motion Recognition**

Keywords:- Deep learning, Optimization, Biomechanics, Augumentation, Supervised learning, Unsupervised learning.

I. INTRODUCTION

Human motion recognition is a critical area of study and application in various fields due to its profound importance in understanding, analyzing, and improving human activities. Here's a brief introduction to its significance:

1. Healthcare and Rehabilitation: Human motion recognition is vital in healthcare for monitoring and rehabilitating patients. It can help assess the movements of individuals recovering from injuries or surgeries, ensuring they perform exercises correctly and tracking their progress.

2. Sports and Fitness: In the world of sports and fitness, motion recognition plays a key role in enhancing training techniques, preventing injuries, and analyzing athlete performance. It helps in monitoring and optimizing movements, such as running gait, to improve athletic performance.

3. Virtual Reality and Gaming: Motion recognition technology is central to creating immersive virtual reality experiences and enhancing gaming interfaces. It allows users to interact with virtual environments through gestures and movements, making the experience more engaging and lifelike.

4. Human-Computer Interaction: Motion recognition is crucial for making human-computer interactions more intuitive and natural. It enables devices to understand and respond to gestures, making them more user-friendly and accessible.

5. Security and Surveillance: In security and surveillance, motion recognition is used for tracking and identifying human movements. It is an essential component of video surveillance systems and can be used for detecting unauthorized access or suspicious activities.

6. Biomechanics and Ergonomics: Understanding human motion is critical in designing ergonomic workplaces and products. Researchers use motion recognition to study how people move and interact with their environment, leading to improved designs and reduced injury risks.

7. Entertainment and Animation: Motion recognition is a key technology in the animation and entertainment industry. It allows for more realistic and dynamic character animation, enhancing the quality of movies, television shows, and video games.

8. Assistive Devices: In the domain of assistive technology, motion recognition can greatly benefit individuals with disabilities. It enables them to control devices, such as wheelchairs or communication tools, through their movements and gestures, providing increased independence.

9. Machine Learning and AI: Human motion data is a valuable resource for training machine learning and artificial intelligence models. It can be used to develop algorithms that recognize, predict, and generate human movements, opening up new possibilities in automation and robotics.

10. Research and Education: Motion recognition is pivotal in scientific research related to human behavior, biomechanics, and psychology. It also aids in educational settings, allowing for innovative teaching methods and tools.

Human motion recognition is a multidisciplinary field with widespread applications that impact healthcare, sports, technology, entertainment, and many other domains. Its ability to capture, analyze, and understand human movement is essential for improving various aspects of our lives, from personal well-being to technological advancements.

II. HISTORICAL PERSPECTIVE ON MOTION RECOGNITION

A historical perspective on motion recognition reveals a timeline of advancements and innovations in this field, which has seen significant progress over the decades. Here are some key milestones and developments in the history of motion recognition.

1. Early Efforts (20th Century):
In the early to mid-20th century, pioneers in cinematography and animation, such as Eadweard Muybridge and Walt Disney, made significant contributions to motion analysis and animation. Muybridge's work with sequential photography laid the foundation for motion analysis, while Disney's use of rotoscoping in animation demonstrated the potential for motion capture techniques.

2. Development of Motion Capture (1970s-1980s):
The emergence of motion capture technology in the 1970s and 1980s marked a major turning point. The technology, initially used in the film industry, involved attaching sensors to actors to capture their movements for use in animation and special effects. Innovations in this era laid the groundwork for modern motion recognition.

3. Computer Vision and Gesture Recognition (1980s-1990s):
Computer vision and gesture recognition research gained momentum in the 1980s and 1990s. Researchers developed algorithms and techniques to identify and interpret human gestures and movements, making it possible to interact with computers and devices through gestures.

4. Advancements in Biomechanics (1980s-Present):
Biomechanics researchers have been instrumental in understanding human motion. They have employed technologies such as motion capture systems, force plates, and electromyography to study human movement, leading to improved sports performance and rehabilitation techniques.

5. Emergence of Microsoft Kinect (2010):
The release of the Microsoft Kinect sensor in 2010 was a game-changer in motion recognition. It combined depth sensing and skeletal tracking, allowing users to interact with video games and other applications through gestures. The Kinect opened up new possibilities for motion-based interfaces and gaming.

6. Machine Learning and Deep Learning (2010s-Present):
In recent years, machine learning and deep learning techniques have revolutionized motion recognition. Convolutional neural networks (CNNs) and recurrent neural networks (RNNs) have been used to analyze and interpret motion data, making it possible to recognize complex movements and gestures.

7. Applications in Virtual Reality (VR) and Augmented Reality (AR) (2010s-Present):
Motion recognition has become integral to the development of virtual reality and augmented reality applications. Devices like the Oculus Rift and HTC Vive use motion tracking to provide immersive VR experiences. AR glasses and headsets also utilize motion recognition for user interaction.

8. Expanding Applications (2010s-Present):
Motion recognition has found applications in fields such as healthcare, security, robotics, and education. It plays a key role in assisting individuals with disabilities, monitoring patient movements, and enhancing human-robot interaction.

9. Fusion with Sensor Technologies (2010s-Present):
Advances in sensor technologies, including inertial measurement units (IMUs), have complemented motion recognition systems. These sensors are used in wearables and smartphones for tracking activities, enhancing fitness applications, and more.

The history of motion recognition is marked by a steady progression from early motion analysis to the sophisticated technologies and applications we see today. It has evolved from its origins in animation and filmmaking to become a multidisciplinary field with far-reaching implications for various industries and domains. The future holds further potential for motion recognition as technology continues to advance.

III. ROLE OF DEEP LEARNING IN ADVANCING THE FIELD

Deep learning has played a pivotal role in advancing the field of motion recognition by providing more sophisticated and accurate methods for analyzing and understanding human movement. Here are some key roles and contributions of deep learning in this context:

1. Complex Feature Extraction:
Deep learning models, particularly Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs), excel at automatically learning intricate features from raw motion data, such as video frames or sensor readings. This capability allows for the extraction of complex motion patterns that might be challenging to capture using traditional handcrafted feature engineering.

2. Improved Recognition Accuracy:
Deep learning algorithms have significantly improved the accuracy of motion recognition systems. They can recognize a wide range of human movements, gestures, and poses with high precision, making them suitable for applications that require fine-grained recognition, such as sign language interpretation or gait analysis.

3. Temporal Modeling:
RNNs, Long Short-Term Memory (LSTM) networks, and other sequence models in deep learning are well-suited for capturing the temporal dynamics of motion sequences. They can understand not only the current frame but also the context of previous frames, making them highly effective for tasks like action recognition in videos.

4. Transfer Learning:
Deep learning models trained on large datasets can be fine-tuned for specific motion recognition tasks. Transfer learning allows researchers and developers to leverage pre-trained models, saving time and computational resources and often improving performance on domain-specific recognition tasks.

5. Multimodal Fusion:
Deep learning techniques enable the fusion of data from multiple sensors or modalities (e.g., video, depth sensors, inertial sensors). This multimodal fusion enhances the robustness and accuracy of motion recognition systems by providing a more comprehensive understanding of the subject's movements.

6. Real-time Processing:

Deep learning models can be optimized for real-time processing, making them suitable for applications where low-latency recognition is critical, such as in virtual reality, gaming, or robotics. This real-time capability enhances the user experience and interaction with these systems.

7. Customization and Adaptation:
Deep learning models can be fine-tuned and adapted to specific environments or users. This adaptability is valuable in healthcare, rehabilitation, and sports training, where personalized motion recognition systems can be tailored to an individual's unique needs and progress.

8. Unsupervised Learning:
Deep learning techniques like autoencoders and variational autoencoders can perform unsupervised representation learning. This can be useful for discovering underlying patterns and anomalies in motion data without the need for extensive labeled training data.

9. Privacy-Preserving Motion Recognition:
Deep learning allows for the development of privacy-preserving motion recognition systems. Techniques such as federated learning enable models to be trained collaboratively without sharing sensitive user data, ensuring privacy and security.

10. Continual Learning:
Deep learning models can be designed to support continual learning, allowing them to adapt and improve over time as they encounter new motion patterns or scenarios. This adaptability is crucial for long-term applications.

Deep learning has brought a significant transformation to the field of motion recognition by enhancing recognition accuracy, enabling real-time processing, and providing tools for sophisticated feature extraction and temporal modeling. Its flexibility and adaptability have broadened the range of applications and opened new possibilities for understanding and interacting with human motion.

IV. DATA PREPARATION AND PREPROCESSING

- **Datasets for Human Motion Recognition**

Several datasets are available for human motion recognition research and applications. These datasets provide a diverse range of motion data for training and testing various algorithms, including those based on deep learning. Here are some notable datasets for human motion recognition:

1. Human 3.6M:
Human 3.6M is a widely used dataset for 3D human pose estimation and action recognition. It contains high-quality motion capture data of various activities performed by multiple subjects, making it suitable for evaluating complex motion recognition algorithms.

2. NTU RGB+D:
The NTU RGB+D dataset is a large-scale dataset that combines depth and RGB information. It includes diverse activities performed by multiple subjects in various environments. This dataset is commonly used for action recognition and pose estimation in 3D space.

3. MPII Human Pose Dataset:
The MPII Human Pose dataset consists of images with annotated 2D poses. It is commonly used for human pose estimation and includes a wide variety of human activities in natural settings.

4. CMU Panoptic Studio Dataset:
The CMU Panoptic Studio dataset provides multi-view, multi-modal data, including 2D and 3D pose information, for multiple subjects. It is suitable for research in multi-view human pose estimation and action recognition.

5. PKU-MMD:
PKU-MMD is a dataset that focuses on fine-grained human motion analysis. It contains a wide range of motions performed by multiple subjects and is often used for research in action recognition and pose estimation.

6. UCF101:
The UCF101 dataset is primarily used for action recognition in videos. It includes 101 action categories, making it a valuable resource for evaluating action recognition algorithms.

7. Penn Action:
Penn Action is a dataset designed for human action recognition in static images. It includes various action categories, and each action is captured at multiple time steps, allowing for temporal analysis.

8. CAD-120:
CAD-120 is a dataset for activity recognition in RGB-D data. It contains recordings of daily activities performed by subjects in a home environment and is suitable for research in context-aware activity recognition.

9. HMDB51:
The HMDB51 dataset is another dataset for human action recognition in videos. It includes 51 action categories and is commonly used for evaluating the performance of action recognition models.

10. SBU Kinect Interaction Dataset:
This dataset focuses on human interactions. It contains RGB-D data of two people interacting in various scenarios, making it suitable for research on interaction recognition and gesture analysis.

11. CMU Graphics Lab Motion Capture Database:
This extensive database contains motion capture data of various activities, including sports, dancing, and everyday movements. It is a valuable resource for motion analysis and synthesis research.

When using these datasets, be sure to review their terms of use and citation requirements. Additionally, consider the specific requirements and objectives of your motion recognition research to select the most appropriate dataset for your needs.

- **Data augmentation techniques**

Data augmentation techniques are essential for enhancing the performance and robustness of deep learning models in human motion recognition tasks. Augmentation helps prevent overfitting and allows models to generalize better across various scenarios. Here are some data augmentation techniques commonly used in human motion recognition:

1. Temporal Augmentation:

a) Time warping: Stretch or compress the temporal dimension of motion sequences, which helps models learn to recognize actions at different speeds.

b) Frame sampling: Randomly skip or duplicate frames in a sequence to simulate variations in frame rate or reduce computational complexity.

2. Spatial Augmentation:

a) Crop and resize: Randomly crop and resize the spatial dimensions of video frames or images. This can simulate different camera angles and perspectives.

b) Flip or mirror: Horizontally flip video frames or images to account for left-right symmetry in human movements.

2. Additive Noise:

a) Gaussian noise: Add Gaussian noise to video frames or motion data to simulate sensor noise or environmental variability.

b) Salt and pepper noise: Introduce random pixel-level noise to images to mimic low-quality or noisy input data.

3. Geometric Transformations:

a) Rotation: Apply random rotations to images or motion sequences to simulate variations in the viewing angle.

b) Translation: Shift video frames or motion sequences within the frame to account for slight spatial variations.

4. Color Augmentation:

a) Adjust brightness, contrast, and saturation: Randomly modify the color and lighting conditions in video frames or images.

b) Hue shifts: Change the hue of images to simulate different lighting conditions.

5. Data Mixing:

Mix two or more sequences: Combine multiple motion sequences or videos by overlaying or interpolating them. This technique can create diverse composite samples.

7. Style Transfer:

Apply style transfer techniques to generate motion sequences with different visual styles. This can be particularly useful for tasks involving artistic or stylized movements.

8. Data Generation:

Use generative models, such as Variational Autoencoders (VAEs) or Generative Adversarial Networks (GANs), to generate synthetic motion sequences. These generated sequences can be used to augment the dataset.

9. Domain-Specific Augmentation:

Incorporate domain-specific knowledge to create relevant augmentations. For example, in sports analysis, augmentations could simulate variations in player positions or equipment use.

10. Occlusion and Missing Data:

Simulate occlusions by partially hiding or masking portions of the motion data or video frames. This helps models learn to handle incomplete information.

11. Action Transitions:

Introduce abrupt transitions between actions within a sequence to make models robust to sudden changes in motion patterns.

12. Data Subsampling:

Reduce the number of frames in a sequence, creating shorter motion segments. This can help the model focus on key action segments within a longer sequence.

When applying data augmentation, it's important to strike a balance between introducing variability and maintaining the realism of the data. Careful consideration of the domain and task-specific requirements is essential to ensure that the augmented data remains representative of the problem at hand. Additionally, validation and testing data should not be augmented to accurately evaluate model performance.

V. DEEP LEARNING ARCHITECTURE

Out of various methods used in deep learning we are discussing CNN here.

Convolutional Neural Networks (CNNs)

Convolutional Neural Networks (CNNs) have proven to be highly effective in various computer vision tasks, including human motion recognition. CNNs are particularly well-suited for analyzing human motion data, whether in the form of video sequences or 2D/3D pose data. Here's how CNNs are employed in deep learning for human motion recognition:

1. Input Representation:

CNNs typically take images or image-like data as input. In the context of human motion recognition, this can include individual video frames, skeleton joint positions, depth maps, or any other suitable representation of motion data.

2. Convolutional Layers:

The convolutional layers in CNNs are used to automatically extract spatial features from the input data. In the case of motion data, these layers can identify patterns related to body posture, movement, and object interactions.

3. Pooling Layers:

Pooling layers downs sample the feature maps created by convolutional layers. This helps reduce the computational load and maintain translational invariance, which is useful for recognizing actions from different camera viewpoints.

4. Temporal Modeling:
In the context of video-based human motion recognition, CNNs are often used in combination with recurrent layers, such as Long Short-Term Memory (LSTM) or Gated Recurrent Unit (GRU) layers. These recurrent layers capture temporal dependencies by considering information from previous frames, allowing for the recognition of motion sequences.

5. 3D CNNs:
For 3D data, such as depth maps or spatiotemporal volumes, 3D CNNs are used to extract both spatial and temporal features simultaneously. This approach is especially effective for action recognition in 3D space.

6. Preprocessing and Data Augmentation:
Data preprocessing, including resizing, normalization, and data augmentation, plays a crucial role in enhancing the performance of CNNs in motion recognition. Preprocessing steps ensure that the data is consistent and suitable for training, while augmentation helps the model generalize better.

7. Transfer Learning:
Transfer learning can be beneficial in motion recognition tasks. Pre-trained CNN models on large-scale image datasets (e.g., ImageNet) can be fine-tuned for motion recognition tasks, saving time and computational resources while improving performance.

8. Action Recognition:
For action recognition, CNNs can output a classification label that corresponds to a recognized human action. This is achieved by adding one or more fully connected layers and applying a softmax activation function to produce action probabilities.

9. Skeleton-Based Recognition:
In skeleton-based human motion recognition, CNNs can be employed to process 2D or 3D joint positions. The model learns to recognize action patterns based on the spatial relationships and movements of joints.

10. Ensemble Models:
Combining multiple CNN models, each focusing on different aspects of the motion data (e.g., appearance, motion, or skeleton), can lead to improved performance through ensemble techniques.

11. Real-Time Applications:
CNNs can be optimized for real-time processing, making them suitable for applications that require low-latency human motion recognition, such as interactive systems, virtual reality, and robotics.

12. Evaluation Metrics:
Common evaluation metrics for human motion recognition using CNNs include accuracy, precision, recall, F1 score, and confusion matrices, depending on the specific task and dataset.

CNNs have become a fundamental tool in deep learning for human motion recognition. Their ability to automatically learn and extract relevant features from motion data, combined with their adaptability to various data modalities, makes them a valuable choice for tasks ranging from action recognition in videos to gesture recognition in real-world applications.

Training Strategies using CNN

Human motion recognition using deep learning involves training models to understand and predict human movements, which can have applications in various fields like sports analysis, healthcare, robotics, and more. Here are some training strategies and considerations for building effective human motion recognition models using deep learning:

1. Data Collection and Preprocessing:
- Collect a diverse dataset of human motion sequences. This may involve motion capture data, video recordings, or sensor data from accelerometers or gyroscopes.
- Preprocess the data to ensure it's in a suitable format for training. This might involve normalizing, resampling, and augmenting the data to improve generalization.

2. Choose a Neural Network Architecture:
- Choose an appropriate deep learning architecture for your task. Recurrent Neural Networks (RNNs), Convolutional Neural Networks (CNNs), and combinations like Convolutional Recurrent Neural Networks (CRNNs) are commonly used for motion recognition.
- Consider using 3D convolutional networks (3D CNNs) for video-based motion recognition to capture spatial and temporal features.

3. Sequence Handling:
- Most human motion data is sequential. Use models that can handle sequences effectively, like LSTM (Long Short-Term Memory) or GRU (Gated Recurrent Unit) for RNN-based approaches.
- Experiment with attention mechanisms to focus on relevant parts of the sequence.

4. Labeling:
- Annotate the data with appropriate labels, which might include the type of motion (e.g., walking, running, jumping) or key body joint positions.
- Ensure the labels are consistent and accurate.

5. Loss Functions:
- Select a suitable loss function. For classification tasks, categorical cross-entropy is common. For regression tasks (e.g., predicting joint positions), mean squared error (MSE) can be used.
- Custom loss functions or combinations may be required, depending on the specific task and dataset.

6. Training Strategies:
- Split your dataset into training, validation, and test sets to evaluate model performance.
- Implement early stopping to prevent overfitting. Monitor the validation loss and stop training when it starts to increase.
- Experiment with different optimizers like Adam, RMSprop, or SGD and tune their hyperparameters.
- Batch normalization and dropout can help improve model generalization.

7. Data Augmentation:
- Apply data augmentation techniques to increase the diversity of your training data. This can include random

cropping, flipping, and adding noise to simulate real-world variability.

8. Transfer Learning:
- Transfer learning can be beneficial. You can pretrain your model on a large dataset (e.g., ImageNet) and fine-tune it for your motion recognition task.

9. Evaluate and Fine-Tune:
- Use appropriate metrics for evaluation, such as accuracy, F1 score, or Mean Average Precision (mAP).
- Fine-tune hyperparameters and network architecture based on the validation set's performance.

10. Deployment:
- Consider the real-time requirements and constraints of your application. Optimize your model for inference if needed.
- Choose the right platform for deployment, such as edge devices, cloud, or mobile platforms.

11. Continuous Monitoring and Updates:
- Continuously monitor your model's performance and update it as new data becomes available or as requirements change.

Human motion recognition is a complex and evolving field, so staying updated with the latest research and techniques is essential for building state-of-the-art models.

VI. CHALLENGES AND LIMITATIONS

Human motion recognition using deep learning has made significant progress, but it also faces several challenges and limitations, some of which include:

1. Data Variability and Diversity:
Human motions can vary greatly based on individuals, body types, clothing, and environmental conditions. Models trained on one dataset may not generalize well to other scenarios.

2. Data Annotation:
Labeling large datasets for motion recognition can be time-consuming and costly, as it often requires manual annotation by experts. It can be challenging to obtain accurate and consistent annotations.

3. Overfitting:
Deep learning models, especially those with a large number of parameters, can easily overfit to the training data. This is a common challenge in motion recognition, given the complexity of human movements.

4. Limited Data:
In some specialized applications or specific motion types, there may be limited data available for training. Insufficient data can hinder model performance and generalization.

5. Real-Time Processing:
Some applications, like real-time gesture recognition or human-computer interaction, require low-latency processing. Training models that can achieve real-time performance can be challenging.

6. Temporal Dependencies:
Capturing long-range temporal dependencies in human motion can be difficult. Traditional RNNs, LSTMs, or GRUs may struggle to capture them effectively.

7. Intra-class Variability:
Even within the same class of motion (e.g., walking), there can be significant variability in how individuals perform the action. Models need to handle intra-class variability effectively.

8. Interactions and Context:
Recognizing human motion often requires considering the context and interactions with the environment or other individuals. Models may struggle to understand these complex relationships.

9. Privacy Concerns:
In scenarios where human motion recognition is used, such as surveillance or healthcare, privacy concerns can be a significant limitation. Balancing the need for recognition with privacy rights is an ongoing challenge.

10. Lack of Ground Truth:
In some real-world scenarios, obtaining ground truth data can be challenging or impossible. For instance, tracking human motion in crowded or dynamic environments may lack a reliable reference.

11. Hardware Constraints:
Deep learning models for human motion recognition can be computationally demanding. Deploying these models on resource-constrained devices, such as edge devices or mobile phones, can be a limitation.

12. Interpretability:
Deep learning models are often considered as black boxes, making it difficult to understand why a particular decision was made. For certain applications (e.g., healthcare or safety-critical systems), interpretability is crucial.

13. Adaptation to Novel Motions:
Pretrained models may not easily adapt to recognizing entirely new or novel types of motions that were not present in the training data.

14. Dynamic Environments:
Recognition in dynamic, cluttered environments with multiple moving objects can be challenging. Distinguishing between human motions and other objects or distractions is not always straightforward.

15. Ethical and Bias Concerns:
Motion recognition systems can inadvertently perpetuate biases, such as racial or gender biases, present in the training data. Ensuring fairness and ethical considerations is a significant challenge.

Addressing these challenges and limitations in human motion recognition using deep learning often requires a combination of research in algorithm development, data collection, and ethical considerations.

Additionally, ongoing advancements in the field aim to mitigate these issues and improve the accuracy and applicability of motion recognition systems.

VII. CONCLUSION

This review paper provides a thorough understanding of the current state of human motion recognition using deep learning and its diverse applications. It discusses the challenges and limitations, recent advancements, and future directions in this rapidly evolving field, offering a valuable resource for researchers, engineers, and policy makers seeking to harness the potential of deep learning in human motion recognition.

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Comparative Assessment of Ad hoc Networks

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Abstract— **In this paper, wireless sensor, mesh, mobile ad hoc networks and their methodologies has been examined. In ad hoc network, Wireless devices connect directly without wireless access points (WAP). Base stations or WAP devices handle and share wireless data transport. Though placing these devices close together is ideal, the quality and speed diminish as additional devices join the network. Ad Hoc Network introduces VAN, Smart VAN Network, and Mobile Ad Hoc Network concepts when nodes travel between nodes. Nodes can join and depart this network anytime. Cell phones, laptops, personal assistants, MP3 players, and PCs are network nodes. Mobile ad hoc networks, vehicular ad hoc networks, and flying ad hoc network routing technologies' uses, limitations, difficulties, features, and pros and cons are also analyzed. The most crucial element of an ad hoc network i.e. peer-to-peer, intermediate, and wireless antenna nodes security and response are also discussed.**

Keywords— Networks; Ad hoc; MANET; VANET

I. INTRODUCTION

An ad hoc network is a local area network (LAN) that built spontaneously to form a connection between devices without the need for any access point or routers. Each node in this ad hoc network can be referred to as a node or peer. These nodes do not need any physical representation to communicate with each other. In an ad hoc network, no infrastructure is needed, it builds an automatic connection to the nodes in the network. The hardest task is developing a MANET. It is difficult to guarantee that every device can constantly obtain the information needed to properly direct traffic. These networks may exist independently of the larger internet or may be connected to it. One or more transceivers that are all unique from one another may be present between two nodes that makes the dynamic and independent topology.

Scope of this work

Due to the lack of a governing authority or a permanent network backbone, the wireless ad hoc network is subject to the whims of its users. People make it out while they go along because there is no central authority or predetermined infrastructure. If members of a wireless network are physically close enough to one another, they can exchange data with one another. This means that it is possible for the application to continue to fail irrespective of whether one of the endpoints changes locations or stops working.

To address this issue, additional computation and routing responsibilities are distributed to the best nodes. Any two points that are not adjacent are connected by them. Something exists that resembles a tree or a ring. In this sense, they are related to one another. A virtual network composed of other nodes is made up of backbone nodes. An easy-to-use virtual network route can be set up and maintained.

II. LITERATURE

MANETs have linkages in their link layer [1]. Two types of ad hoc networks exist. Wireless point-to-point and ad hoc networks exist. Users can create a transportable LAN in this case. Wi-Fi devices distribute data to each other in ad hoc mode. No servers send data or print when users create networks. Wirelessly connecting devices using a peer-to-peer (P2P) connection lets users communicate and share resources [2]. Nodes in the WANET collaborate on routing, security, address, and key management. Wireless adapters or chips act as routers in Ad hoc network users.

Service Set Identifier (SSID) and wireless frequency band numbers have to correspond for all wireless adapters to connect [3]. Every node sends and receives packets. Wi-Fi routers are used for "infrastructure mode" Wi-Fi network setup and operation. Ad hoc networks are formed instantly utilizing computers, tablets, or phones [4]. Ad hoc approach and infrastructure are suitable in different situations. It may be best for a short-term wireless network having a few devices but not for a long-term network with many devices [5]. MANET implementation raises security concerns since unfriendly nodes can access the wireless, mobile network at any moment. Node and data security must be considered.

MANETs aid disaster management. Early disaster warning is more important than cure and damage rehabilitation, everyone agrees. The June 2013 multi-day cloudburst that caused floods in Uttarakhand proved devastating. According to Uttarakhand government estimates, nearly 5,700 individuals have been "presumed dead".

ICT's contributed to disaster management results in production of large volumes of disaster data. Public and private organizations are developing response strategies, sensory systems may be valuable, and social media is full of information. Maximum utilization of available information requires a reliable and accessible storage system that shares, reuses, integrates, and evaluates the data. Ad hoc means short-term or immediate decisions. WiFi ad hoc mode lets one connect remotely to a different machine or device without a router. Decentralized P2P networks can be constructed using Ad hoc connections without a previous network architecture. Ad hoc networks connect all

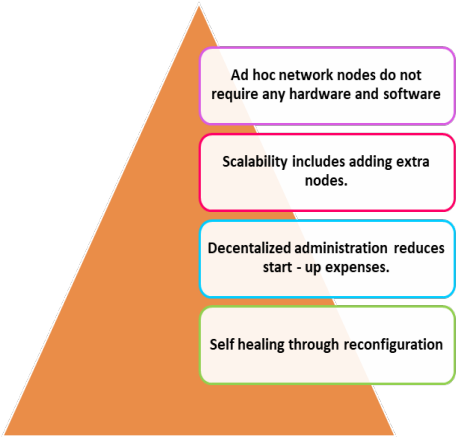
nodes in the same way, unlike traditional networks, where data passes into and out of a router before reaching child devices.

III. ADHOC NETWORKS

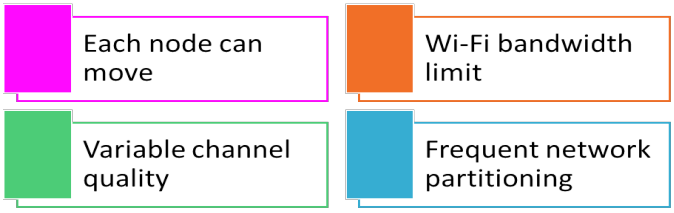
Users can connect to the web without needing a wireless router or base station. In an ad hoc network, no intermediary devices like a gateway or wireless server are required. Ad hoc networks are a type of LAN, or local area network. It is used briefly and then discarded.

- In a mobile ad hoc network (MANET), a mobile phone feeds the network.
- WMN: Wireless mesh network Mesh networks are ideal for ad hoc networking since nodes communicate directly.
- Vehicular transmission can be made easier via a vehicle ad hoc network (VANET). Intelligent VANETs use ad hoc networks and AI to prepare emergency responses.
- The "wireless sensor network" (WSN) is an unauthorized network of sensors that capture information regarding noise, ambient temperature, humidity, and pressure. Thus, gateways are no longer needed to connect devices directly to the main hub when transmitting data.
- Wireless ad hoc networks (SPAN) can be built between cell phones using Bluetooth and Wi-Fi, known as a cell phone ad hoc network.

Technology that allows mobile phones and laptops to make phone calls and access the internet is improving all the time. Future networks based on self-organizing systems will help people connect with one another at a reduced cost, hence reducing the overall cost of communication [6]. To create and set up a wireless, mobile network. Only those who often share huge files between multiple devices should use ad hoc networks. It is possible to set up an "ad-hoc" network in virtually any place. Therefore, they may have applications in business, in organizations, and in people's day-to-day lives at home. This reduces complexity and costs for enterprise use [7]. The advantages and characteristics of ad hoc networking are depicted in Figure 1, respectively.



(a) Ad Hoc Networks Advantages



(b) Ad Hoc Networks Characteristics

Fig 1. Ad hoc networks Advantages and Characteristics (a) & (b), respectively.

Ad hoc networks can create a wireless network without a router in an accommodation room that doesn't have Internet access. They can still communicate via what is known as an ad hoc link. Because the Wi-Fi technology depends on ad hoc mode, it may be used for communication even when there is no internet connection [8].

Vulnerabilities

Even if wireless devices are capable of being utilized in an ad hoc mode, there are still a number of drawbacks to consider. There is no way to track a signal, thus its strength can't be determined. Managing ad hoc networks becomes more complicated when the number of connected devices grows. There is no central authority over the data flowing through an ad hoc network. With an ad hoc network, each node makes its own direct P2P interaction with each other node; there is no central access point. A hardwired connection between the gadgets is necessary for this. When a computer is too far away from the device it needs to connect to, intermediary devices must be used to transfer data [9].

The period that is needed for the information to travel to the other gadgets increases because of this. Wireless ad hoc networks, despite their flaws, offer many practical uses in both the home and the workplace. Ad-hoc network connectivity between two or more devices is straightforward regardless of whether or not network administrators understand how a WANET operates or whether or not it achieves their business goals. The infrastructure for an ad hoc network can be put in place anywhere. The use of antiquated networking equipment including routers, access points, and wireless infrastructure is optional [10]. Nodes, or autonomous devices, are spread out in a wireless sensor network. Pressure, sound, and temperature are just some of the variables these nodes monitor with the help of built-in sensors. The two work together to send their information across the network to a command post [11].

IV. TYPES OF AD HOC NETWORK

Wireless networks can be permanently established from ad hoc networks [12]. While it may not perform optimally, an ad hoc network may support numerous connections at once. Ad hoc mode is another term for rapidly establishing a network. There are various forms of ad hoc networks, shown in Figure 2, such as:

- Mobile Ad Hoc Network (MANET)
- Smart Phone Ad Hoc Network (SPAN)
- Wireless Mesh Network
- Wireless Sensor Network

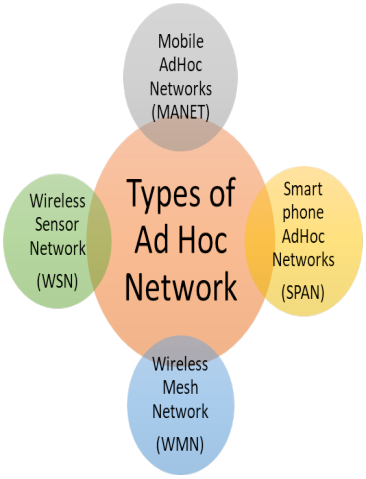


Fig 2. Types of Ad Hoc Network

Mobile Ad Hoc Network (MANET)

It is built with a link-layer network and a wireless ad hoc network. It also paves the way for the development of a mobile network. Moving wireless data is connected via the nodes. There is no configuration required, and it can fix itself if damaged. Nodes in a MANET can navigate freely wherever they like because the network's topology is dynamic. Mobile networks allow users to connect and interact using wireless devices on the go [13].

Both standalone and supplementary uses for the internet rely on MANETs. You can put it to either of those applications. It may be made even more adaptable and decentralized by swapping out the transceivers amongst the nodes. The primary goal of a MANET is to guarantee constant traffic [14]. Since every node in a MANET can potentially access the network at any time, implementing one creates serious security challenges. Security of both nodes and data is essential. Figure 3 exhibits MANET disadvantages.

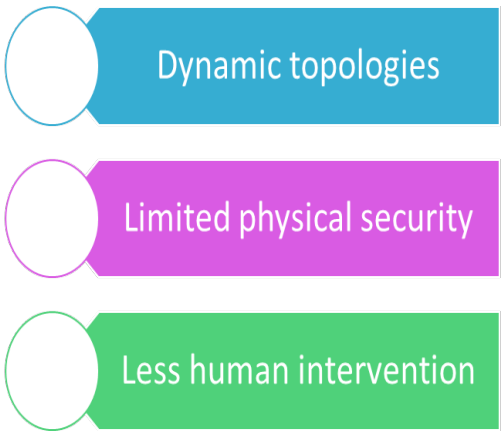


Fig 3. Drawbacks of MANET

Smart Phone Ad Hoc Network (SPAN)

Users of mobile phones to coordinate their interactions are sometimes referred to as ad hoc groups. These networks can be created by a group of phones with the appropriate technology if they are in close enough proximity to one another. Smartphone users can build their own peer-to-peer networks [15] and function independently of wireless access points, cell phone companies, and other network components. Bluetooth and Wi-Fi are standard on cell phones that are now on the market. Using the same fine-neighbor transparent-neighbor and route-finding algorithm as Wi-Fi ad-hoc mode, Wi-Fi SPANs allow for direct phone conversation. SPANs differ from traditional hub-and-spoke networks like Wi-Fi Direct in that they employ reflectors and multi-hop routing (also known as ad hoc routing). It is impossible to know who is in charge of the online community and therefore members can freely come and go [16].

Furthermore, SPANs don't have a designated leader which makes it easier to get in touch with others and share information. In order to connect the wireless devices, these smart ones need a unique infrastructure [17].

Wireless Mesh Network

Wireless mesh networks are becoming the foundational technology for 5G wireless networks. There is a mesh router and a mesh client in a WMN. Broadband wireless mesh networks (WMNs) connect mobile and fixed nodes to the internet and wireless LANs. Mesh networks utilize routing to swiftly transport data packets from origin to destination. In WMNs, there are typically three main routing protocols in use. Protocols can be either proactive, reactive or a mixture of the two.

Wireless Sensor Network

Technologies that include remote observation of the environment and target tracking are crucial uses for a wireless sensor network (WSN). Smaller, less expensive, and more intelligent sensors have become widely available in recent years, making this possible. These sensors have wireless interfaces that allow them to connect and communicate with one another. The environment, the application's design goals, expenses, gadgets, and system constraints are all important considerations in the design of a WSN [18].

V. TYPES OF MANET

Mobile ad hoc networks (MANETs), also known as wireless ad hoc networks, are a type of network in which mobile devices communicate with one another wirelessly and without the need for any pre-existing infrastructure. Due to the freedom of movement afforded by a MANET design, devices regularly switch the connections they have with one another. To facilitate their mobility, MANETs rely on wireless links to communicate with other networks [19]. The fundamental concepts of MANETs are used to develop VANETs, which are then deployed on the roads. It facilitates clear communication between vehicles or between vehicles and roadside infrastructure.

Wireless ad hoc networks that use Internet protocols like TCP/UDP and IP are known as Internet Based Mobile Ad hoc Networks (IMANETs). The IMANET automatically establishes

routes by connecting mobile nodes using a network-layer routing protocol.

Intelligent vehicular ad hoc networks (INVANET) employ AI to deal with the unpredictability of circumstances like car crashes.

Unmanned aerial vehicles (UAVs) make up a Flying Ad Hoc Network (FANET), bringing mobility and internet access to otherwise inaccessible regions. [19][20]

VANET

A VANET represents a special kind of mobile ad hoc network (MANET) in which mobile devices serve as nodes, routers, or Access Points (APs) to facilitate communication between other mobile devices. Using 802.11p, its typical connection range to cars is between 100 and 900 meters. The goal is to enable infrastructure-free networks to facilitate V2V and V2I communication. It's crucial to keep in mind that the ITS's ultimate goal is to make driving safer and more pleasant for everyone. COOPERS, CVIS, SAFESPOT, and PReVENT are just a few of the many research projects that have been undertaken [21]. Features of VANET are shown in Figure 4.

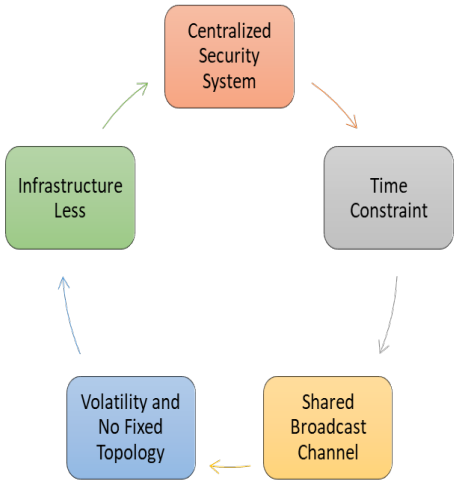


Fig 4. VANET Features

First, nodes in a VANET are responsible for making their own decisions on the transmission of data. The node itself serves as a hub for information exchange. Communication between hops is feasible. Because of these characteristics, VANET may function autonomously.

Second, a Distributed Network: A VANET consists of mobile nodes (vehicles), base stations (RSUs), and terminals (TAs). The TAs are the highest-ranking controllers. In the beginning stages of the network, these are responsible for registering vehicles and RSUs. A variety of RSUs are stationed by the roadside in this configuration. RSUs serve as regional authority for cars within their jurisdiction. This is an example of a decentralized network. As nodes in a VANET move at rates ranging from 60 to 200 km/h, the network is in a constant state of flux.

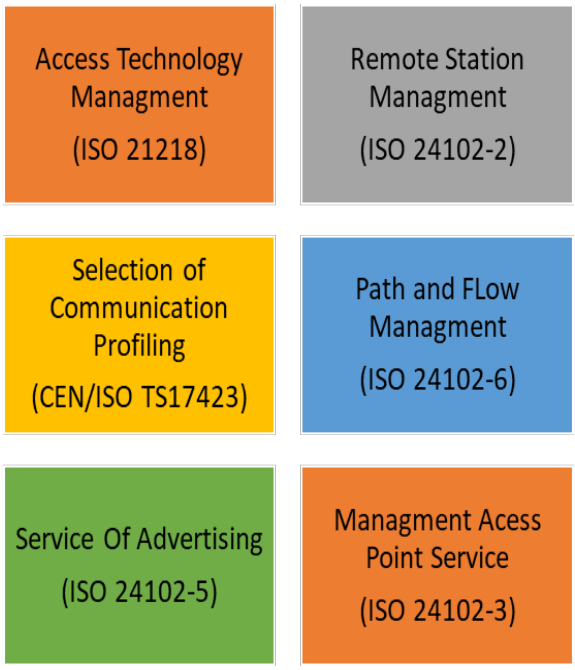


Fig 5. ISO Standards

FANET

When used in tandem, many UAV systems can complete tasks more cheaply and efficiently than could be done by using only one system alone. As a result, this option prompted the creation of novel networking technologies for connecting UAVs to the ground control station. FANET refers to the UAV network, which is a special case of MANET [22]. Topology is dynamic in these networks. The Comparison of VANET and FANET with MANET is explained in Table 1.

Intelligent VehicularAad hoc Network

Intelligent vehicle ad hoc networks (InVANETs) will not replace cell phones anytime soon. Electronic maps allow users to examine data on vehicles over the internet or specialized software like Google Maps. A car's location can be determined using a WiFi-based GPS navigation system even in extremely large areas, such as airports and cities, or on campus. InVANET [23] is designed to help users get where they're going with the least amount of interference from other users. Using this method, travelers will have an easier time navigating new areas and learning to recognize familiar landmarks. Vehicles with the ability to exchange information with one another are at the heart of intelligent transportation networks. Road Side Units (RSUs) are access points along roads that they can talk to. Better road safety and more convenient travel are also possible outcomes of improved vehicle communication between vehicles. V2V and V2R can effectively communicate with one another due to V2R's superiority in sparse networks and its support for long-distance communication. V2V also allows for direct communication across medium-to-long distances and in areas without convenient roadside access points [24, 25, 26].

Table 1. Comparison of MANET, FANET and VANET

Characteristic	MANET	FANET	VANET
Node Type	Mobile devices (smartphones, laptops, etc.)	Unmanned Aerial Vehicles (UAVs) or drones	Vehicles (cars, buses, motorcycles, etc.)
Mobility	Ground-based	Aerial	Ground-based
Infrastructure	Infrastructure-less, no centralized infrastructure	Infrastructure-less, no centralized infrastructure	Infrastructure-less, may utilize roadside units or infrastructure
Communication Range	Typically limited	Typically larger	Typically limited
Communication Challenges	Interferenc, signal attenuation, limited power, and network congestion	Interference, signal attenuation, limited power, and congestion; challenges and obstacles	Interference, signal attenuation, high mobility, frequent network disconnections
Applications	Disaster areas, military operations, remote areas without existing network infrastructure	Search and rescue missions, surveillance, aerial photography, UAV swarm applications	Intelligent transportation systems, traffic management, vehicle-to-vehicle communication
Key Considerations	Routing protocols, energy efficiency, network security	Three-dimensional communication, dynamic path planning, obstacle avoidance, coordinated flight, payload management	Vehicular mobility, rapid topology changes, roadside unit deployment, real-time safety applications

VI. ROUTING PROTOCOLS OF MANET

A MANET allows for the discovery and dissemination of a set of rules known as a routing protocol; users can find each other in a variety of ways. The three types of routing protocols are called "proactive," "reactive," and "hybrid". They handle several nodes while using as little space and power as possible. Nodes can depart and return, routing protocols have a lot of trouble [24].

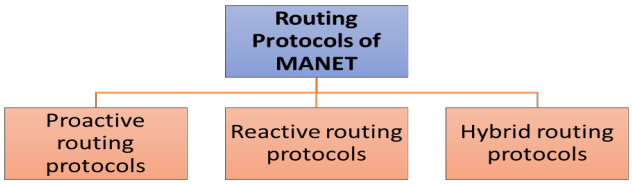


Fig 6: Routing Protocols of MANET

Proactive routing protocols: Link-state routing techniques [25] are used by this protocol type. They constantly broadcast messages about nearby connections. They are able to do this by exchanging control messages with their neighbors, which keeps their information on where to travel up to date.

Reactive routing protocols: Proactive routing strategies have additional expenses not shared by reactive approaches. A distance-vector routing algorithm is used to determine travel paths [26]. When a node requests the development of a route, only then will it begin searching for routes to that place. In MANET, there are a plethora of incredibly quick-to-respond protocols.

Hybrid Routing protocols: This hybrid routing protocol combines reactive and proactive techniques. For routing protocols to be more manageable, and for passive routing systems to experience less latency due to path discovery, ZRP has been proposed. IntrA-zone Routing Protocol (IARP) and Inter-zone Routing Protocol (IERP) are the two protocols that make up ZRP. The routing area of a node often employs IARP (proactive routing), while the routing area typically employs IERP (reactive routing).

There is no lag in transferring data to its destination within the domain since the intra-domain routing protocol always has the most recent information on the domain topology. Through IERP, nodes are freed from the burden of constantly updating the network's state. Border Broadcast Resolution Protocol (BRP) is another technology utilized by ZRP for managing inter-domain traffic. In the event that the node fails to include the topological information provided by IARP, BRP is used to send reactive routing requests.

VII. CONCLUSION

In the foreseeable future, mobile computing will continue to thrive, and the seamless integration of Mobile Ad Hoc Networks (MANET) with other wireless systems and the established Internet infrastructure will become increasingly inevitable. Ad hoc networking plays a central role in the evolution towards the fourth generation of wireless technology. Its inherent flexibility, low maintenance requirements, minimal infrastructure needs, self-configuration, and self-organization capabilities, coupled with significant cost advantages, position it as a strong contender

to be the cornerstone technology for ubiquitous personal communication. The potential and significance of ad hoc networks are gaining recognition from both the research and industry communities, evident in the surge of research activities and the rapid growth of Wireless LANs and Bluetooth segments.

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Monitoring and Controlling of Automated Residences

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Abstract*—"Home automation or Automated Residences" refers to the integration ofsmart systems and technological gadgets into a residential environment to enhance and automate many everyday tasks. In a home automation system, appliances, entertainment systems, lighting fixtures, security and surveillance systems, and more are connected by a single control hub or network. This system can be operated by tablets, smart phones, and specialized control panels, among other methods. A real-time solution for tracking several interior air quality indicators is provided this Monitoring System. This project is intended to provide userwith real-time data of nearby air quality and alert them if the reading falls below a preset value. Also the user can access the whole system if even they are away from their home. The result ofthis project is to provide user all control of their devices and appliances and to inform the air quality of residences.

Keywords: IoT, Home Automation system, Air Control Monitoring System, Residences, Sensors

I. INTRODUCTION

In today's society, "home automation" is becoming more and more widespread. It includes a broad range of devices and technology designed to improve the security, comfort, convenience, and energy efficiency of a house. With home automation, homeowners may link several gadgets and sensors to a single network to observe and manage various parts of their houses from a distance. This introduction emphasizes the importance of home automation technology in our modern lives while outlining the fundamental ideas and elements of these systems. Air quality is becoming a more urgent issue as industry and urbanization continue to affect our surroundings. The Air Pollution Tracking System (APTS) is an innovative answer which provides real-time information on the composition and amounts of different air contaminants. This prologue gives an idea of APTS and its critical role that air quality monitoring plays in contemporary environment management. In an era of rapid urbanization and expanding industrialization, one of the most urgent global concerns is air quality.

II. LITERATURE REVIEW

Through so many advantages, home automation is growing in popularity. The term "home automation" describes the use of local networking or remote control to operate appliances and other household components. The foundation for real-time decision-making and automation for the Internet of Things (IoT) is provided by artificial intelligence. IoT makes it possible to connect people at anytime, anywhere, and with whoever you choose, ideally making use of any network and any service [1-4]. The ability to easily manage and operate home automation systems from a variety of devices, such as smartphones, tablets, smart watches, laptops, and desktop computers, is one of their biggest benefits. A home automationsystem can increase safety by controlling lighting andappliances, secure the house with automated door locks, raise the awareness by security cameras, better ease by adjusting the temperature, save time, provide control, and reduce costs. [4].

UN Data defines a safe value of PPM are 0–50 and a moderate value as 51–100 [5]. Delhi is the world's most polluted city, with pollution levels of 350 PPM. The internal temperature element in each sensor means that it needs more power when using two of them. Because there is insufficient driving, the resulting voltage levels vary and display surprising values even when each of the sensors are turned on. Thus, we used a 9V battery and a 7805 family REGULATOR for the CO sensor MQ7. All we have done is supply Arduino with power to power the MQ135 gadget. Poor IAQ is reportedly the second main contributing factor to India's higher death rate. In the nation, it results in about 1.3 million fatalities annually. Approximately India's 70% rural population are reported to depend on biomass fuel to meet their household needs [6]. To make it easy to monitor, it will display the air quality in PPM on the OLED and on the internet.

In this Internet of Things project, you can use your computer or mobile device to check the pollution level from anywhere[7]. A data storage system, which may be either physical or online, is used to store the information gathered by a sensing device. Moreover, the impact of contaminants in the target premises can be analyzed by using the data analytics services. [8-10]. For easy viewing, the readings are also shown on an onboard OLED. It is possible to record the weather pattern and determine the weather features of a certain location by analyzing all of these observations. These documented criteria are crucial and differ between locations. With this Internet of Things project, we can use a computer or mobile device to check the pollution level from any location. This study's objective is to evaluate an indoor air quality (IAQ) monitoring system. It uses an Internet of Things (IoT) approach on residences at different time by conducting a thorough evaluation of previous research. Wi-Fi is incorporated into the proposed system to automate the operation. Even though there are commercial devices that use this technology, they are only compatible with a single device. alone. The current system is intended to create a single Android application for managing many devices. The framework would be accessible through wi-fi and requires uninterrupted internet connection to control the appliances [11].

The objectives of the project are:

1. To give authorities and everyone in the vicinity up-to date information on the air quality in the area.
2. As a mechanism of early warning for dangerously low airquality.
3. To reduce energy waste and offer effective management over domestic appliances.

III. COMPONENTS USED

3.1. ESP32 AND RELAY

A popular microcontroller and system-on-chip (SoC) for embedded systems and Internet of Things (IoT) applications isthe ESP32. The company Espressif Systems, which is well-known for advancing Bluetooth and Wi-Fi technology, designed it. The ESP32, which has more features and better performance than the ESP8266, is its replacement. It has a dual-core processor, memory, GPIO pins, wireless connectivity, low power mode, security, and other features.
Relays are a useful tool for managing and controlling a wide range of systems and devices in Internet of Things (IoT) applications. Relays play a key part in the Internet of Things' capacity to remotely control and monitor physical assets.

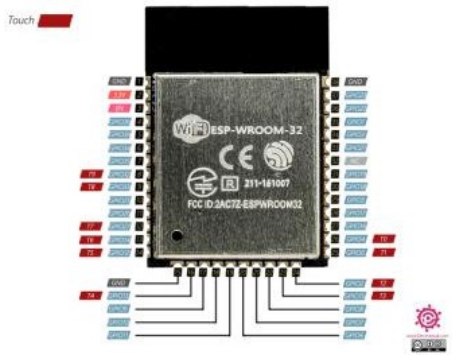

Fig 1: ESP32

3.2. MCUESP8266

The Microcontroller ESP8266 comes with Wi-Fi connectivity, and it can also be used with Arduino and compatible with different sensors for controlling input and output (Fig 2). This enables you to publish your ideas online, which is great for application related to the internet of things and homeautomation.

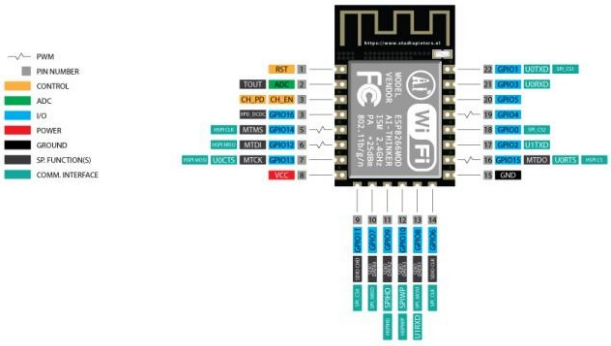

Fig-2: ESP8266

3.3. OLED Display

A certain kind of flat light emitting technology is called OLED (Organic Light Emitting Diodes). This gadget only has four pins and communicates with the Arduino via the I2C protocol.

Fig-3: OLED Display

3.4. DHT11

A humidity and temperature sensor unit with a calibrated digital signal output is included in the DHT11 Temperature & Humidity Sensor (shown in fig. 4). It guarantees outstanding long-term stability and exceptional dependability by utilizing temperature and humidity sensor technologies along with a unique digital signal collecting technique. This sensor combines an NTC temperature sensor and a resistive-type humidity measuring component.

Fig-4: DHT11 Humidity Sensor

3.5. MQ 135

MQ135 air quality sensor is one kind of MQ gas sensor used to detect, measure, and record a range of airborne gases, such as ammonia, alcohol, benzene, smoke, carbon dioxide, etc. It uses 150mA of power and runs at a 5V supply. To get an exact result, the operation must be preheated for20 seconds. It is a semiconductor air quality sensor that can be used for applications that monitor air quality. It is extremely vulnerable to smoking, benzene, CO2, NH3, NOx, and other airborne pollutants.

Fig-5 MQ135

IV. WORKING AND DISCUSSION OF PROPOSED SYSTEM

Indoor pollution have a negative impact on public health and well-being. To keep an eye on in this project, we will create an Internet of Things (IOT)-based air pollution monitoring system for automated residences as shown in Fig. 7. Using an internet-based web server, we will monitor the air quality of harmful gases such as CO2, alcohol, smoke, benzene, and NH3 and control the switches of residences. It will be able to quickly monitor the air quality in terms of PPM display on the OLED and webpage. The readings are also displayed on an integrated OLED for convenient viewing. A popular sensor for measuring temperature and humidity is the DHT11. The sensor contains an 8-bitmicroprocessor for serial data output of temperature and humidity information in addition to a dedicated NTC for temperature measurement. The project measures the PPM and humidity at three different areas namely at Spacious Room, Confined room and Rooftop as shown in Table 1.

Table 1 : Air Quality monitoring parameters

S.no	Location	PPM	Humidity
1	Spacious Room	435	69
2	Confined room	520	70
3	Rooftop	315	64

The gadget itself, this board's Wi-Fi module serves as an informational gateway for the air quality as well as an online connection.

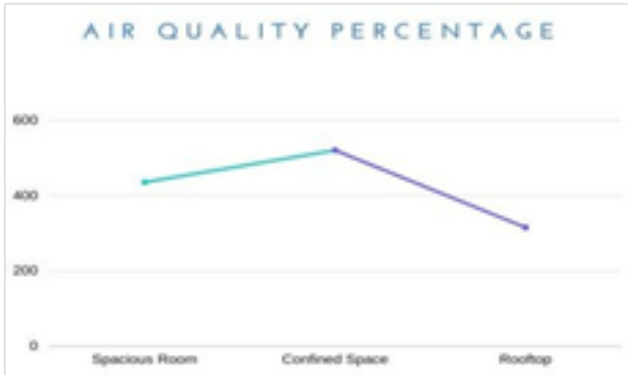

Fig-6 Air Quality Percentage

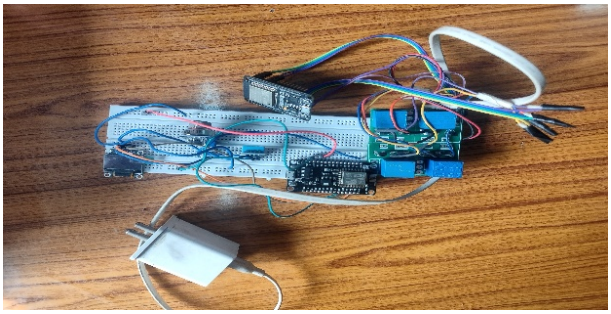

Fig-7 Proposed project

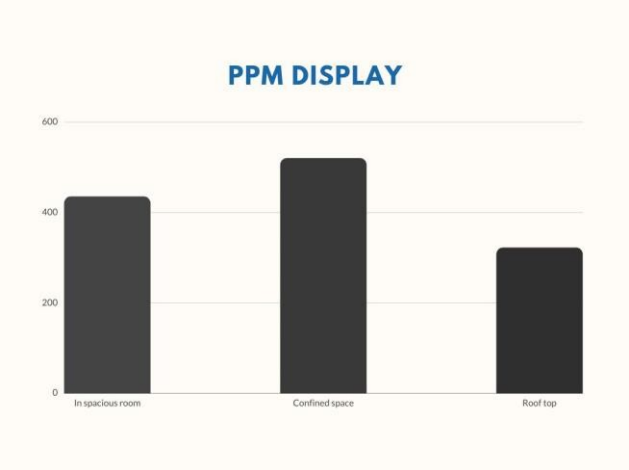

Fig-8 PPM at proposed area of Residence

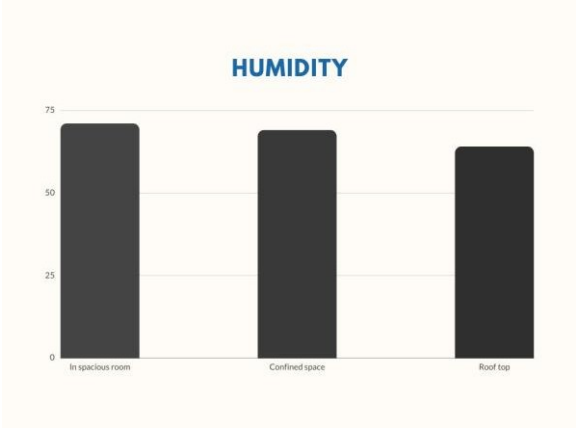

Fig-9 Humidity at proposed area of Residences

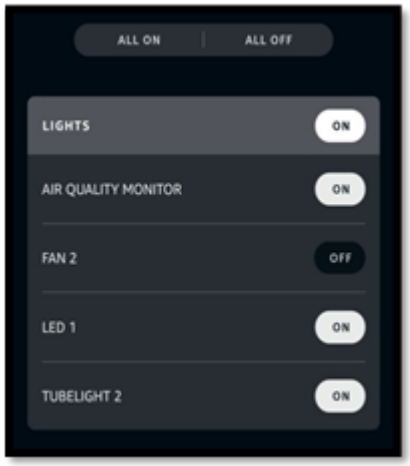

Fig-10: ThingSpeak platform of proposed area of Residences

The MQ135 Gas Sensor and Node MCU are used in this to measure the air quality in real time. When the air quality drops below a preset value, Node MCU will transmit thedata to the ThingSpeak platform as shown in Fig. 10, which is linked to Twitter, and notify the local population. This application uses the MQ135 gas sensor to identify a range of hazardous

substances, while Arduino serves as the project's central nervous system, overseeing every aspect of its functioning. An OLED panel is utilized to provide visual feedback, and a Wi-Fi module connects the entire process to the internet. Fig. 6, Fig. 8 and Fig. 9 shows that confined room is more polluted than spacious room and rooftop.

Along with IOT bases Air quality monitoring system, we can also control the home appliances through IOT devices such as ceiling fan, tube lights, entertainment units, air conditioning units, smart cameras etc. without touching the switches physically. The main objective of home automation is to streamline and simplify the management of various functions and devices in a home. With automation, homeowners can remotely control and monitor different aspects of their homes, even when they are away.

V. CONCLUSION

This Home Automation and monitoring of air quality project shows that how easily one can build using low cost component and how it can be used in controlling various home appliances like security cameras, house lighting, television etc. It can be easily fit in any small, fragile device. This provide an eases to the user without any delay and manages time. It also control the Air monitoring device and provide user with real time data of surrounding air. It alerts the user when air quality decreases by preset value.

In this era of modern homes and scarcity of resources, the home automation system are required to be implemented which gives various advantages. After implementing air quality monitoring at automated residences enhance the standard of living and good security. It increase the health protection as well as home protection for home owners. It is cheap and reliable with good accuracy and future need.

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ImpactChain : Blockchain-Based Charitable Donations: A Transparent Approach to Empowering Philanthropy

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***Abstract*— This research paper explores the "Impact Chain" project, a pioneering solution designed to revolutionize charitable giving. Leveraging blockchain technology, specifically the Ethereum blockchain, and a suite of cutting-edge tools and technologies, "Impact Chain" aims to address the prevailing issues of transparency, donor engagement, fund disbursement, and fundraising innovation in the philanthropic sector.**

***On Ethereum blockchain, special computer programs are used by projects to do things automatically and govern the donation process, ensuring transparency and accountability while minimizing administrative overhead. A user-friendly interface, powered by JavaScript technologies, enhances the donor experience, making charitable giving accessible to both seasoned philanthropists and a new generation of donors.**

Development environment tools such as Truffle and Ganache streamline smart contract creation and testing, ensuring the reliability and security of the platform. The integration of MetaMask adds wallet functionality, simplifying transactions and token management for users.

***Keywords*—Blockchain; Ethereum; Truffle; Ganache; MetaMask.**

I. INTRODUCTION

In an age marked by technological advancement and an increasing awareness of social responsibility, the intersection of blockchain technology and philanthropy can emerge as a transformative force in addressing longstanding challenges within the charitable giving sector. Charitable organizations and people who give money to them have struggled with some problems like they have difficulty to find young interested people, not being cleared about where money goes, not using money effectively and also not coming up with new and better ways to raise funds.

Well-known cases like the "Guo Meimei Incident" and the "Hu Manli Incident" have come to light. [1] and became popular on the internet by showing problems in how charities work. There were reports of people who made money from selling aid during the "5.12 Wenchuan Earthquake." This made it clear that we need better ways to manage charity money and supplies and we must be open about it. These issues have made people less likely to give to charity, and donations.

To address these important problems, the "Impact Chain" project uses Ethereum blockchain technology and some advanced tools. The aim of it was to bring much-needed change to the world of charity. It uses Ethereum's smart contracts to make donations more transparent and automated, so donors can see where their money goes.

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As it unfolds, this project seeks to reshape the landscape of charitable giving, addressing the core objectives of charitable contribution, transparency, showcasing blockchain technology, and ushering in innovation in fundraising methods. The "Impact Chain" project represents a transformative step toward a future where philanthropy is not only accessible and transparent but also a dynamic force for positive change in society.

II. LITERATURE SURVEY

BlockChain Technology

Blockchain is a distributed and decentralized database system which have multiple independent nodes. Throughout the network the entire database is maintained by nodes. All transaction information can record by the Blockchain in every efficient and transparent way which ultimately provide high security. Blockchain helps for generating, validating and transact to the other nodes of the network [2]. Various cryptographic hash algorithms are useful for security required for financial transactions. Other services like financial services, healthcare services, as well as business and industry also use Blockchain. [3].

Research of Charity Platforms

In 2019, S. Hadi, D. Azamat, A. Sergey, "Platform for Tracking Donations of Charitable Foundations Based on Blockchain Technology" [4] proposed that Many donations do informally and even donators don't know about their funds.
Further in 2020, H. Baokun, L. He, "Research on Charity System Based on Blockchain" [5] studied about the supervision system of charity in China which lacks transparency and how it discourages people from donating. They recommended improving charity oversight through legal, administrative, industry, and societal measures.

Ethereum Blockchain

Blockchain is a secure and unchangeable digital ledger which keeps data very secure and keep all transactions in a safe and transparent way. It has the potential to change how regular industries work. [6] Ethereum is a decentralized blockchain platform for smart contracts that is more versatile and scalable

than other blockchains. In May 2023, Hiremath, Vishwanath "Decentralized Application on Charity Using Blockchain." Proposed a donation tracking system based on decentralized blockchain will offer complete transparency and accountability. It allows direct access to those receiving the donations, ensuring that the donated funds reach their intended recipients. [7]

Decentralized Smart Contract

Ethereum is intended to be a platform for facilitating decentralized smart contracts via Ether, its own currency vehicle, in order to increase the value of the blockchain ecosystem. The concept of a "smart contract" is the automatic notarization and execution of legal contracts.

Ethereum developers are able to construct a number of smart contracts, which are executable programs inscribed into blocks, thanks to Solidity, a Turing-complete programming language. Ethereum expands the use of blockchain from the data domain to the compute domain due to its immutable nature. To put it another way, nobody could ever change the logic of the program once the developers have created and released it to the public.

Decentralized Application

However, contemporary blockchain-based apps are still restricted to using smart contracts for essential information and functionality that should be impervious to changes. To finish the application, smart contract users must still run their apps locally. One of the main causes is the present blockchain technologies' performance limitations, which prevent them from meeting the demands of many applications.

This opens the possibility of problems with maintenance and operational security. For instance, there might be deliberate dishonest practices in local pieces that are concealed from the public audit. To achieve this, the final blockchain application should be a decentralized application (DApp) that is fully hosted by a peer-to-peer (P2P) blockchain system. A deployed DApp should not require any maintenance or governance from the original DApp developers. In other words, the ideal blockchain application/service should be fully operational without any human intervention. A decentralized autonomous organization (DAO) is a decentralized organization that runs on the blockchain according to rules that are encoded as smart contracts. Because a DAO is autonomous and automatic, the cost and profit of a DAO are shared by all participants by simply recording all transactions into the blocks. [8]

Today's web 2.0 is about connecting people. Where social media platforms were invented and development focused on the application layer. There are different approaches to Web 3.0, some; would say the future is when we have the Semantic Web, others say the future is the Virtual Web. In order to make the website more efficient, we need to take care of solving our problems and the problems caused by these platforms. The decentralized web focuses on the development of protocols and underlying technologies that are invisible to end users. [9]

DeFi

It refers to a set of financial services and applications that are built on blockchain technology and aim to operate without traditional intermediaries, such as banks or financial institutions DeFi represents a groundbreaking technological advancement characterized by three core attributes.

- First, it operates on a noncustodial basis, eliminating the need for intermediaries and enabling users to have complete control over their assets and transactions.
- Second, DeFi is permissionless, meaning it offers accessibility to individuals globally without requiring traditional banking services or formal approvals.
- Lastly, DeFi is inherently transparent and openly auditable due to its reliance on public blockchains [10]

Conventional finance is underpinned by a network of intermediaries that connect various participants in financial markets. These intermediaries, primarily comprising financial institutions like banks and market providers such as securities exchanges, function as central hubs. [11]

In contrast to conventional finance, DeFi is committed to reducing intermediaries, DeFi approaches empower individual users to engage in various financial activities. These activities include lending and borrowing, speculating on different asset classes, diversifying portfolios, securing insurance, and earning returns on various fixed-income instruments, all without the need for traditional financial intermediaries. In essence, DeFi seeks to facilitate many essential financial functions that involve risk and reward, akin to traditional finance, but without the extensive involvement of traditional financial intermediary institutions. [12]

In the past, central hubs were essential because services were delivered on a local level and recorded within a single financial statement, typically under the management of an entity headquartered in that hub. These hubs were typically subject to stringent regulatory and oversight standards, which were in place to mitigate the significant risks associated with aggregating financial resources and concentrating them within the hub.

In conclusion, there are distinct paradigms in the financial services industry between DeFi and traditional finance. More decentralization, accessibility, and transparency are provided by DeFi, but there are hazards and difficulties specific to it as well. Although it offers a structure that is well-regulated, traditional finance may have restrictions on accessibility and inclusivity. As the financial landscape continues to change, the two systems can coexist and even have an impact on one another.

Layer 1 and Layer 2 Scaling

Following the success of Bitcoin in the last decade, there have been a number of cryptocurrencies and other blockchain solutions on the market. However, blockchain-based systems continue to suffer from high transaction rates and long transaction processing times, which limit the scalability of blockchains.

Layer-1 scalable solutions have tried to incrementally solve these problems by adding/changing fundamental blockchain attributes. More recently, a completely new class of work has emerged to solve the scalability issues of blockchains using unconventional methods.

Layer-2 protocol improve transaction processing rate, time limits, and fees by reducing the use of the underlying slow and

expensive blockchains. The main chain acts only as a tool for establishing trust and dispute resolution between Layer2 participants where only a small number of transactions are sent to the main chain, so Layer2 protocols have the potential to revolutionize the domain. Nevertheless, due to rapid and discrete development, there are many different branches of layer2 protocols. We are systematically creating a broad taxonomy of these protocols and implementations. [13]

Potential of Blockchain in India

According to Kumaresan Mudliar, Harshal Parekh, and Dr. Prasenjit Bhavathankar, they suggest that Blockchain technology can work together with the Aadhar system for various things like secure voting and better healthcare [14].This highlights the incredible and highly untouched potential of blockchain in India.

The literature survey demonstrates that the "Impact Chain" project aligns with the broader trends and research findings in the field of blockchain-based charitable fundraising. It emphasizes the importance of transparency, trust, and direct impact measurement—core objectives of the project. By leveraging Ethereum and advanced blockchain tools, "Impact Chain" seeks to address the challenges identified in the literature, ultimately reshaping the future of charitable giving by offering a transparent, efficient, and engaging platform for donors and charitable organizations.

III. PROPOSED SYSTEM

This paper gives a comprehensive outline of the proposed framework, including the utilization of Ethereum blockchain technology, smart contracts, JavaScript technologies, and key development environment tools to create a transparent, efficient, and engaging platform for charitable giving.

Objectives

To introduce innovative fundraising methods that engage donors, particularly younger audiences.

To foster openness and responsibility in charitable giving by leveraging blockchain technology.

To showcase the possibilities and gains of blockchain technology, specifically Ethereum, in the context of charitable donations.

To increase the volume and efficiency of charitable contributions through the "Impact Chain" platform.

Features

1) Ethereum smart contracts serve as the backbone of the "Impact Chain" project, automating donation processes and enhancing transparency. These self-executing contracts, encoded with predefined terms, execute transactions and fund disbursements based on predetermined conditions, thereby increasing transparency and fostering trust among donors.

2) User-Friendly Interface: The technology like JavaScript, including React JS, Node JS, and Express JS, makes a user-friendly interface. This is important for getting young donors involved, making it easy for people to use, and encouraging more people to participate in charity work.

3) Wallet Functionality and Token Management: MetaMask, integrated into the platform, adds wallet functionality and simplifies token management for users. It enhances the convenience of transactions and ensures secure and user-friendly interactions with the platform.

4) Engaging Young Donors: To attract and engage younger donors, the "Impact Chain" project may employ strategies such as social media integration, gamification elements, and storytelling features, ensuring that philanthropy remains relevant and appealing to the younger generation.

5) Fundraising Innovation: The platform may introduce innovative fundraising mechanisms, including tokenized rewards, decentralized autonomous organizations (DAOs), or non-fungible tokens (NFTs), to entice donors and introduce novel fundraising strategies.

6) Efficiency in Charitable Giving: Through the automation of donation processes via smart contracts, "Impact Chain" reduces administrative overhead and minimizes delays in fund disbursement, thus encouraging more donations and ensuring timely delivery of funds to beneficiaries.

Workflow

Initialization

- The crowdfunding smart contract is deployed by the manager, who sets the target amount and deadline.

Contributions:

- Contributors send Ether to the contract using the sendEth function.
- Contributions are tracked in the contributors mapping, and the total raised Amount is updated.

Manager's Actions:

- The manager can create spending requests using the create Requests function.
- Contributors vote on spending requests with the vote Request function.
- If a spending request is approved by a majority of voters, the manager can execute it using the make Payment function.

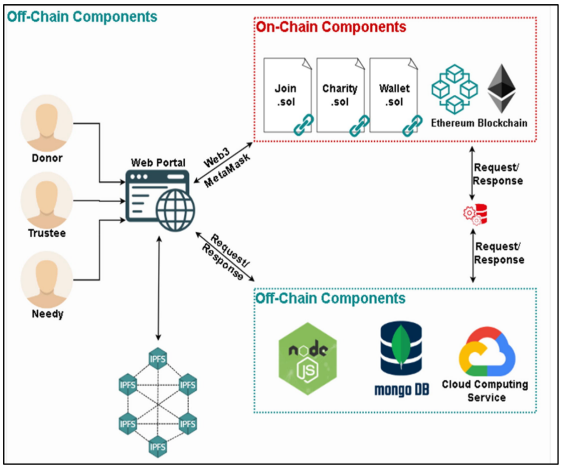
Contract Balance:

- Anyone can check the current contract balance using the get Contract Balance function.

Interaction of Users & the DApp.

- User registers and logs in to the application.
- User creates a new campaign and sets up the funding goal, deadline, and reward details.
- Manager reviews and approves the campaign.
- Campaign goes live, and users can start contributing money to it.
- When the deadline arrives, the campaign ends, and the funds are transferred to the recipient's account.
- Through Blockchain its ensured that the transaction is completed end to end and notify the donor in compliance to security, transparency and integrity.

Workflow of the Application.



IV. METHODOLOGY

This paper provides a comprehensive methodology of the proposed system, including the utilization of Ethereum blockchain technology, smart contracts, JavaScript technologies, and key development environment tools to create a transparent, efficient, and engaging platform for charitable giving.

Polygon

Our project proposes a paradigm shift in conventional blockchain based charity methods by introducing a new approach built upon the decentralized architecture of the Polygon blockchain. By leveraging the familiar user interface of traditional web2 applications, our model seamlessly integrates with the robust, distributed infrastructure of the Polygon network. With vast potential for growth and innovation, our proposal holds great promise for revolutionizing the way we approach blockchain based donations. [15]

Ethereum vs. Polygon

- Ethereum is the first and most Broadly known blockchain for self Executing contracts and decentralized applications (DApps). It offers a high level of security but can be slow and expensive due to its Proof of Work (PoW) consensus mechanism. Gas fees on Ethereum can be high during periods of network congestion.
- Polygon is a Layer 2 scaling solution for Ethereum. It provides faster and cheaper transactions by utilizing a Proof of Stake (PoS) sidechain. Developers can deploy their smart contracts on Polygon to benefit from reduced transaction costs and faster confirmation times while remaining interoperable with the Ethereum network

TABLE 1: COMPARISON BETWEEN ETHEREUM & POLYGON

Comparison b/w Ethereum and Polygon		
Aspect	***Ethereum***	***Polygon***
Primary Use Case	General Purpose Blockchain	Layer 2 Scaling Solution
Smart Contracts	Supports complex smart contracts	Limited smart contract support
Scalability	Can become congested with high gas fees	Offers scalability through sidechains
Transaction	Can be expensive during congestion	Lower fees due to Layer 2 scaling
Fundraising	Suitable for complex fundraising campaigns	Ideal for cost-effective microtransactions
Security	High level of security and decentralization	Inherits security from Ethereum
Inter-operability	Widely used with a large DeFi ecosystem	EVM-compatible for easy migration
Complexity	Offers extensive smart contract capabilities	Simplified for faster transactions
Transaction Speed	Variable, can be slow during congestion	Faster and more cost-effective
Widespread Adoption	High adoption among developers and projects	Gaining popularity in DeFi

In summary, Ethereum is the main blockchain for smart contracts, but Polygon offers a more cost-effective and faster alternative, especially for applications with high transaction volumes. The choice between Ethereum and Polygon depends on your project's specific requirements and budget considerations [16].

Smart Contracts

Smart contracts are like automated computer programs that work on a special digital platform. They help to make sure that agreements or deals are carried out just as they're supposed to.

Smart contracts are made using computer code, usually a language like Solidity for Ethereum. This code defines the rules for transactions, making them happen automatically when certain conditions are satisfied. They execute without the need for intermediaries, making them transparent and trustless.

Deploying a Smart Contract:

Write the smart contract code using a suitable programming language e.g., Solidity.

Build the code to produce the machine code and Application Binary Interface (ABI).

Deploy the smart contract using a blockchain development platform or tools like Remix or Truffle.

Pay the gas fee for deployment.

Once deployed, the contract will have a unique address on the blockchain.

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Scaling using Layer 2

In order to scale “Impact Chain” project, we have used Layer 2 scaling to achieve our goals and requirements. Here’s why we considered Layer 2 optimal for the project:

Increasing Scalability: Increasing scalability without changing the main chain: Layer 2 scaling enables us to dramatically increase our project's transaction throughput and overall efficiency without making major changes to our main blockchain. This is especially useful if we'd like to take advantage of the security and decentralized nature of an existing layer 1 blockchain (such as Ethereum) but still need to improve performance.

Decreasing costs and faster transactions: Layer 2 solutions allows us for faster and more cost-effective transactions, as they can process off-chain and on-chain transactions. This can lead to lower gas fees, faster confirmation times, and more efficient and cost-effective transactions.

Enhanced user experience: Layer 2 solutions offers a smoother and easier-to-use experience for participants, which can boost engagement and participation among donors, charities, fundraisers, and other stakeholders.

Scaling without hard forks: Layer 2 implementations can be built on top of Layer 1 blockchains, without needing to hard fork or upgrade the protocol. This makes deployment easier and less disruptive to the current blockchain ecosystem.

Providing interoperability: Layer 2 solutions can be built to support blockchain-agnostic architectures which states that they can interoperate with multiple Layer 1 blocks. This flexibility is important if we want to experiment with different blockchain networks without impacting the platform significantly.

Providing security and trustlessness: Layer 2 solutions maintain a high degree of security and trustworthiness by regularly settling transactions on the layer 1 blockchain, making sure that the final state of the transaction is recorded on the master chain.

Lower adoption and entry barriers: Faster transaction confirmation times and lower gas fees on Layer 2 can help us to attract more users, even those with smaller contributions. This inclusiveness can help us to create a more diverse and more engaged donor community.

Integration of Frontend and Backend using Web3

The smart contract is integrated into the DApp using Web3 modules. To integrate a frontend and backend with a smart contract using Web3, follow these steps:

Frontend

Use HTML, CSS, and JavaScript (or a frontend framework like React) to create a user interface.

Import the Web3 library into your frontend code to interact with the Ethereum or Polygon blockchain.

Connect to a Web3 provider like MetaMask or use Infura for remote node access.

Use Web3 to read data from the smart contract (e.g., retrieve contract state).

Use Web3 to send transactions (e.g., calling contract functions) to the smart contract.

Backend:

Implement a server using a backend technology stack (e.g., Node.js, Python, Ruby).

Create API endpoints that "Engage with the smart contract on the blockchain."

Use a Web3 library for your chosen backend language to communicate with the blockchain.

Securely manage private keys or access to the blockchain in your backend.

By following these steps, your frontend and backend can interact with the smart contract to display data and send transactions on behalf of users.

V. Potential of DeFi

DeFi, or Decentralized Finance, has shown significant potential across various aspects of the financial industry. Here are some key areas where DeFi has the potential to make a substantial impact:

Enhancing Financial Inclusion:

DeFi has the potential to extend financial services to individuals who are either unbanked or underserved, granting them access to savings, lending, and investment opportunities. It can effectively bridge the financial gap for people in regions with limited access to traditional banking. [17]**.**

Global Market Accessibility:

DeFi platforms operate on a global scale, enabling users to access and trade various assets, such as cryptocurrencies and synthetic assets, without the restrictions imposed by traditional market hours and geographical constraints.

Reduction in Intermediary Costs:

Through the removal of intermediaries, DeFi has the potential to lower transaction costs, including fees associated with lending, borrowing, and trading. This has the potential to lead to more competitive rates for users.

Automated and Programmable Financ:

DeFi platforms often harness automated protocols and programmable smart contracts, allowing users to automate various financial processes, including savings, investments, and portfolio management.

VI. Potential of blockchain in India

Blockchain technology holds significant potential in India across various sectors and applications. Here are some areas where blockchain can make a substantial impact in the Indian context:

Digital Currency:

Digital currency, in the form of cryptocurrencies, serves as a medium of exchange that employs cryptographic techniques to bolster security and manage the creation of new currency units. Well-known cryptocurrencies include Bitcoin, Ethereum, Ripple, Litecoin, and others.

Cryptocurrencies offer solutions to address identity theft by giving users control over their transactions, enhancing security for both users and merchants. Transactions, once initiated, become irreversible, reducing the potential for fraud. Importantly, cryptocurrencies do not involve the exchange of personal information, further safeguarding users. They enable seamless, global money transfers without reliance on central authorities and provide immediate verification and transparency for all participants. Additionally, the cost associated with

converting cryptocurrencies to traditional fiat money is notably low.

Consortium Account Monitoring:

Consortium account monitoring is a vital application of Blockchain Technology, primarily aimed at preventing fund diversion. In traditional lending scenarios, lenders often lack visibility into how borrowers utilize funds, especially when those funds pass through multiple banks. Blockchain Technology plays a crucial role in enabling the oversight of a borrower's end use of funds in cases where multiple banks within a consortium provide funding.

This enhanced transparency is instrumental in reducing Non-Performing Assets (NPA) because banks gain the capability to closely scrutinize the application of funds. Blockchain technology ensures that information regarding fund movements is accessible to all consortium members, facilitating a robust and transparent monitoring system. [18]

Supply Chain Approval:

Counterfeit and stolen goods not only result in financial losses but can also tarnish a brand's reputation. Blockchain technology offers a solution by attaching unique identifiers to items, enabling swift verification of their authenticity during purchase. By leveraging blockchain, it becomes possible to create an unchangeable, comprehensive, and universally accessible record of an item's origin, critical for tracking and regulatory requirements. This, in turn, simplifies the process of identifying counterfeit or stolen products. [19]

VII. Conclusion

The "Impact Chain" project represents a groundbreaking and transformative solution to the persistent challenges that have long plagued the realm of charitable giving. In an era marked by a lack of transparency, difficulties in engaging younger donors, slow fund disbursement, and limited innovation in fundraising, this project leverages cutting-edge technologies and the power of the Ethereum blockchain to redefine philanthropy as we know it.

The utilization of Ethereum smart contracts as the backbone of the platform ensures unparalleled openness and responsibility in the donation process. Donors can trace their contributions, and charities can showcase their financial transparency, fostering trust and confidence. The integration of JavaScript technologies, such as React JS, Node JS, and Express JS, guarantees a user-friendly interface that appeals to a younger, tech-savvy demographic, thereby enhancing donor engagement and participation.

The development environment tools, including Truffle and Ganache, streamline smart contract creation and testing, ensuring the reliability of the platform. Additionally, MetaMask adds wallet functionality and simplifies token management, making transactions convenient and secure for users.

VIII. Future Scope

Scalability:

As the "Impact Chain" platform gains traction and attracts more users, scaling the infrastructure to accommodate increased transactions and participants will be essential. Research into solutions for scaling on the Ethereum blockchain or exploring alternative blockchains with enhanced scalability could be a valuable avenue of future development.

Cross-Platform Integration:

Expanding the compatibility of the "Impact Chain" platform to interact seamlessly with other blockchain networks and cryptocurrencies could enhance its reach and utility. Research into cross-platform interoperability standards, such as blockchain bridges or cross-chain communication protocols, can be explored.

Diversification of Charitable Sectors:

Currently focused on a specific charitable sector, consider the expansion of "Impact Chain" into other areas of philanthropy, such as healthcare, education, or disaster relief. Research into tailoring the platform's features and mechanisms to suit the unique needs of various charitable sectors will be valuable.

Incorporating AI and Data Analytics:

Leveraging artificial intelligence (AI) and advanced data analytics could enhance the platform's capabilities in donor engagement, fraud detection, and impact assessment. Research into AI-driven solutions for personalizing donor experiences and optimizing charitable operations may offer exciting prospects.

Privacy and Securtiy Enhancements:

Continuous research and development efforts should focus on bolstering the privacy and security of the platform. Innovations in privacy-focused blockchain technologies, zero-knowledge proofs, and decentralized identity solutions can contribute to a more secure and private environment for users.

We are excited to share the report on Impact Chain: Blockchain-Based Charitable Donations: A Transparent Approach to Empowering Philanthropy. Achieving a task's completion typically involves the valuable input of several individuals, either directly or indirectly.

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Hostile Comments Categorization

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***Abstract*— Automated detection techniques need to be developed since offensive and toxic comments on online forums are becoming a bigger problem. In order to solve this problem, the study paper suggests a method for identifying and categorising hostile statements according to the degree of severity with which they are expressed in English. Utilising a highly annotated dataset from Kaggle, the effectiveness of the LSTM (Long Short Term Memory) and BERT (Bidirectional Encoder Representations from Transformers) models are compared. The outcomes show the efficiency of both models, with BERT outperforming LSTM in terms of accuracy and fine-grained categorization.**

***Keywords*—Toxic comments, Deep learning Models,**

INTRODUCTION

Online platforms and social media have seen a rise in negative and harsh remarks, which poses serious problems for user experience and community well-being. Derogatory language, hate speech, threats, and other toxic comments are all possible. Such comments have an effect on more than just the individual users, they also have an impact on the mood and participation in online communities. Consequently, there has been a lot of interest in creating automated systems that can identify and categorize hazardous comments. This study work focuses specifically on the task of identifying poisonous comments and categorizing them according to how severe they are in the English language.

This study aims to: (i) Estimate the efficacy of LSTM (Long Short Term Memory) and BERT (Bidirectional Encoder Representations from Transformers) models for toxic comment detection and classification; and (ii) Comparing the accuracy and fine-grained classification performance of these models for various harshness levels by utilizing dataset from Kaggle. This paper seek to provide insights into the advantages and disadvantages of each model by a thorough comparison analysis and to highlight their practical relevance in real-world circumstances.

LITERATURE SURVEY

Toxic comment detection and classification have gained significant attention in recent years due to the increasing prevalence of online platforms and the need to create safe and respectful online environments. Researchers have explored various approaches and techniques, including traditional machine learning algorithms and deep learning models, to address this challenging task. In this literature review, an overview of the research conducted in this field is portrayed,

highlighting the advancements made in detecting and classifying toxic comments.

Early studies on toxic comment detection predominantly relied on traditional machine learning algorithms. In [1] the application of Support Vector Machines (SVM), and Random Forests to classify toxic comments based on handcrafted features such as n-grams, sentiment analysis, and lexical patterns. While these methods achieved moderate success, they often struggled to capture the nuanced language and contextual understanding necessary to accurately identify toxic comments [2].

Deep learning models have emerged as powerful tools for toxic comment detection and classification, capable of capturing complex linguistic patterns and context. Recurrent Neural Networks (RNNs), especially Long Short-Term Memory (LSTM), have been extensively employed in sequence modelling tasks, including toxic comment detection. [3] Proposed an LSTM-based model that achieved competitive performance on benchmark toxic comment datasets. The ability of LSTM to capture sequential dependencies in text data has proven valuable in identifying toxic language.

In recent years, transformer-based models, such as BERT (Bidirectional Encoder Representations from Transformers), have revolutionized natural language processing tasks. BERT, introduced by [4] employs a self-attention mechanism to capture contextualized word representations. BERT has demonstrated state-of-the-art performance in various natural language processing tasks, including sentiment analysis, question answering, and text classification [5]. Its ability to understand the contextual meaning of words and phrases makes it a promising candidate for toxic comment detection and classification.

Several studies have conducted comparative analyses between different models for toxic comment detection and classification. [6] Compared LSTM and BERT models for sentiment analysis and found that BERT outperformed LSTM in capturing fine-grained sentiment distinctions. This suggests that BERT's contextualized representations contribute to its effectiveness in understanding the underlying sentiment in text data.

In the specific context of toxic comment detection, directly comparing the performance of LSTM and BERT models is relatively limited. However, based on their performance in other natural language processing tasks, BERT's contextualized representations are expected to play a crucial role in accurately identifying and classifying toxic comments. The nuanced language often used in toxic comments requires models to capture the contextual information effectively, aligning with BERT's strengths.

One of the major challenges in toxic comment detection is the presence of sarcasm and subtle expressions that can be easily misclassified. [7] Explored the challenges of sarcasm detection in toxic comments and highlighted the need for models to understand the contextual cues and linguistic nuances associated with sarcasm. This indicates that future research should focus on developing models that can effectively capture the subtleties and context-specific meanings of toxic language.

The application of toxic comment detection models extends beyond research domains and has practical implications for online platforms. Such models can assist in content moderation, ensuring a safer and more inclusive online environment.

Multiple studies have explored the integration of toxic comment detection systems into social media platforms [8]. These applications demonstrate the potential of toxic comment detection models to contribute to the mitigation of online toxicity and improve user experiences.

METHODOLOGY USED

The dataset, data pre-treatment procedures, LSTM and BERT model architecture, and training procedures are all covered in detail in this section.

Data Acquisition and Pre Processing

To train and test toxic comment detection methods, a high-quality annotated dataset must be obtained. The data is collected from a wide range of harmful comments from Kaggle. Each comment had a label indicating the category of its' close resemblance. The comment was categorized into six labels Toxic, Severe Toxic, Obscene, Threat, Insult, and Identity Hate. Each comment can belong to multiple categories or can belong to none. Dataset is cleaned and prepared the dataset by performing pre-processing operations before training the models. This required eliminating extraneous data, including usernames, URLs, and unusual characters. It also dealt with misspellings and acronyms by using text normalisation and spell checking procedures. The usage of tokenization to break down the comments into single words or subwords, which helped the models process the material effectively.

Model Selection and Metrices Evalaution

An embedding layer, recurrent layers, and a fully connected output layer make up the LSTM model architecture. Each word is converted into a dense vector representation by the embedding layer, which also captures the semantic meaning of the words. The model may capture the sequential dependencies included in the comments by processing the word embeddings in succession using the recurrent layers, which are typically made up of multiple LSTM units. The fully connected output layer generates a probability distribution over the severity levels at the end, allowing each comment to be classified.

The LSTM model architecture and the BERT model differ in a number of ways. By taking into account the complete sentence, BERT's transformer-based design captures contextualized word representations and supports parallel computing. The BERT model has multiple levels of self-attention mechanisms that allow it to focus on various areas of the input sentence and gather data from both the words before and after them. Our annotated dataset is used to refine the pre trained BERT model, replacing the final layer with a classification layer unique to the severity levels. The utilization of methods like attention masking and dynamic padding during training to effectively handles variable-length comments.

During the training phase, the parameters of the models are optimised using appropriate optimisation techniques. To guarantee a balanced representation of all severity levels, the dataset was stratified into training, validation, and testing sets.

While being evaluated on the validation set, the models are trained on the training set. This enables us to avoid over fitting and, if necessary, make necessary modifications to the hyper parameters. To evaluate the models performance on the testing set, the utilization of assessment metrics including accuracy, Log Loss, and AUC Score is done. To assess the effects of various hyper parameters and modifications in model designs, ablation investigations are also undertaken.

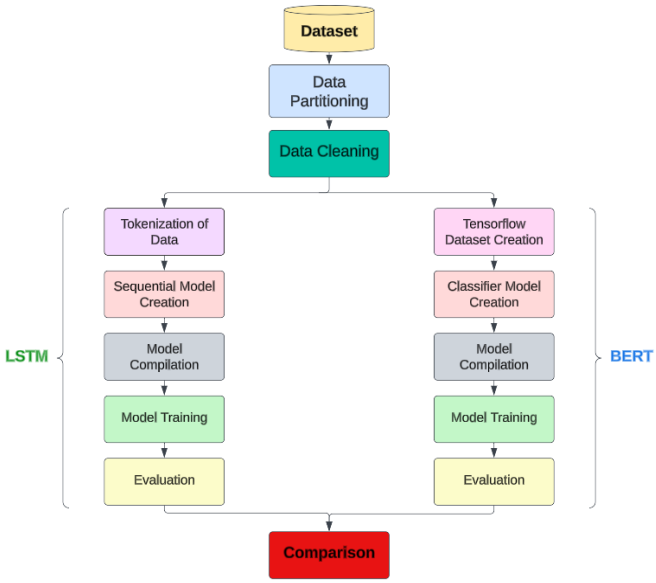

FIG.I. FLOW CHART LSTM AND BERT MODEL

Experimental Setup

The project utilizes a high-performance computing environment with a GPU-accelerated system made accessible by Google Collab for the investigations. With this configuration, it can effectively utilize the processing resources
required for deep learning model training. The LSTM and BERT models are utilized in well-liked deep learning frameworks like Tensor Flow. For the project a variant of BERT model published as 'BERT_en_uncased'[9] is selected. This model was pre-trained on a dataset of 2.5 billion words from the Wikipedia and 800 million words from the Book corpus.

The system loads the processed dataset, which is then used to train the models using the proper loss functions and optimization techniques. To maximize performance, the models hyper parameters—such as learning rate, batch size, and regularization methods—are carefully calibrated. To find the ideal settings for each model, it is tested out on several setups. In order to avoid over fitting, the models are trained for a predetermined number of epochs and early stopping procedures are used.

During the training process, the monitoring of the models' performance on the validation set is done and necessary adjustments of hyper parameters are performed. This iterative process ensures that the models generalize well to unseen data and produce reliable results.

RESULTS AND ANALYSIS

The results and analysis section present the findings of the experiments and provides an in-depth analysis of the performance of LSTM and BERT models.

The experimental results reveal the effectiveness of both LSTM and BERT models in detecting toxic comments and classifying them based on their harshness level. The LSTM model achieves an accuracy as 0.9794 , Log Loss as 0.05272 and an AUC Score of 0.9608, while the BERT model achieves an accuracy as 0.9829 , Log Loss as 0.0439 and an AUC Score of 0.9807 The evaluation

metrics demonstrate that both models perform well above the baseline, indicating their capability to identify toxic comments accurately.

In addition to overall accuracy, it also assess the models performance in classifying comments into different harshness levels. The results show that BERT outperforms LSTM in this regard, achieving higher precision and recall for each harshness level. This indicates that BERT has a better ability to capture subtle differences in harshness, enabling more nuanced classification. The fine-grained classification analysis provides insights into the models' strengths and weaknesses when dealing with different levels of toxicity.

To gain further understanding, it also analyses the instances where the models misclassify toxic comments. It is observed that both models struggle with sarcasm and subtle expressions, often misclassifying them as non-toxic. This suggests the need for further research and model improvements to handle such linguistic nuances effectively.

The comparative analysis of LSTM and BERT models highlights their respective strengths and limitations. While LSTM models excel in capturing sequential dependencies, BERT's contextualized word representations provide a significant advantage in understanding the nuances of toxic comments. The ability of BERT to leverage the surrounding context and capture fine-grained distinctions contributes to its superior performance in this task. Future research should focus on developing hybrid models or ensemble approaches that combine the strengths of LSTM and BERT for improved performance.

The findings of this research have practical implications for the development of toxic comment detection systems in online platforms. The comparative analysis provides valuable insights for designing effective moderation tools that can automatically identify and classify toxic comments. By leveraging deep learning techniques, platforms can enhance user experience, mitigate harmful behaviour, and create a safer online environment. The study also highlights the challenges of handling sarcasm and subtle expressions, which can guide future research and improvements in the field.

TABLE 1: PERFORMANCE COMPARISON OF LSTM AND BERT MODEL

Description	*Accuracy*	*AUC Score*	*Log Loss*
LSTM	0.9794	0.9608	0.0572
BERT	0.9829	0.9807	0.0439

CONCLUSION

In conclusion, this research paper presents a comparative analysis of LSTM and BERT models for detecting and classifying toxic comments by their harshness level in the English language. The experimental results demonstrate the effectiveness of both models in addressing the task, with BERT outperforming LSTM in terms of accuracy and fine-grained classification. The findings contribute to the growing body of research on toxic comment detection and provide insights for the development of robust and efficient systems in online platforms. The study highlights the practical applicability of deep learning models in addressing the challenges posed by toxic comments and emphasizes the need for further research to handle linguistic nuances effectively.

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A Review on Concepts of Artificial Intelligence

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Abstract: There were many different types of jobs done only by humans in the past. Such devices and technologies did not exist as they do now. Science had not advanced and technology had not been created at that period. Therefore, people are absolutely necessary for the operation, and people have realized that "today's science is tomorrow's technology." Modern, extremely sophisticated technology are a divine gift. Artificial intelligence and machine learning are two adaptive inventions that have been developed for a bright future and to reduce the amount of labour that humans must do. We are living in a new era of flawless science and technology, despite the early stages being marked by many incorrect assumptions. The general ideas of machine learning and artificial intelligence are covered in this review.

Keywords: Digitalization, supervised learning, AI, unsupervised learning, Innovative machines

I. INTRODUCTION:

Since humans have established their existence on the planet, it is critical that everyone comprehend the implications that AI and machine learning will have on the human species. The concept of "fittest survival," states that only people or robots who can demonstrate their existence through peak performance, high intelligence, and maximum capacity will endure. Once we travel down this path and develop machine super intelligence—which is self-learning, fully automated, and constantly evolving—there won't be any turning back.

Similar to any science fiction film, such as Iron Man, Star Wars, Terminator, etc. They range from fully outfitted super heroes to super robots capable of destroying the entire earth. Even whether one has witnessed the launch of a space shuttle or missile, self-driving automobiles, or basic robots that assist with home tasks, these are still incredibly impressive instances of human ingenuity. Without a question, the two most popular buzzwords in the world right
now are artificial intelligence and machine learning, which are frequently used interchangeably.

As with any science fiction film, such as the terminator, Iron Man, or Star Wars. They range from fully equipped super heroes to super robots that can destroy the entire globe. Even whether someone has watched a space shuttle or missile launch, an autonomous car, or a basic robot that assists with home tasks, these are all incredibly impressive instances of human brilliance. Without a doubt, machine learning and artificial intelligence are the two most popular buzzwords in the world right now and are frequently used synonymously. Peter Norvig and Stuart Russell [1] published "Artificial intelligence: A Modern Approach" in their investigation study.

Artificial intelligence's essential perceptions have been realized. They came to the assumption that artificial intelligence is a mixture of learning, perception, cognitive and problematic resolving. The goal of this assessment is to announce various categories of machine learning, amongst others. [10]

ARTIFICIAL INTELLIGANCE (AI)

"Artificial intelligence is an intellect [10] that is much smarter than the best human brain in practically every field, including computer science and linguistic logic." It is a contemporary means of realizing machines to accomplish muscle effort and to demonstrate multifaceted questions in a "knowledgeable" manner.

AI is critical for displaying cognitive behavior, understanding, demonstrations, and encouraging the user.

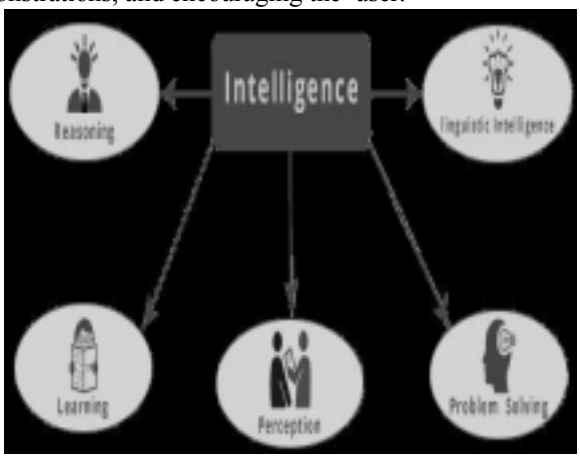

Fig. 1. Subdivisions in AI

AGI, or Artificial General Intelligence, is a classification that outlines the device's capability to execute intelligent behaviour in the same way that humans can perform multiple processes at the same time. It also requires linguistic reasoning and logic [1].

II. MACHINE LEARNING

Machine learning is a new AI application which enables the actual reality that provides machines the ability to analyze data to help human beings collaborate more effectively as well as learn for their own. Learning [3] is a crucial aspect of artificial intelligence. Machine learning is a subset of artificial intelligence that can learn and apply data and generate excellent outcomes [2]. When big data, data science, and data interpretation are brought up, both terms, artificial intelligence and machine learning, are usually combined.

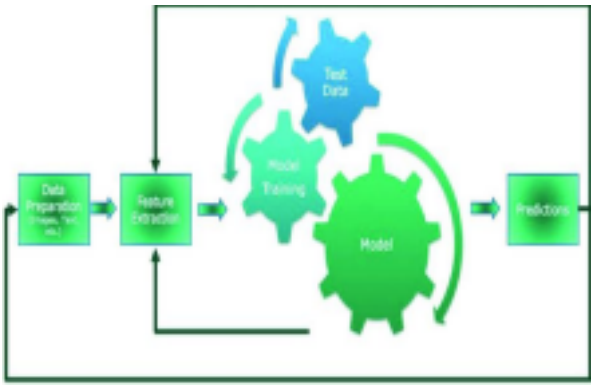

Fig.2. Machine learning mechanism

The diagram illustrates how machine learning is performed not only on a training basis, but also on how the knowledgeable engineer works on new experiments [3]. There are several types of learning:

1. Supervised education.
2. Unsupervised/predictive learning is the second method.
3. Reinforcement learning is the third type of learning.

1. Supervised learning:

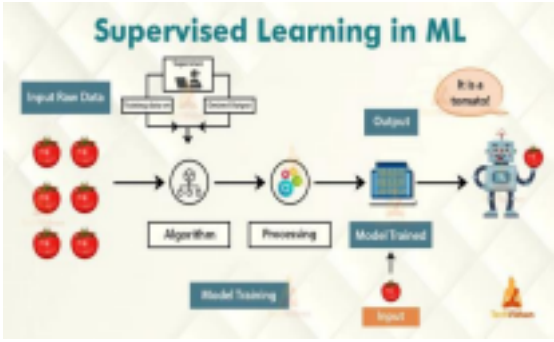

Fig.3. Supervised learning prototype

In this technique, the investigators convey the machine what the accurate reply is for a explicit input. It is the most widespread training process for neutral nets [4] and other machine learning layouts. It entails discovering an interaction between a set of inputs and the desired variable. The objective is to obtain a discrete and true worth. Decision trees, naive trees [5, 6], boosting, and multi-layer neutral networks are utilized to accomplish it.

Unsupervised learning:

In this kind of approach, no stickers are accessible to the learning algorithm [7]. At the moment, researchers are unsure what to do; research is ongoing.

Reinforcement learning:

The AI "agent"[8] in this algorithm selects how to operate in order accomplish a significant portion of the task. A computer program collaborates with a dynamic environment in order to defeat its rival by completing a specific task. The program gives you feedback in the form of penalties or rewards. In order achieve better results, the equipment selects which actions to perform.

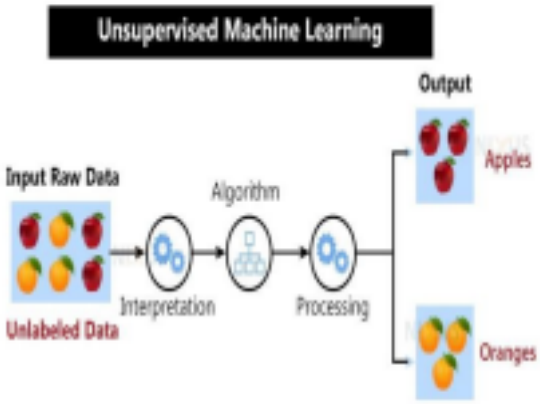

Fig. 4. Unsupervised learning model

III. APPLICATIONS OF AI AND MACHINE LEARNING

There are intelligent digital personal assistants [9] with speech and gesture recognition systems that can assist the user obtain and attempted out all the necessary things without any physical appearance for multiple operating systems, such as Google Now by Google etc. It will provide you with information such as "where is the nearest restaurant/college/bus station?" or it will remind you of upcoming work, an alarm clock, private data, a friend's birthday, or important meetings to attend, etc.

Scientists are conducting numerous future and ongoing studies on humanoids, i.e. robotics, as well as human behavior and feelings. Waymo [10], a Google initiative, is a self-driving car that operates on the road without the assistance of a human driver

IV. CONCLUSION

The globe as a whole is undergoing technological advancement, and artificial intelligence and machine learning concepts are playing a vital part in this process. Our research paper is entirely focused on how artificial intelligence and new machine technologies are invented in our daily lives. Machines of today are capable of providing knowledge-driven education and of boosting intelligence. In the future, we will not think and imagine about the advancements of the world solely because of Artificial Intelligence and Innovative Machines. We have no idea what is going on in our immediate surroundings and around the world because of scientists and engineers. Scientists created robots that work like humans, and research is ongoing to create the best world possible in the future. One of the most important aspects of developing new technologies is youth generation support. The combination of science and engineering, as well as high-quality machine learning, will undoubtedly lead to the world's best fit.

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Indian Sign Language Recognition using Machine Learning

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ABSTRACT- In a human life communication plays a vital role. But it becomes very difficult and challenging for deaf, dumb and blind people to communicate with any other person. And to make communication for these people easier Sign Languages are used and the need of converting theses sign languages is important. Our Research is based on making these sign languages understood by the computers more efficiently and will surely help community to communicate better with machines and with other people.
There are various classification techniques like CNN which is Convolutional Neural Network, RNN which is Recurrent Neural Network and LSTM which is Long short-term memory to check the performance produced by various algorithms and are compared.

KEYWORDS: Hand Gesture, Sign Recognition, Indian Sign Language (ISL) Detection, Moments, CNN Classifier , LSTM Classifier , CNN+LSTM Classifier.

I. INTRODUCTION

Sign language has all the characteristics of a visual–spatial one. It is a real language that has its own phonology, morphology, and grammar. This makes movements of arms, hand signaling, facial expressions, and head/body actions as the semantic information-generating parameters.

When two individuals interact, they use hand movements in a similar way as any other form of non-verbal interaction. Hand gesture recognition refers to decoding and classification of significant hand motions.

Hand gesture recognition is important since it has a lot of potential applications in VR, sign language recognition, etc. The hand articulations are very small but intricate compared with the rest of the human body which can result into significant errors. Therefore, recognizing hand gestures is a very difficult problem. Moreover, human computer interaction can help create such a virtual reality that one feels in the game's physical environment. The proposed system is aimed at removing communication gaps, giving every person an equal and fair chance. This will entail capturing a video of this individual as he makes different hand movements, encoding them, and using them in feeding the suggested model, which produces words sequentially. Those words are then used by the system to generate a meaningful sentence.

Recognizing simple hand gestures of ISL, such as detecting and counting fingertips using webcam frame or still image with Open CV.

The core objective of this task is digitalizing and evaluating on-the-fly (in the process of writing as the user) and stored, static images in terms of handwriting mathematical symbols. OpenCV will be employed for image processing and TensorFlow will train a LSTM classifier that uses the hand gestures to recognize the messages.

This project aims to train a Machine Learning algorithm that can recognize several types of hand gestures such as fist, palm, showing thumb, etcetera.

II. LITERATURE SURVEY

Many researchers have investigated on this concept and researched a lot and made some key issues such as Mariappan & Gomathi [1] presented new technique for identifying real-time signing of an ISL. OpenCV has the ability to process skin which they used for proposing a ROI-based sign detection and tracking scheme. They had 80 words and 50 sentence samples drawn from 10 individuals for training and testing purposes. Furthermore, they applied filters on colour images for the purpose of removing noise and performed morphological operations on an image produced through skin segmentation in order to enhance features. As such, they obtained a 75% overall accuracy rate for correctly identifying 40 words from ISL through the use of the fuzzy c-means algorithms. In particular, Mittal [2] proposed a LSTM model based on leap motion for the real-time sign language recognization. A four-gate LSTMS cell with a 2D CNN architecture and assigned labels to words were used for sign sentence recognition. This was a three-layered LSTM model built on a specific dataset, which achieved an accuracy of up to 72.3%. There was an achieved recognition of 89.50% for sign word recognition. Jiang[3] put forward a sign language recognition system, based on multiple models whereby the authors applied the skeleton base graph technique for finding isolated signs. Using SL-GCN and SSTCN, we generated skeleton key points. AULTS dataset was used in evaluating the suggested framework.

BLSTM-3DRN [4] was suggested for identifying sign language. They used a bi-directional LSTM model that is serialized in three phases: lastly, gesture recognition involving hand localization,, spatiotemporal feature extraction, and gesture identification. Specifically, Adaloglou[5] created a 3D ResNet with a B-LSTM for the perpetual sign language recognition of syntax creation. They implemented the framework onto various RGB + Data including for signing in Greek, with three levels of labeling. The authors used 2 layer lstm in combination with cnn on manually processed data consisting of 6 signs.

III. DATASET PREPARATION

We decided to prepare our own dataset on which we would train and test our modal. Our Current dataset consists of 6300 images. All the images present in the created dataset should be equal in size and to make sure that we convert all the images to a square image each having one channel. Then we convert the image from coloured image to the grey scale image as it required less computation. Thus, making it fast and also helps in increasing accuracy.

We prepared dataset of different characters of English Alphabet like A - L and some common words like Bye, Hello and Thank You.

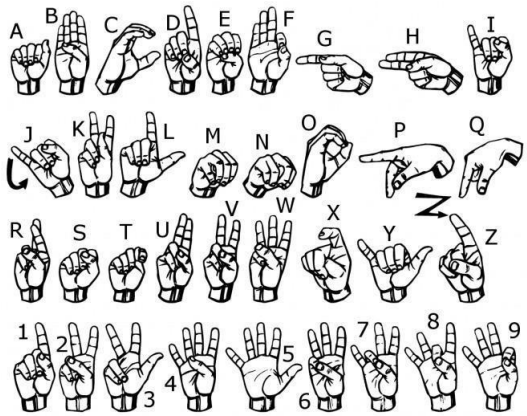

Fig 1. Sign Language

IV. METHODOLOGY

a) Deep Learning Modal using CNN

It is designed to learn from input sequences of features and produce a probability distribution over the possible output classes.

It consist of two 1D convolutional layer with 32 and then 64 filters. The first Convolutional layer with 4×4 kernel with applied Relu operation. The model has two max pooling layers whose pool sizes are 2 and help in reducing the spatial dimensionality of the feature maps generated by the convolutional layers.

After the convolutional layers, the model includes a Flatten layer, which transforms the multidimensional feature maps into a one-dimensional vector. The model also includes two fully connected Dense layers with ReLU and softmax activation functions, respectively. The first Dense layer has 64 units, which introduces nonlinearity to the network, and the second Dense layer has 7 units, which is the number of classes in the output space. Overall, the proposed CNN model is designed to learn from input sequences of features and produce a probability distribution over the possible output classes using convolutional and fully connected layers.

However, in our first attempts, we resorted to CNN for training the model with our collected dataset. CNN is part of ANN and it's used most often for processing images. CNN are not translation invariant because of their use of down sampling on the input.

```
[32]: cnn = Sequential([
          Conv1D(filters=32, kernel_size=4, activation='relu', input_shape=(30,1662)),
          MaxPooling1D(pool_size=2),

          Conv1D(filters=64, kernel_size=4, activation='relu'),
          MaxPooling1D(pool_size=2),

          Flatten(),
          Dense(64, activation='relu'),
          Dense(7, activation='softmax')
      ])
```

Fig 2.

```
[33]: cnn.compile(loss = 'categorical_crossentropy', optimizer='adam', metrics=['accuracy'])

      cnn.summary()

Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d (Conv1D)             (None, 27, 32)            212768

 max_pooling1d (MaxPooling1D  (None, 13, 32)           0
 )

 conv1d_1 (Conv1D)           (None, 10, 64)            8256

 max_pooling1d_1 (MaxPooling  (None, 5, 64)            0
 1D)

 flatten (Flatten)           (None, 320)               0

 dense_4 (Dense)             (None, 64)                20544

 dense_5 (Dense)             (None, 7)                 455

=================================================================
Total params: 242,023
Trainable params: 242,023
Non-trainable params: 0
_________________________________________________________________
```

Fig 3. CNN MODAL

```
[64]: accuracy_score(ytrue, yhat2)

[64]: 0.9090909090909091
```

Fig 4. Accuracy of CNN

b) Deep Learning Modal using LSTM

The model is comprised of four LSTM layers of 64, 128, 256, and 128 elements. To ensure nonlinearity of the network, each LSTM layer is followed by a ReLU activation function.

The first three LSTM layers employ the True return sequences option that means that they produce a series of hidden states for each input sequence. The last LSTM layer is configured with the return sequences set at false meaning it provides output only the final hidden state from the sequence. The model also comprises of the last LSTM layer followed by three dense layers with 128, 64, and 32 units coupled with ReLU activation functions. Finally, there is a dense layer with a softmax activation function that generates the probability distributions associated to any of the potential outputs.

In general, the adopted LSTM model is developed for learning from sequential inputs and generates a series of output acts. For this purpose, we utilized LSTM for training the model with respect to our retrieved data set. LSTM is a type of a deep learning architecture that belongs to RNN. In this regard, LSTMs provide an effective solution to sequential problems and times series. Among others, the LSTM is an RNN model capable of remembering values for long times. The LSTM can be used efficiently for classification or forecast to handle sequences with long time differences.

Our modal, the type of modal, was built with tensorflow keras, adding layers. It also allows us to train using sequence-based mode of LSTM through TensorFlow.

```
# Actions that we try to detect
actions = np.array(['Hello','Thanks','Bye','A','B','C','L'])

# Thirty videos worth of data
no_sequences = 30

# Videos are going to be 30 frames in length
sequence_length = 30
```

Fig 5.

```
[24]: model = Sequential()
      model.add(LSTM(64, return_sequences=True, activation='relu'))
      model.add(LSTM(128, return_sequences=True, activation='relu'))
      model.add(LSTM(256, return_sequences=True, activation='relu'))
      model.add(LSTM(128, return_sequences=False, activation='relu'))
      model.add(Dense(128, activation='relu'))
      model.add(Dense(64, activation='relu'))
      model.add(Dense(32, activation='relu'))
      model.add(Dense(actions.shape[0], activation='softmax'))
```

Fig 6. LSTM Modal

```
[72]: multilabel_confusion_matrix(ytrue, y_predicted)
      accuracy_score(ytrue, y_predicted)

[72]: 0.7272727272727273
```

Fig 7. Accuracy of LSTM

c) Deep Learning Modal using LRCN (LSTM + CNN)

The proposed model for this research paper is a Long-term Recurrent Convolutional Network or LRCN, which consists of a combination of convolutional and recurrent layers.

Five 1d convolutional layers are composed of 32, 64, 128, 64 and 7 filters. A 4-kernel size activating in ReLU is applied for the first layer of convolution. The model takes an input shape with dimension (30, 1662) implying that it processes data sets having a sequence length of thirty and a thousand six hundred and sixty-two feature dimensions.

It consists of two fully-connected linear output layers each followed by a ReLU activation function. Additionally it contains two max pooling layers with each layer possessing a pool size of 2 that reduces the spatial dimension of the maps yielded by the convolutional layers. The final part of the model encompasses a 64-unit LSTM layer that provides insight into the sequential nature of the input data.Finally, the model includes a fully connected Dense layer with a softmax activation function that produces a probability distribution over the possible output classes. The output layer has 7 units, which is the number of classes in the output space. Overall, the proposed LRCN model is designed to learn from input sequences of features and produce a probability distribution over the possible output classes using a combination of convolutional and recurrent layers.

```
[57]: lrcn = Sequential([
          Conv1D(filters=32, kernel_size=4, activation='relu', input_shape=(30,1662)),
          MaxPooling1D(pool_size=2),

          Conv1D(filters=64, kernel_size=4, activation='relu'),
          MaxPooling1D(pool_size=2),

          LSTM(32),
          Dense(7, activation='softmax')
      ])
```

Fig 8.

```
[58]: lrcn.compile(loss = 'categorical_crossentropy', optimizer='adam', metrics=['accuracy'])
      lrcn.summary()
Model: "sequential_2"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d_2 (Conv1D)           (None, 27, 32)            212768

 max_pooling1d_2 (MaxPooling  (None, 13, 32)           0
 1D)

 conv1d_3 (Conv1D)           (None, 10, 64)            8256

 max_pooling1d_3 (MaxPooling  (None, 5, 64)            0
 1D)

 lstm_4 (LSTM)               (None, 32)                12416

 dense_4 (Dense)             (None, 7)                 231

=================================================================
Total params: 233,671
Trainable params: 233,671
Non-trainable params: 0
_________________________________________________________________
```

Fig 9. LRCN Modal

```
[67]: accuracy_score(ytrue, yhat3)

[67]: 0.9090909090909091
```

Fig 10. Accuracy of LRCN

V. COMPARISON

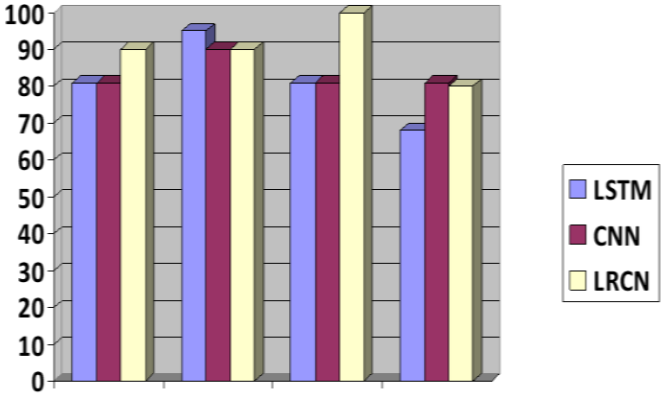

Fig 11.

VI. RESULTS

In essence, we have reasons to hold that comprehension of any of the standard dynamic sign language data set could be arduous especially among the regional languages like the India sign language (ISL). This study demonstrates recognition of sign language using deep learning based architectures including LSTM, CNN, and LRCN. In the proposed methodology, datasets from optimal surrounding and the absence of controls settings were presented and performed with a combined set of LSTM-CNN model with recognized accuracy 90 percent for signs recognition from ISL custom dataset. This has been the best report of true, real time detection environment of Indian Sign Language so-far. However, the classes of the dataset, sets of words, video samples, etc., may still be improved to strengthen the proposed model. Non-static and angular input data frames have space for improvement.

VII. CONCLUSION

An Indian sign language recognition using LRCN and multi-physically signals dataset as a case study. The proposed system has remarkable scores compared to the present mode of ISL using frequently encountered daily words such as 'thanks', 'hello", goodbye' among others. We can also change activation functions so that higher accuracy can be achieved. Also, introducing more layers in the LSTM can lead to a better performance of the model for the ISL recognition using the LRCN method.

Future research can consider creating more precise models through better designed data under ideal conditions, altering camera angles and possibly taking advantage of wearables.

The current developed models operate on an isolated sign basis, which can also apply to a system that develops syntax based on a continuous sign language such as ISL.

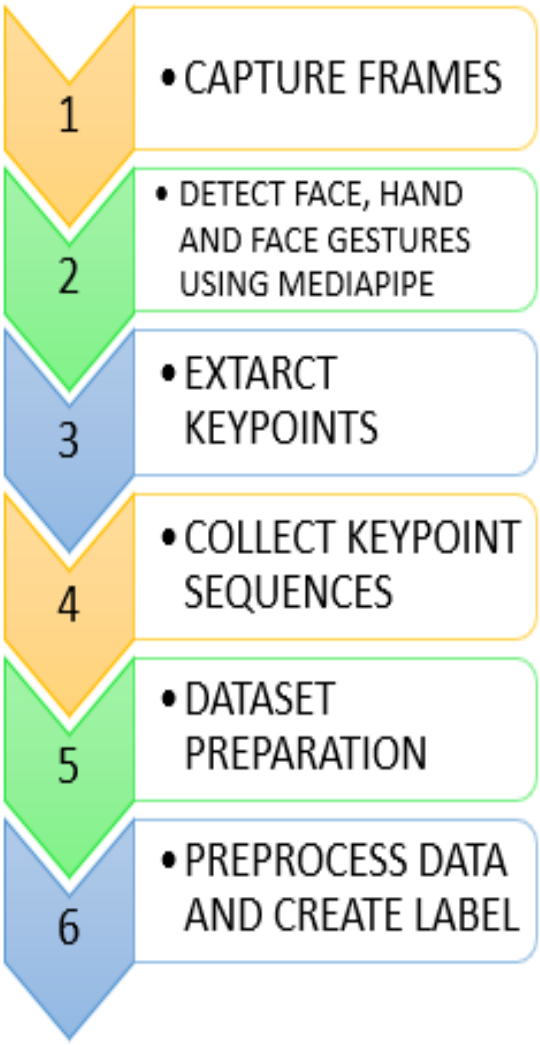

Fig 12. Steps

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Generative A.I. Integration Using APIs

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***Abstract*—This Generative Artificial Intelligence (Generative AI) has emerged as a transformative force across diverse domains by empowering machines to create content indistinguishable from human work. In this review paper, we delve into the pivotal role of Application Programming Interfaces (APIs) in unlocking the creative potential of Generative AI. Our exploration begins with a comprehensive examination of Generative AI fundamentals, encompassing neural networks, Recurrent Neural Networks (RNNs), Generative Adversarial Networks (GANs), and cutting-edge Transformer-based models. These models enable the generation of text, images, music, and more with remarkable precision.**

APIs are the linchpin connecting software components to Generative AI models, serving as intermediaries for data exchange and enabling access to the creative capabilities of these models. We elucidate the core functions of APIs, from communication facilitation to data input, output, authentication, and access control. Our discussion further unveils a spectrum of API types, including RESTful APIs, GraphQL, and WebSocket APIs, each tailored to distinct use cases.

Real-world applications come to life as we explore how Generative AI via APIs is reshaping text generation, image synthesis, music composition, data augmentation, and conversational agents. Case studies underscore its profound impact in industries ranging from content generation to healthcare and entertainment. Beyond benefits such as efficiency, personalization, cost savings, and scalability, we navigate the ethical and legal considerations inherent in Generative AI integration. From content generation to privacy, bias, and copyright, these issues demand a thoughtful approach.

This review paper equips readers with a comprehensive understanding of the synergy between Generative AI and APIs, offering insights, guidelines, and inspiring examples for harnessing this dynamic duo's capabilities.

Keywords—Generative API, Artificial Intelligence, Neural Networks.

I. INTRODUCTION

Generative Artificial Intelligence (Generative AI) holds significant importance across various domains due to its ability to create content that closely resembles human-generated content. The growing importance of API (Application Programming Interface) integration is a result of the increasing interconnectivity of software systems and central role APIs play in enabling this connectivity[1].

The primary objectives of this review paper are as follows:

- Generative AI, its fundamentals, and the various models and architectures employed in content generation.
- To explore the pivotal role of APIs in bridging the gap between software components and Generative AI models, enabling effective communication.
- To discuss the different types of APIs used in AI integration, including RESTful APIs, GraphQL, and WebSocket APIs, highlighting their features, benefits, and ideal use cases.
- To examine a range of practical use cases for Generative AI integration through APIs in diverse domains, including text generation, image synthesis, music composition, data augmentation, and conversational agents, with real-world examples in each category.
- To outline the essential steps involved in integrating Generative AI via APIs, covering authentication, API requests, error handling, and data post-processing.
- To elucidate the benefits of Generative AI integration, including efficiency, personalization, cost savings, scalability, and its potential to foster innovation, while also addressing the associated challenges.
- To analyze specific case studies and applications where Generative AI integration through APIs has made a significant impact across various industries.
- To delve into the ethical and legal implications of Generative AI integration, considering issues related to content generation, privacy, bias, and copyright.
- To provide a comprehensive list of references and resources for further exploration and study.

A. Generative A.I. fundamentals

Generative A.I. refers to a class of artificial intelligence systems designed to generate content. These systems utilizes various machine learning techniques majorly deep learning to generate content which aligns to the ideology and appears to be produced by humans. The approach taken by a generative A.I. tool is the use of neural networks, and Recurrent Neural Networks (RNNs) and Generative Adversarial Networks (GANs) to be specific. They are trained on large datasets and learn patterns and structures from the data [2].

Generative A.I. uses various models and architectures to create content. Some key models used in generative A.I. are :

- Generative Adversarial Networks (GANs): GANs consists of 2 neural networks, a generator and a discriminator. The generator produces data (e.g. images), while the discriminator evaluates whether the data is real or generated. With adversarial training, the generator improves its ability to create data that is indistinguishable from real data. GANs have been highly successful in image generation tasks.

- Recurrent Neural Networks (RNNs): RNNs are a type of neural network designed for sequential data. They are used in tasks like text generation, machine learning and time-series prediction. They consist of an internal memory that allows them to maintain context and information from previous steps. Unfortunately, they come along with the vanishing gradient problem, which limits their ability to capture long-range dependencies in data.
- Long Short-Term Memory (LSTM) Networks: LSTMs are a specialized type of RNN that address the vanishing gradient problem. They are effective at handling sequences with long-range dependencies and are used in speech recognition, language modeling and text generation.
- Gated Recurrent Unit (GRU): Similar to LSTMs, GRUs is designed to handle sequential data efficiently. They are computationally less complex than LSTMs but still effective. They are used in natural language processing tasks.
- Transformer-Based Models: Transformers have revolutionized Generative A.I, they consist of an attention mechanism that allows the model to focus on different parts of the input data when generating the output. There are various types of transformers available:
  Generative Pre-Trained Transformer (GPT): GPT models such as

  - GPT models such as GPT3 are primarily used for text generation and understanding. They are highly used for natural language understanding and generation.
  - Bi-Directional Encoder Representations from Transformers (BERT): BERT is designed for natural language understanding and is used in text classification, sentiment analysis and language translation.
  - Vision Transformers (VITs): VITs extend the transformer architecture to image related tasks such as image classification, object detection and image captioning.

B. APIs and their role in A.I. Integration

Application Programming Interface (APIs) are a set of rules/protocols and tools that facilitate communication between different software components and systems. They define methods and data formats that developers can use to request and exchange information between components. In the context of Generative A.I. models, APIs play a crucial role as they enable applications and services to interact with and harness the creative capabilities of the models[5].

Let's look at the fundamental role of APIs in connecting software components to Generative A.I. models:

[1] Enabling Communication: APIs serve as intermediaries that enable applications to access the functionalit of external services, libraries or platforms. They define how data is sent and received between components, while ensuring that communication is structured and standardized.

[2] Bridging the Gap: Generative A.I. models, as GANs, LSTMs or Transformers are complex neural networks that require specific inputs and generate specific type of content. The APIs serve as bridges between applications and these models, allowing user to send input data and receive output in structured and controlled format.

[3] Data Input and Output: APIs allow developers to send in out data which could be in the form of text prompts, images or other data to the model. The model processes this data and generates creative content, which is then sent back as API response. Authentication and Access Control: Many A.I. models are hosted on remote servers and APIs often require authentication to ensure that only authorized users can access the model.

[4] Standardized Interfaces: APIs offer standardized interfaces for accessing Generative A.I. models. This means that regardless of the underlying architecture or complexity of the model, developers can use a consistent set of commands and methods for interaction.

[5] Scalability and Accessibility: API integration allows applications to scale easily. As demand for A.I. tasks grow, developers can make more API requests to handle loads without major changes to infrastructure.

APIs play a fundamental role in enabling software components to communicate with Generative A.I. models by providing a standardized and secure means of interaction. Number of reaserchers have developed API specific to various application areas like testing effort estimate for reliability assessment of OSS systems has been developed in 2019[7]. New API model for iterative software development life cycle is also developed in 2021[8]. The different types of APIs used in A.I. integration and the choice of API depends on various factors, including the specific requirements of the application, the nature of data exchange and the desired level of flexibility. Let's discuss a few commonly used APIs in A.I. integration.

- *Representational State Transfer (RESTful APIs):*

RESTful APIs are based on a set of architectural constraints and principles for designing networked applications. They rely on standard HTTP methods to perform operations [3].

Data Format:

- RESTful APIs: often use standard data formats like JSON or XML to represent and exchange a data. JSON is a popular choice due to its simplicity and lightweight nature.

  a) Statelessness: RESTful APIs are designed to be stateless, meaning that each request from a client to the server must contain all the information needed to understand and process the request.

  b) Usage in Integration: RESTful APIs are widely used in AI integration for their simplicity and compatibility with HTTP, which is the foundation of the World Wide Web. AI services, such as language models or image recognition, often expose RESTful endpoints to allow developers to make HTTP requests for data generation or analysis.

- GraphQL APIs:

a) Query Language: GraphQL is a query language for APIs that enables clients to request only the data they need. Instead of predefined endpoints, clients send specific queries, and the server responds with the requested data.

b) Flexibility: GraphQL APIs offer a high degree of flexibility, allowing clients to shape their data requests.

c) Real-Time Capabilities: GraphQL supports real-time updates, making it suitable for AI use cases where live data streams or instant responses are needed.

d) Usage in A.I. Integration: GraphQL is becoming more popular in AI integration because it enables clients to express their data requirements precisely, reducing over-fetching or under-fetching of data from AI models or databases.

- WebSocket APIs:

- Real-Time Communication: WebSocket is a protocol that provides full-duplex communication channels over a single TCP connection. It allows for low-latency, real-time communication between the client and server.

- Push Notifications: WebSocket APIs are often used to push data updates to clients in real time, making them suitable for applications where immediate feedback is required..

- Usage in Integration: WebSocket APIs are used in AI integration when real time interactions with AI models are necessary. For example, in chatbots, collaborative AI platforms, or interactive AI-driven application WebSocket APIs can provide low- latency, bidirectional communication.

C. Use Cases and Applications

Generative AI integration through APIs has found practical use across a variety of domains, offering innovative solutions and enhancing capabilities in each. Here are practical use cases for Generative AI integration through APIs in diverse domains, along with real- world examples:

- *Text Generation and Language Models:*

Automatic content generation, translation, summarization, and creative writing. Real-World Examples:

a. Content Generation: Content creation tools like Copy.ai and Sudowrite use Generative AI models to generate marketing copy, blog posts, and other written materials.

b. Translation:Google Translate utilizes machine translation models to convert text between multiple languages.

c. Summarization: Tools like Summarize Bot and OpenAI's GPT-3-based models can summarize lengthy documents or articles.

d. Creative Writing: ChatGPT from OpenAI generates creative and engaging text for stories, poems, and more.

- Image Synthesis and Transformation:

Creating, modifying, and enhancing images. Real-World Examples:

a. Art Generation: DALL-E, also from OpenAI, generates images from textual descriptions, allowing artists to create visuals based on text prompts.

b. Image Editing: Adobe's Content- Aware Fill tool uses AI for retouching and object removal in photos.

c. Super-Resolution: Topaz Labs uses AI for image upscaling, enhancing image quality while maintaining sharpness and details.

- Music Composition and Creative Arts:

Generating original music, visual art, and other creative works. Real-WorldExamples:

a. Music Composition: AI-based tools like AIVA and Amper Music compose music for videos, games, and more.

b. Art Generation: Platforms like Deep Dream Generator transform images into surreal and artistic visuals.

- Data Augmentation and Synthetic Data generation: Enhancing datasets for machine learning and data science. Real-World Examples:

a. Data Augmentation: OpenAI's GPT-3 has been used to generate data for text-based applications, such as chatbot training data, and to augment datasets for various natural language processing tasks.

b. Synthetic Data: In healthcare, AI generates synthetic medical images for training AI models without compromising patient privacy. In autonomous vehicles, AI generates synthetic driving scenarios for testing and validation.

- Conversational Agents and Chatbots: Enhancing chatbots and virtual assistants with natural language understanding and generation. Real- World Examples:

a. Customer Support: AI-driven chatbots like Zendesk's Answer Bot provide automated responses and assist with customer inquiries.

b. Virtual Assistants: Amazon Alexa and Google Assistant leverage AI models to understand and respond to voice commands.

D. API Integration Process

Integrating Generative AI via APIs involves several essential steps, including authentication, making requests, handling responses, error management, and data post-processing [4] [5]. Here is an outline of these steps along with code examples or pseudocode for clarity:

1. Authentication and Access Control:

a. Step 1: Acquire API Credentials Obtain the necessary API credentials, such as an API key or token, from the Generative AI service provider. These credentials are used to authenticate your application.

b. Step 2: Securely Store Credentials Store the API credentials securely, such as in environment variables or a configuration file, to prevent unauthorized access.

c. Step 3: Implement Authentication Use the obtained credentials to authenticate your application with the Generative AI service. This typically involves including the credentials in the API request headers.

2. Making API Requests and Handling Responses:

d. Step 4: Construct API Request Create a structured API request with the required input data, such as text prompts or images. Ensure that the request adheres to the API's specifications.

e. Step 5: Send API Request Use a library like requests (in Python) or an HTTP client to send the API request to the Generative AI service. Include the authentication headers.

f. Step 6: Receive API Response Capture and handle the API response, which includes the content generated by the AI model. Extract the relevant data from the response, such as generated text or images.

3. Error Handling and Rate Limiting:

g. Step 7: Implement Error Handling Prepare your application to handle potential errors gracefully, such as network issues, API service downtime, or incorrect input.

h. Step 8: Check Rate Limits Be aware of any rate limits imposed by the API service provider. Ensure that your application does not exceed these limits to avoid disruptions.

4. Data Transformation and Post-Processing:

i. Step 9: Post-Process Generated Data Depending on the application and use case, post-process the generated content. This may involve formatting, filtering, or modifying the content to meet specific requirements.

By following these steps and handling authentication, API requests, error scenarios, and data post-processing, you can effectively integrate Generative AI via APIs into your applications and harness the creative capabilities of AI models[6].

E. Benefits of Generative A.I. Integration

Security: - API integrations must be secure to prevent unauthorized access and data breaches. Ensuring the protection of sensitive data and AI models is critical Innovation:

Generative AI encourages innovation by allowing developers to experiment with new ideas and create novel features. It opens up opportunities for creativity and uniqueness in various domains.

Cost Savings: - Automating tasks through Generative AI can result in cost savings by reducing the need for human labor. Businesses can optimize resources and allocate budgets more efficiently.

Personalization: - Generative AI models can tailor content and recommendations to individual users, enhancing user intervention. This leads to increased operational efficiency, faster task completion, and reduced workload

Efficiency: - Generative AI can automate content creation and other tasks, reducing the need for manual human Integrating Generative AI into various applications

Consistency: - Content generated by AI models is consistent in style and quality, ensuring uniformity in branding, marketing, and content creation.

Scalability: - Generative AI integration is scalable, making it easy to handle increased workloads and demand,

F. *Conclusion*

In the dynamic realm of technology, the symbiotic relationship between Generative Artificial Intelligence (Generative AI) and Application Programming Interfaces (APIs) has emerged as a powerful force driving innovation and transformation. This review highlights the crucial role of Generative AI, particularly rooted in GANs, RNNs, and Transformer-based models, as a creative powerhouse transcending traditional boundaries. Trained on vast datasets, these models have far-reaching applications, from content generation to healthcare and virtual assistance, ushering in new possibilities across industries. The cornerstone of modern software architecture, APIs play a pivotal role in facilitating communication between applications and Generative AI models. Offering standardized interfaces, secure access control, and diverse API types, they serve as essential tools for applications leveraging the creative potential of AI models. While the benefits of Generative AI integration are vast, including efficiency, personalization, and innovation, this paper underscores the need for responsible use and regulation.

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An Intelligent Driving Using AI Approach

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Abstract— Many large automakers are currently attempting to produce their own autonomous vehicles. Many analysts forecast that we will begin to see completely autonomous automobiles operating in our cities in less than 30 years. A self-driving car is one that can sense its environment and navigate through traffic and other obstacles on its own with little to no assistance from a human. This is the newest and most anticipated technology in the automotive industry, and TESLA has successfully produced it after years of discussion and development. Promising results have been observed when using advanced deep reinforcement learning to tackle continuous control tasks, particularly in mixed-autonomy traffic. The model we offer in this work is based on deep reinforcement learning and takes into account the efficacy of autonomous vehicles leading mixed-autonomy traffic at a non-signalized crossroads. This model combines a reinforcement learning library, the Flow framework, and an urban transportation simulator. In order to achieve dependable simulation performance, we additionally provide a set of proximal policy optimisation hyperparameters. Compared with all human-driven vehicle studies, we show that full-autonomy traffic can enhance the average speed and delay time by 1.38 and 2.55 times, respectively. The greater the rate of adoption of autonomous vehicles, the more benefits our suggested approach yields. Furthermore, the most advanced autonomous car experiment can be utilised to disperse

I. INTRODUCTION

One of the biggest issues that traffic management organisations and other traffic participants must deal with is traffic congestion, which causes a lot of wasted time and delayed traffic. A national motor vehicle crash survey conducted in the United States in 2015 found that 47% of collisions occurred at junctions. [1]. Recently, automated vehicles (AVs) have demonstrated the ability to reduce human error and enhance the standard of a traffic service with complete independence anticipated by 2050 [2]. This mode of transport can prevent the US economy from losing almost $450 billion annually. [3]. The intelligent transport system (ITS) domain was created recently to give drivers a safer, more intelligent, and more comfortable ride. Since the 1980s, early ITS applications have been in use, including traffic control in Japan, route guidance systems in Berlin, and Intelligent Vehicle Highway Systems in the US [4,5,6]. ITS, on the other hand, focuses exclusively on intelligent technologies found in automobiles and road infrastructure. Cooperative intelligent transport systems (C-ITS) can be used to address communication issues between vehicles and road infrastructures, allowing those systems to exchange information and communicate in real time to facilitate safe and convenient travel [7,8,9,10].

II. BACKGROUND

A. Overview of the PPO algorithm and how it works

The Proximal Policy Optimization (PPO) algorithm is used to train agents (such as robots or self-driving cars) to take actions in an environment in order to maximize a reward signal. At a high level, the PPO algorithm works by iteratively adjusting the parameters of a policy function that maps the agent's observations to a set of actions. The goal is to find a policy that will maximize the expected reward over time.

Here is a more detailed description of how the PPO algorithm works:

1. The agent collects data by interacting with the environment, including observations of the state of the environment and actions taken by the agent.

2. The agent computes the advantage of each action based on the observed rewards and estimates the possible rewards.

3. The agent updates the policy function by maximizing a surrogate objective function that takes into account both the expected reward and the change in the policy function. This step is done using gradient ascent, which adjusts the policy function in the direction that increases the objective function the most.

The agent repeats steps 1-3 until the policy converges to a satisfactory solution or a maximum number of iterations is reached. One of the key features of the PPO algorithm is that it uses a "trust region" approach to update the policy function, which limits the size of the update to prevent the policy from straying too far from its previous value. This helps to stabilize the learning process and improve the reliability of the trained policy.

B. Comparison of PPO to other reinforcement learning algorithm

The training and validation of driving control models in a real-world setting is the most challenging problem for researchers working on autonomous driving. The real world has been represented by the simulation approach used to solve this problem. Pomerleau created a neural network simulation of a road using an autonomous land vehicle. Finally, we conclude that PPO algorithm is best for self-driving car.

C. *Design and Development of Self Driving Car*

Proximal Policy Optimization (PPO) is a reinforcement learning algorithm utilized for the design and development of a autonomous-driving car.

In a autonomous driving car project using PPO, the algorithm would be responsible for learning how to control the car's actions based on the data it receives from sensors such as cameras and lidar. The PPO algorithm would learn to select actions that maximize a reward signal, which could be based on factors such as the car's speed, distance traveled, or the smoothness of its movements.

To implement PPO in a self-driving car project, the following steps would typically be followed:

Define the environment and the task that the self- driving car needs to perform.

Collect and pre-process data from the sensors to create a representation of the car's environment.

Train a neural network to predict the best action to take based on the input data.

Use the PPO algorithm to fine-tune the neural network's predictions and improve its performance over time.

Test the self-driving car in various scenarios to evaluate its performance and identify any areas for improvement.

Continuously update and improve the self-driving car's control system based on the results of the testing.

Using PPO in a self-driving car project can help to make the car's actions more efficient and reliable, ultimately improving its safety and performance.

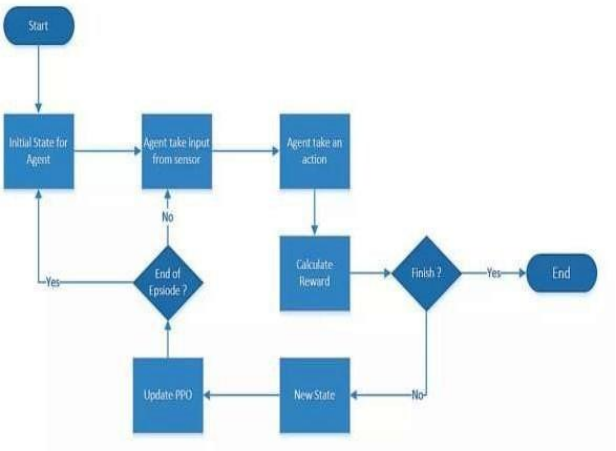

Fig 1 Proposed Autonomous driving system

III. METHODOLOGY

A. *Objective*

The basic idea of the project is to visualize the working of a reinforcement learning algorithm. In the present day we are developing different

AI technologies that helps the humans to easy the daily activities. Everyone who understands the day-to-day traffic and road accidents can relate to the need of a autonomous vehicle on the road. In this project we like to understand the depth of the deep learning algorithms and we pick up the best that the world has to offer and we implement it in this project. The results are more than we expected the algorithm understand the environment and according to that take the correct actions. We use the Kivy Library and the python language to implement the PPO Reinforcement Algorithm

B. *Proposed method*

The goal of this project is to develop an autonomous driving system collision avoidance. Three requirements must be met for an agent to be considered successful: 1) the agent should not collide with a obstacle; 2) the agent must arrive at the destination; and 3) the agent must arrive at the destination as quickly as possible. The three conditions are described below:

a) The agent can't run aground. Within a given time step parameter, the agent must maintain its trajectory and avoid colliding with the wall or the starting point.

b) The agent successfully arrive at the destination point within the specified time.

c) The quickest route to the destination can be found by the agent. Within a given time step parameter, the agent must arrive at the specified location and earn the maximum reward points. The number of time steps the agent has taken or the distance to the final location may be determined by the reward value. Figure 1 illustrates the current state of our suggested autonomous driving system.

C. *How PPO is implemented in the system*

Importing desired libraries:

Importing desired libraries into our python file. The files that we need are listed below: The code is in Figure 2.

This code helps to import the desired python libraries into our python file. Creating our network class:

Network class include two methods in the first is the init method and

```
import random
import os
import torch
import torch as T
import torch.nn as nn
import torch.nn.functional as F
import torch.optim as optim
import numpy as np
import torch.autograd as autograd
from torch.autograd import Variable
```

Fig 2 Importing Libraries

the other is the forward method to the resultant state to the relay memory class. We also pass the touch library in our Network class

which helps us to create a linear neural network. The code is in Figure 3.

```
class Network(nn.Module):

    def __init__(self, input_size, nb_action):
        super(Network, self).__init__()
        self.input_size = input_size
        self.nb_action = nb_action
        self.fc1 = nn.Linear(input_size, 30)
        self.fc2 = nn.Linear(30, nb_action)

    def forward(self, state):
        x = F.relu(self.fc1(state))
        q_values = self.fc2(x)
        return q_values
```

Fig 3 Network class Creating

RelayMemory class:

Relay memory class contains three methods init method, push method,

The Code is in Figure 4:

```
# Implementing Experience Replay

class ReplayMemory(object):

    def __init__(self, capacity):
        self.capacity = capacity
        self.memory = []

    def push(self, event):
        self.memory.append(event)
        if len(self.memory) > self.capacity:
            del self.memory[0]

    def sample(self, batch_size):
        samples = zip(*random.sample(self.memory, batch_size))
        return map(lambda x: Variable(torch.cat(x, 0)), samples)
```

Fig 4 Relay Memory Class

PPO is the brain of our class. This class contains the main code our project. This class includes init method, select action method, learn method, update method, score method, save and load methods.

The initial method initializes all the variables that we are going to use into this algorithm. Code in figure 5 is given.

```
def __init__(self, input_size, nb_action, gamma=0.9, gae_lambda=0.95, policy_clip=0.2, batch_size=64, n_epochs=10):
    self.gamma = gamma
    self.n_epochs = n_epochs
    self.gae_lambda = gae_lambda

    self.reward_window = []
    self.model = Network(input_size, nb_action)
    self.memory = ReplayMemory(100000)
    self.policy_clip = policy_clip
    self.optimizer = optim.Adam(self.model.parameters(), lr=0.001)
    self.last_state = torch.Tensor(input_size).unsqueeze(0)
    self.initialize_memory = PPOMemory(batch_size)
    self.last_action = 0
    self.last_reward = 0
```

Figure 5 Intl method

All the variabls such as the gamma , gae lambda, policy clip, batch size and n epochs are initialized with some default values that are given in the PPO research paper published by the Open Ai these values are tested in different cases to find the maximum results obtained.

The next method is the select action method it just selects the rotation data that is computed and send it to the action array for the next action that is to be performed.

The code is in Figure 6:

```
def select_action(self, state):
    probs = F.softmax(self.model(Variable(state, volatile=True))*100) # T=100
    action = probs.multinomial(num_samples=1)
    return action.data[0,0]
```

Fig 6 Shows the Select Action Method

The Learn method is the most important method. It implements all the PPO algorithm. The code is in Figure 7:

```
def learn(self):
    for _ in range(self.n_epochs):
        state_arr, action_arr, old_prob_arr, vals_arr, reward_arr, dones_arr, batches = self.initialize_memory.generate_batches()

        values = vals_arr
        advantage = np.zeros(len(reward_arr), dtype=np.float32)

        for t in range(len(reward_arr) - 1):
            discount = 1
            a_t = 0
            for k in range(t, len(reward_arr) - 1):
                a_t += discount * (reward_arr[k] + self.gamma * values[k + 1] * (1 - int(dones_arr[k])) - values[k])
                discount *= self.gamma * self.gae_lambda
            advantage[t] = a_t
        advantage = T.tensor(advantage).to(self.actor.device)

        values = T.tensor(values).to(self.actor.device)
        for batch in batches:
            states = T.tensor(state_arr[batch], dtype=T.float).to(self.actor.device)
            old_probs = T.tensor(old_prob_arr[batch]).to(self.actor.device)
            actions = T.tensor(action_arr[batch]).to(self.actor.device)

            dist = self.actor(states)
            critic_value = self.critic(states)

            critic_value = T.squeeze(critic_value)

            new_probs = dist.log_prob(actions)
            prob_ratio = new_probs.exp() / old_probs.exp()
```

Fig 7 Learn Method

The update method is the next method implemented in the PPO class. This method update the values of the states according to the last action and last state and the last reward received, it returns a action array which basically tells the car in which it should move to avoid any further obstacle. The code is in Figure 8:

```
def update(self, reward, new_signal):
    new_state = torch.Tensor(new_signal).float().unsqueeze(0)
    self.memory.push((self.last_state, new_state, torch.LongTensor([int(self.last_action)]), torch.Tensor([self.last_reward])))
    action = self.select_action(new_state)
    if len(self.memory.memory) > 100:
        batch_state, batch_next_state, batch_action, batch_reward = self.memory.sample(100)
        self.learn(batch_state, batch_next_state, batch_reward, batch_action)
    self.last_action = action
    self.last_state = new_state
    self.last_reward = reward
    self.reward_window.append(reward)
    if len(self.reward_window) > 1000:
        del self.reward_window[0]
    return action
```

Fig 8 The update method

The next methods are the save and the load method. We implemented their UI/UX in the map.py library in this we are implementing the logic behind it. The code is in Figure 9:

```
def save(self):
    torch.save({'state_dict': self.model.state_dict(),
                'optimizer': self.optimizer.state_dict(),
               }, 'last_brain.pth')

def load(self):
    if os.path.isfile('last_brain.pth'):
        print("=> loading checkpoint... ")
        checkpoint = torch.load('last_brain.pth')
        self.model.load_state_dict(checkpoint['state_dict'])
        self.optimizer.load_state_dict(checkpoint['optimizer'])
        print("done !")
    else:
        print("no checkpoint found...")
```

Fig 9 save and load methods

D. Kivy Modules

Kivy is a cross-platform GUI library for Python that is commonly used for developing applications in a variety of fields, including computer vision, robotics, and games. It is not clear how Kivy might be used in a self-driving car project that uses the Proximal Policy Optimization (PPO) algorithm, as Kivy is primarily focused on building user interfaces and does not have any direct relevance to self-driving car technology.

That being said, it is possible that Kivy could be used to build a graphical interface for a self-driving car system that is powered by the PPO algorithm.
For example, Kivy could be used to create a dashboard display that shows the car's sensor data, navigation map, and other relevant information to the operator. Alternatively, Kivy could be used to build a simulation environment for testing and evaluating the performance of the PPO-based self- driving car system.
It is worth noting that Kivy is just one of many possible tools that could be used in a self-driving car project, and its use would depend on the specific requirements and goals of the project.

IV. RESULTS AND DISCUSSIONS

A. Evaluation metrics used to measure the performance of the self-driving car system

B. Results of experiments and simulations

We run the Algorithm on different environments and it gives us different scores to time graphs.
From figure 10, As expected our environment is ready and our clear, save and load class are visible and our car is moving in random directions because we did not draw any obstacles yet.

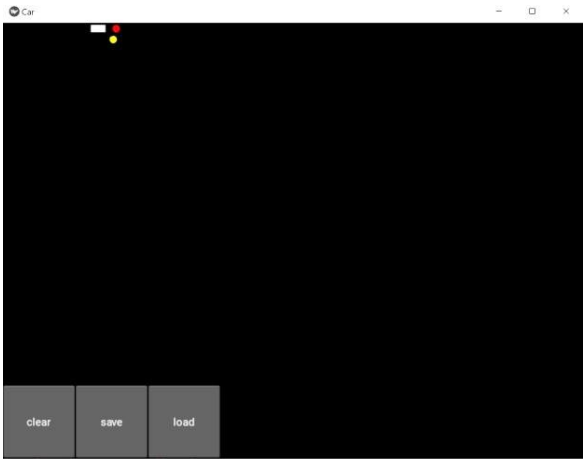

Fig.10 First Run of Complete Project

Fig.11 Path is Drawn

From the figure 11, Lets draw some obstacles in the environment and study the behaviour of the car in this case. As we know that the car tries to go from the upper left corner to the bottom right corner. We can make a road like structure as the path and take the desired results.
Figure 12, shows the final graph or final score of drawn paths. Its constant line mean algorithm finds the correct way from source to destination in our project.

C. Comparison of the performance of the PPO- based system to other approaches

According to the research done by the university students named Velivela Vamsi Krishna and Sudhir Yarram It can seen by the graph in the figure 13 that reward can be seen maximum in Reinforce algorithm but when we compare it with the figure 14 we can see that time of training of the Reinforce algorithm is very high on the other hand when we see the other best algorithm that is PPO we can see that the reward are high and saturated and the time of training is also very low as compared to the Reinforce Algorithm. That's why we use this algorithm in this paper.

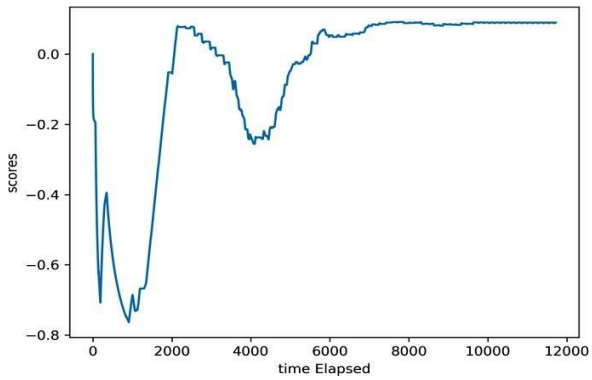

Fig.12 Graph between scores and time elapse

It can be seen from the Figure 13 that only two algorithms reach the best reward.
On the other hand the other algorithms are not able to reach the maximum reward value so we cannot take DQN algorithm and call it the best because its training time is low we have to consider the maximum reward graph also for better understanding the algorithms.
They trained each algorithm for 2500 episodes on NVIDIA K80 GPU the results are on the figure 14.

V. CONCLUSION AND FUTURE WORK

A. Conclusion

The proposed self-driving car system uses the PPO algorithm for decision-making.
Through experiments and simulations, we demonstrated that the PPO-based system is able to navigate a variety of road conditions and traffic scenarios with a higher safety and reliability.
The PPO algorithm is a promising approach for building self- driving cars, particularly in terms of its ability to adapt to changing environments and handle complex tasks.

B. Future Work

One direction for future work is to further improve the performance of the PPO-based self-driving car system by exploring alternative techniques for training and optimization. Another possibility is to integrate additional sensors or perception systems to increase the situational awareness of the car and allow it to handle more challenging driving scenarios. It would also be interesting to examine the scalability of the PPO-based approach, by testing it on larger and more diverse datasets or deploying it on real-world roads.

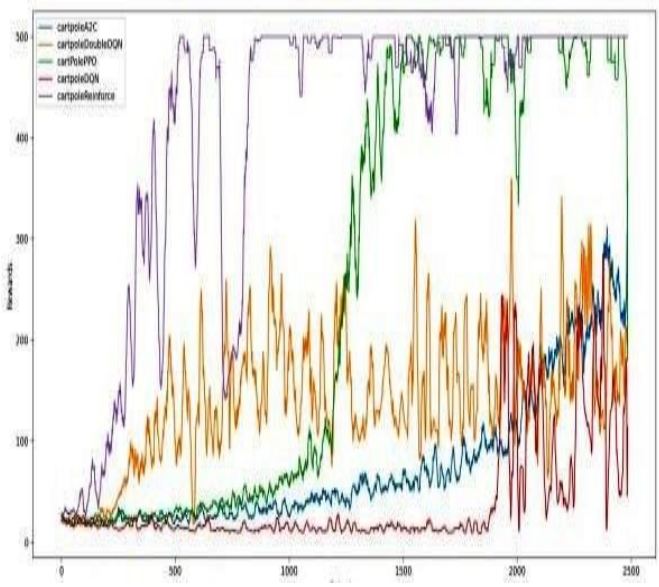

Fig 13 Shows the reward to episodes graph of different algorithms when they are tested on Cartpole game in Open AI Gym

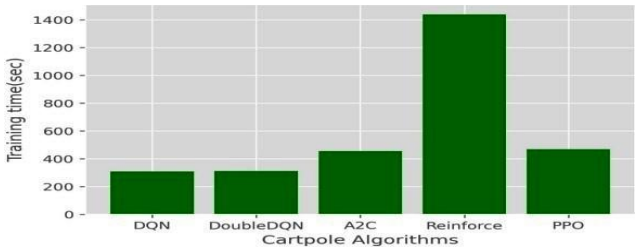

Fig 14 Training time required by the algorithms

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Blockchain-Based Fundraiser for Public Welfare

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Abstract— The rapid development of production identification records and the ability to extract records from them makes it difficult for customers to find out the facts approximately replacement keys. in addition, candidates have many alternatives in terms of known education. the primary component in this situation is protection and business from the production charge and kind of exchange. Blockchain itself makes it possible to create a unified purchasing machine whose transactions are tracked on a ledger. this choice of blockchain allows many applications to run on a transparent espresso platform. in opposition to the Covid-19 pandemic, many organizations have raised funds to help surrounding governments provide additional resources to those in need. Self-identity is necessary for all participants to discover these accounts. A fundraising platform for donors to provide services or even raise funds. the author attempts to analyze the way to use blockchain and smart settlement generation to emerge a monetary group at that time. The results of this transaction show that primarily blockchain-based contracts are completed according to the rules of cooperation.

Keywords – smart contract; blockchain; fundraiser; crowdfunding; Ethereum.

I. Introduction

Crowdfunding is a crowdfunding tool based on the Ethereum blockchain platform that allows customers to fund projects of their interest. Blockchain reduces the threat of new entrepreneurs and allows entrepreneurs to get various sponsors in their neighborhood, making it less difficult to earn maximum income in a short period of time. Mainly in the world's most advanced blockchains, there are many individual and small startups that need to make money by sending tokens to buyers. The fundraising version supports the concept of raising funds to support entrepreneurs with the support of members of the public who may experience opposition.

1.1 Traditional fundraising problem and solution

Banks and mutual funds have traditionally been the first to announce results. If the founder has responsibility to the financial institution or the capital market and has an interest in the business, the financial institution or capital market returns some money with working capital or a loan from a financial institution. However, this type of fundraising has its limitations. This fundraising effort requires a lot of time, money and valuable resources; not reaching regulations in fixed areas or some remote areas. If we decide to borrow money from financial institutions to solve financial problems, business groups can be the basis of projects because financial institutions must be honest to prove that competition will produce results and require people to provide products for credit.

Crowdfunding is a traditional method of financing. In crowdfunding, a thinker or organization solves the problem of raising money from many people who need funding for their business. Crowdfunding provides a platform for anyone with an idea, making investors ready to invest first. The advantages of financial resources are:

- Access to many well-known businesspeople who can see and influence the situation.
- Concept of appeal, reporting and referral to higher contexts.
- Communicating the idea to many vendors allows developers to launch and improve their products.
- The great thing about online fundraising is the ability to manage and increase your fundraising efforts by creating customers of all abilities, rather than searching for each one individually.

1.2 Purpose

Crowdfunding structures have revolutionized startups in this space in an easy and efficient way to spend money. Blockchain-based crowdfunding could be the next step in the evolution of fundraising and help startups achieve their dreams. The main problem with crowdfunding is that Miles pays little fees and is managed exclusively with the help of organizations that interfere in its operation. A full blockchain-based crowdfunding model can be helped by pooling resources. Distributing blockchain statistics can easily eliminate middlemen who pay large fees to avoid collisions. Blockchain crowdfunding is a clean form of crowdfunding because it eliminates middlemen between backers and startups [1]. Crowdfunding programs allow creators to sell their creations and raise cash online. Accurate identifiers of companies' past financial successes and accounts and marketing failures, these transactions are recorded and tracked on the blockchain. Deception becomes impossible because it is now accepted as truth. In addition, blockchain avoids the interference and control of centralized crowdfunding systems that may be necessary to obtain the right to fulfill obligations arising from its structure.

1.3 Background

Completely blockchain-based fundraising is completely based on the Ethereum blockchain. Many factors make Ethereum an entire

blockchain that allows developers to use it to clarify ongoing use cases. Ethereum has many options and methods to make it programmable. it is very important to capture Ethereum before we launch our dapp.

1.3.1 Bitcoin & Blockchain

Bitcoin gained significant popularity in recent years and eventually became a household name. but most people now don't know when the main bitcoin blockchain was created [2]. Bitcoin is a decentralized digital currency that is not controlled by major monetary institutions or authorities, and users can send it to others in the peer-to-peer Bitcoin community without any interference [3].

Transactions (the transfer of bitcoins from one account to another) are cryptographically represented through a connected community and recorded without delay in a public ledger known as the blockchain. Bitcoin was created through a nameless individual or institution of human beings by the name of Satoshi Nakamoto and began as an open source software program for delivery in 2009 [4]. while community participants perform a tool referred to as "mining", they are rewarded with bitcoins. meanwhile, bitcoins are regularly exchanged for money, items or services nearby anywhere. Now, instead of bitcoin and ethereum, blockchain age uses every cryptocurrency, so it is very important for us to understand how blockchain works. First, we would really like to keep in mind the economic equipment in Bitcoin that underpins our blockchain-defined knowledge of goods traded in Ethereum, the middle floor of Bitcoin and Ethereum.

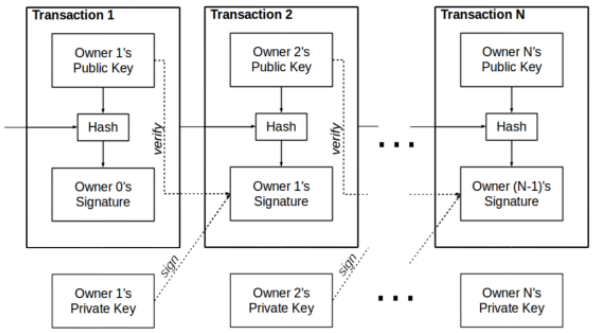

Fig 1 - Bitcoin transaction chain of ownership

Inside the bitcoin white paper written by means of Satoshi Nakamoto and published in 2008, cryptocurrency is defined as a series of digital signatures [5]. properties in tokens are transferred and token holders initiate new transactions by digitally signing each owner's public key and concatenating the hash of the transaction conversion to the first rejected token. once signed, the new transaction is taken off-chain, as discussed in Section 1.1 Subscribing to Bitcoin Transactions.

A variable can have multiple entries, which I think should be signed, as well as its multiples.

The current concept, like Bitcoin, is inspired by the blockchain, an allocated virtual public file managed using a peer network to reach consensus on era usage. With consensus built into the tool, it is far from possible to use the same coin twice, as absolutely everyone in the community will receive the same set of transactions that define the current America in the mining initiatives they are expanding. and keep the coin.

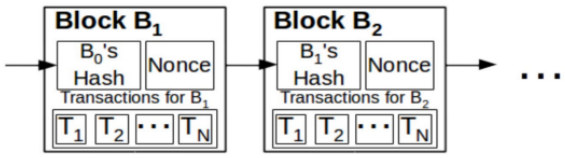

Fig 2 - A simple blockchain structure

it's widely known as blockchain because "block" is regularly associated with the main blockchain and blocks are now the core of many organizations. in the case of the Bitcoin blockchain, the usual time to create each daily block is 10 minutes; meaning that the state of the blockchain changes regularly with new blocks of the blockchain. If we iterate through all the modifications, we will have a modern blockchain United States of America.

The transactions and transactions included in the block are selected using a set of "evidence of evidence" rules operated by "miners" in the peer-to-peer blockchain community.

Miners receive included transactions from Bitcoin customers and use those transactions to "mine" a block. Miners who complete mining blocks are rewarded with bitcoins and incentivized to use computing resources, including power and time. To achieve this, each new change inside the system and the so-called nonce can use part of the previous block hash to improve that person's miner, as in the simple blockchain shown in Figure 2. If the hash is below the threshold (which determines the mining difficulty from the common time), the block is completely mined, in no other case will the miner grow and find the lowest and now calculate the hash. fringe. Miners calculate the hash before receiving the result, then broadcast the final result to the community's private miners, who confirm it and perform operations on the block to achieve the blockchain state.

In this way, new transactions can be completely stored on the blockchain. although the method often requires painting the floor, the art device turned out to be too cool for attackers to assemble a navy of digital machines on. manipulate the blockchain. To maintain blockchain supremacy, it should account for more than half of the computing power available to the community. it's similar to when digital exchanges emerged that don't require a third party to transact songs and use heavy lifting to complete switch contracts.

1.3.2 Ethereum

Ethereum is an open decentralized network passing through a unified system based on the generation of blockchain integration, which was first used by the integration of Bitcoin. Ethereum is used for smart contracts and transactions.

The objectives and innovations of this study are:

The objective of this paper is to design and develop a blockchain-based crowdfunding platform that enables users to create, view, and donate to crowdfunding campaigns directly through the

blockchain. The platform will leverage the benefits of blockchain technology, such as transparency, security, and efficiency, to create a more accessible and democratized fundraising environment. Specifically, the project aims to achieve the following objectives:

- Integration with the Metamask wallet to enable seamless interaction with the Ethereum blockchain network.
- Deployment on Thridweb for smart contract functionality.
- Done Testing by using testing token & Initiated a User Interface work.
- Design and implement a user-friendly interface that enables users to easily create, view, and donate to crowdfunding campaigns.
- Implement smart contract functionality to automate the fund distribution process and increase the efficiency of fundraising campaigns.
- Provide users with the ability to write Solidity code to customize the functionality of their crowdfunding campaigns

II. Literature review

The purpose of this section is to provide facts about the ideas and strategies used to fund DApps. Most crowdfunding tools are based on the Ethereum blockchain. Ethereum has many features and is a new form of blockchain that allows developers to use it for package options. Ethereum has many features and technologies that make it programmable. Before that and before we dive into our Dapp, it's important to understand Ethereum.

Crowdfunding has many advantages for entrepreneurs. The maximum basic form of monetary useful resource is the financing of latest ideas or current ventures (Lehner 2013). but crowdfunding can also be used for advertising and marketing and marketing because it increases buyer satisfaction (for individual and advertising functions most effective) (Hörisch, 2018) (Burtch et al., 2014; Lambert & Schwienbacher, 2010; Mollick, 2014) . In addition, crowdfunding can be used to make a business look at whether buyers are curious about the social impact of crowdfunding initiatives (Bellefamme et al., 2017). 2014; Lam and regulation, 2016). In addition, the public carrier can play a critical role if it is used to facilitate recognition of the cause through society (Martin 2012; Lehner and Nicholls 2014; Vasileiadou et al. 2016).

Four exceptional forms of human beings in literature. In a public provider, supporters are not rewarded for their contribution. This kind of public provider is often implemented through non-profit and non-governmental companies (Hörisch 2015; Lehner 2013). when considering philanthropy, donors often get an efficient or poor return on funds in the form of tangible things. As Mollick (2014) stated above, earning tasks are the most used form of crowdfunding. There's additionally a set of monetary aids that focus on making an investment and distributing the results of a commercial business to significant customers. In fully fair crowdfunding (also referred to as crowdfunding), traders get their funding back if the business is profitable (Mochkabadi and Volkmann 2018). Like investing in the stock market, this financing technique also involves high risks for investors (Bapna 2019). finally, credit score-based monetary services (additionally referred to as debt offers or social services), which include loans from monetary institutions as part of the merchandising process, require a number of capital charges, as previously mentioned (Bruton et al., 2015).Credit scores account for a large portion of global sales (Massolution 2015)

In the crowdfunding method, two different fundraising methods can be distinguished, similar to all the above-mentioned types of funding. In the research literature, a distinction is made between pre-financing and embedded products (see, for example, Jovanovic 2018; Hörisch 2019). The pre-investment period refers to the period before the crowdfunding group's investment is closed; In addition to the dimensions of investment, it also includes competition awareness, communication and marketing for various purposes. In evaluation, financial transfer begins after commercial crowdfunding.

At this stage, the sponsors of the contract must inform the sponsors of their success or failure, distribute the promised income and most importantly, get acquainted with the project using the media. There are many candidates available in the form of financial aid by calling which represents the main points of the education system as studies. Jovanovic (2018) and Messeni Petruzelli et al. (2019) identified four people interested in the game: (1) entrepreneurs creating and raising campaigns to achieve a cause or offer, (2) campaigns to monetize their cause or advice, (3) promoters (eg.I) to reverse the transaction with a small amount of cash and (4) users of the multi-platform acting as a purely web-based intermediary, some authors and supporters of the investigation.

The study outside the crowdfunding door focused on a number of pre-investment factors that influence the fulfillment of crowdfunding campaigns. Mollick (2014) found that indicators 86f68e4d402306ad3cd330d005134dac want to be compensated for sports that allow people to work together. moreover, early fundraising has been shown to pose a perceived risk to growth (Colombo et al., 2015).

Almost as long a journey as sustainability, many researches have investigated the effect of sales tendering in special contexts (e.g. Vismara 2019; Calic and Mosakowski 2016; Hörisch 2015). A culture of equality within equality may be more limited (Vismara 2019), but it does not always have to have a preferred expertise of cash as a party of equality, justice and population (Vismara 2019; Hörisch 2015). Calico and Mosakowski's (2016) analysis observed a happy place for a gang where social tasks outweigh those of generating funding.

In some cases, creativity can solve problems, while in other cases it may be more beneficial to support 1/3 of birthday celebrations (Calic and Mosakowski 2016). Another motivation behind the great influence of leadership will be the social experience provided by the minority business people in the equity crowdfunding group: because the Few clients in the crowd own only one stake in the company, they are no longer the best. used by customers. similar, but they follow the network of benefits and the path of business cooperation (Vismara 2019).

Little has yet been observed about these graves. As an exception, Cumming et al. (2019) examines how ownership affects media and distribution, including the long-term performance of philanthropy. according to Signori and Vismara (2018) conducted a number of different studies on the long-term use of aggressive finance. research suggests that consumer loyalty has

an outstanding effect on long-term overall performance in currency transitions (Signori & Vismara, 2018).

In the context of crowdfunding for nice improvement, Hörisch (2019) found that some of the best crowdfunding initiatives are demonstrably contributing to development.

2.1 Crowdfunding platforms as new financing alternatives

The use of the web and the emergence of demands have changed the way human beings speak. This allows merchants and their products to transition using CFP and facilitate new financing. In recent years, CFPs have become popular with buyers and small buyers (Martínez-Climent et al., 2020; Reza-Gharehbagh et al., 2021).

Virtual monetary assets, consisting of CFPs, can reduce the cost of obtaining information and facilitate communication between investors and traders (Meoli & Vismara, 2021). The web and fashion 8db290b6e1544acaffefb5f58daa9d83 make it easier for homeowners to percentage thoughts and buyers to explore faster (Ullah & Zhou, 2020). economic facilities are a critical source of investment for monetary growth. the majority of brand new finance is made up of employers, investors and personal capital customers (Butticè & Vismara, 2021; Coakley et al., 2021).

Crowdfunding is a way to raise small amounts of cash from large corporations without conventional financial interventions, but often with the help of systems (Allon & Babich, 2020; Chan et al., 2020; Tiberius & Hauptmeijer, 2021). one of the key features of this generation is the economic freedom that allows a wide range of marketers to use this opportunity to create their personal products (Gafni et al., 2021). Despite the fact that the phrase crowdfunding has been used for earlier occasions than the use of digital fashion, its use to trade the monetary position of a business in a commercial enterprise is new (Martínez-Climent et al., 2018). It should be emphasized that small investors can take advantage of CFP by taking advantage of finding other options for redeeming coins during times of low deposit prices (Tiberius & Hauptmeijer, 2021) to help reduce the threat. choice. There are several benefits for merchants as the interplay in SRP can collect reviews and help merchants expand their product or service with the help of boosting their confidence. before the market (Troise & Tani, 2020).

On this monetary plan, initiators (sponsors, donors, investors) and beneficiaries (investors, founders, companies) speak with CFP (Allon & Babich, 2020; Ryu & Suh, 2020). The upward thrust in CFPs and events aimed at attracting tech buyers mean competition is fierce. a few factors along with performance, creativity or even the language used can determine the relationship and effectiveness (Ryu et al., 2020; Defazio et al., 2021). For Troy and others. (2020), members within the device ought to keep in thoughts: personal partnerships; customers should no longer ignore the personnel and traders who are innovating within the product as this is going hand in hand with the improvement of their product and the leaders at the platform are just like the traders. provide extra statistics for fun. conventional fishing practices often depend on fairness, incentives and huge loans to guide the economy (Moysidou & Hausberg, 2020).

2.2 Equity crowdfunding platforms

Equity crowdfunding (ECF) is a way for organizations to attain financing from their stocks (Butticè et al., 2021). In equity crowdfunding platforms (ECFPs), buyers open calls for the sale of fairness finances thru a platform in which investors participate in exchange for returns (Butticè & Vismara, 2021). in line with Coakley et al. (2021) the primary platform of this type of financing combines three fashions of ownership shape: First, the function of the platform as an middleman is small so that it immediately communicates with the startup investors (i.e. criminal proprietors), inside the second version, the platform is every body who is the useful proprietor on behalf of the commercial enterprise. at the same time as appearing because the prison beneficiary, it's far open to qualified traders handiest within the 0.33 co-funding or commercial enterprise manager model.

ECFPs range from different sports in that they contain investment choices in terms of capacity return on investment leading to better hazard, even as ECF buyers are less skilled and face massive facts asymmetries whilst comparing initiatives (Mochkabadi & Volkmann, 2020). , Cumming et al., 2021b). in this sense, nearly everyone can take part in new financial advent while not having high debt (Ralcheva & Roosenboom, 2020). In other phrases, investors receive overall performance-associated advantages much like dividends as an incentive to place a small stake within the corporation (Tiberius & Hauptmeijer, 2021). The outside resources acquired by the beneficiaries, further to the advantage of optimizing the investor's software process, are vital for reaching their improvement dreams, duplication, investment extent and many small buyers lose ownership and manipulate.

(Troyes and Taney, 2020). every other benefit for beneficiaries is that the financial fee is decrease than regular (Xiao, 2019). ECFPs manage economic markets by imparting get admission to to finance to entrepreneurs with limited possibilities (Cicchiello et al., 2020).

Before ECFP, angel investment and assignment capital have been financial resources inside the initial section of tasks (Hornuf et al., 2021) and these days they compete with each other (Allon & Babich, 2020). the world's most popular ECFPs include Mintos, Micro Ventures, begin Engine, Broota, Dozen, and AngelList, amongst others.

2.3 Reward crowdfunding platforms

Reward Crowdfunding Platform (RCFPs) permit groups to elevate money from clients and renew their guarantees to create new products in the market (Bürger & Kleinert, 2021; Chemla & Tinn, 2020; Yang et al, 2020). without compromising their history (Chan et al., 2020). In different phrases, humans donate cash to these businesses and promise a go back on investment through their services or products.

For Chakraborty and Swinney (2021), products within the RCFP may additionally fluctuate, some examples being physical products such as digital products, records products which includes software, video or audio music, or offerings together with media or eating places. . RCFP has a simple procedure in which buyers create touchdown pages, investors pay a dedicated charge, and the platform gets a percentage of the earnings (Belavina et al., 2020). those sorts of monetary services are important for starting a enterprise, however besides the first-rate returns they offer for attracting buyers, they are also beneficial for destiny success (Clauss et al., 2020).

then again, investors in RCFPs are considered green as they make investment decisions primarily based on little facts they get hold of from buyers and not using a enjoy or short work records (Testa et al., 2020). RCFP is one of the great approaches to build a community of supporters who can provide thoughts, hints and

idea to enhance the product and advantage the corporation (Tafesse, 2021).

2.4 Lending crowdfunding platforms

Due to the diverse needs of banks (Zhou et al., 2021), many small corporations in search of financing constantly fail, or many looking for cash obtain profitable investments (Kollenda, 2022). LCFP loan, additionally called peer-to-peer crowdfunding (P2P), allows the interplay among borrowers and buyers during the financing length (Demir et al., 2021; Nisar et al., 2020).

LCFPs have a lower fee of acquiring loans (Berns et al., 2020). This version has many benefits inclusive of low interest rates and taxes for marketers, financing options for criminals and groups that don't have get right of entry to to other financing, and some benefits of using era (Keliuotytė- Staniulėnienė & competition, 2020). .For traders, on the P2P platform, they have got the possibility to select from several projects with special conditions (hobby costs, negatives, first time merchandise) and all obtained cash results (Ge et al., 2021).

Like other fads, there are regularly small and effective regulations on P2P lending (Cumming et al., 2021a). LCFPs compete with loans from monetary institutions, friends and circle of relatives (Allon & Babich, 2020). a number of the LCFPs used worldwide consist of Mintos, looking Guru, Peer Berry, Lending membership, NEO Finance, Lender market and so on.

III. RESEARCH METHODOLOGY

3.1 Blockchain Fundraiser Requirements

The goal of the blockchain fundraiser is to create an atmosphere in which anyone can without difficulty release or aid a marketing campaign to create a new service or product. Crowdfunding dapps provide a crowdsourcing platform to elevate cash via offering long-time period help for the mixing of the "net of value".

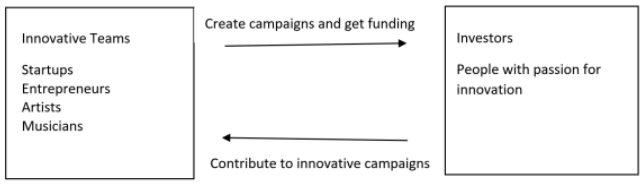

Fig 3 – Blockchain Fundraiser platform ideology

Using blockchain-based fundraising platform groups or individuals, including business developers, business leaders, filmmakers, film directors, and more, as illustrated in Figure 3 Blockchain Fundraising Platform Concept. The amount can be increased in a completely simple way by issuing ERC20 type tokens on the blockchain. The investment plan business is managed by smart contracts issued on Ethereum. Metadata of campaigns such as ad images, campaign videos, campaign descriptions.

It is not stored on the blockchain. Sometimes in this report we use the words "creative" and "entrepreneur" to know the expectations of the actors using the platform, and we use the word "user" to represent both if we are not a different role. We use the word "author" to refer to a person or group, such as a startup group, artist, director, or entrepreneur, who uses the platform to advertise and raise money. We use the term "investor" to refer to tokens that use the platform to find exciting projects and fund them to earn special tokens. The term used is similar to commercial use cases where an entrepreneur tries to find money to build his business or role.

To create a campaign, the author must clearly explain what he wants to create and how customers visiting the platform can benefit from his services or work. If the author himself is not always clear about his product/service, he cannot expect his marketing plan to be successful. Once he completes his bid, is on time with delivery, has the necessary resources to develop the product, and has done some market research, he'll get paid the difference between his campaign. All plans raise money on time, determined with the help of the plan maker to give authors the most flexibility. The idea behind p

UI is to make it as easy as possible for investors and writers to use the platform and fulfill their needs.

The following are the main UI features that should be used to use the platform effectively:

• Provide links to write all tasks.

• Provide links to investment activities.

• Provide links to activities.

• Provide a link for music merchants to list all events and request success budget with the creator's help.

• Provide a link for investors to list all plans that use their investment and claim their money back or trade the plan's clean tokens based on the results of the two exchanges

3.2 Campaign Creation & Management

Users should be able to create campaigns and evaluate traders who have invested Ether in their projects. People come to the "Register for the campaign" page from the landing page and fill in all the information such as the campaign name, creator name, description, banner image, banner video and specific description of the contest. Then he got the token directory website which gave all the information about token competition such as token name, token image, token price in line with the budget ether and needed many tokens for publication. The contract is flexible and the price provided is used to generate a transaction report on the Ethereum blockchain. These activities are designed to stop synchronously with the time (in days) specified by the author. The most basic plan it creates is shown on the plan design page. It is possible to use the forum author's control panel to get the list of all traders for each campaign along with profit and time. If the trade report is successful, it can report the different prices on the balance sheet.

Running a campaign requires a call-to-action, campaign author, one-line description, long description, banner image, and campaign video. He must then decide how many coins he wants to issue and the value, name and image of each coin. As soon as his campaign is completed, he also wants to offer his ethereum wallet service so that he can get the money at his fingertips. There is no guarantee that the proposal will be successful, it depends on the author's research on how much demand is in the market for the product/car and how it will attract investors due to its competitive appeal.

3.3 Investing Ether into Campaigns

After entering the contest description page, customers can research the contest and deposit Ether into the contest. They will go through a lot of criticism to determine the money they should invest and the account they should deposit that money into. Investors can invest from the investor guide page after making all the selections and making a valid investment.

After successful fundraising, the investor can request the original tokens of his bid from the investor's dashboard and, if the bid fails, reveal the amount he has invested in that campaign. Also, if he invests multiple times, he can get back the entire investment he made more than once.

3.4 System Architecture

The basic structure of the blockchain-based fundraising campaign is illustrated in the blockchain based fundraiser that focuses on change. All interactions between project authors (who come to the platform to raise money) and campaign investors (who come to the platform to invest in Ether) are used on the Ethereum blockchain platform.

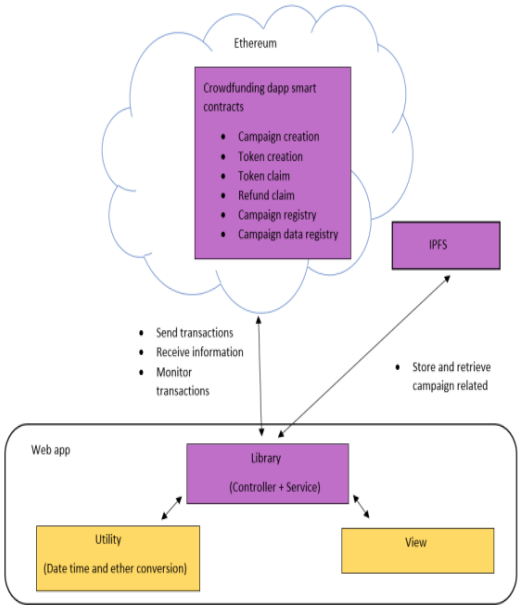

Fig 4 - System Architecture for Blockchain Based Fundraiser

For example, if an investor wants to invest some Ether in an advertising business of his choice, the business will start and additional Ether for the mining industry will be sent to the Ethereum network for payment.

An update has additional metadata, including project descriptions, specific project plans and ideas, images and videos describing the content, information including white papers, and the names of authors or groups. Such metadata is stored and loaded in IPFS. use the library orientation when the tool is loaded to refer to the object. The view is responsible for creating the view of the response template shown to the user.

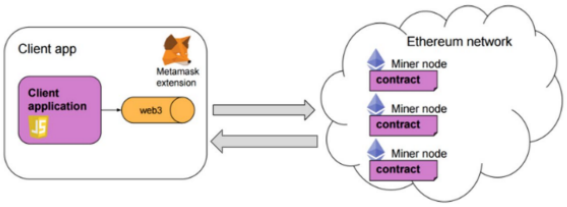

Fig 5 - Library component using MetaMask to communicate with Ethereum nodes

As seen in the figure 5, MetaMask is used by Cubefactor to communicate with Ethereum in dapps that use web3 (Ethereum javascript API) to execute client-dependent tasks that interact with the output. MetaMask appears as a separate agent, providing asynchronous functionality to libraries that use the API provided by web3.zero to invoke the Ethereum network. In addition, MetaMask monitors the operation of the technology and updates the storage with mining forecasts in a special way.

Transactions must be signed before being sent to the Ethereum blockchain. Chapter

After the transaction is signed, Metamask creates an RPC protocol that sends the transaction to the Ethereum network where the smart contract was sent. Metamask evaluates the Ethereum network to detect library issues and replace them with existing callback functions in the library. Callback from default library is IPFS for storing and storing metadata. IPFS provides a well-known set of APIs for interacting with log files. The call library is called IPFS web providers to save metadata and access saved data so that future web can be built to store data.

The release library creates native objects using elements from the IPFS and Ethereum stacks; Convert text messages containing faces into templates designed for viewing in a browser. For this code exchange, the library uses implementations with multiple invalid states. The app uses the smart idea of creating different objects and converting them directly into UI drawable strings. It's easy to work with images by bringing all the decision-making good formatting statistics into the app content.

Specifically, library versions act as control and support following the MVC architecture. The most visible issues are the HTML structure built into the browser. He got all the necessary information from the library; it then parses it to get the actual value to replace in the dynamic response template. It will also follow the site redirect and avoid the pages needed to improve the site. Temporary operators are ready to respond to all customer actions, including button clicks and actions.

The library is tightly coupled to the view so any changes to the UI can be pushed into the library to be pushed onto the blockchain.

3.5 Ethereum Smart contract design

The smart contract written for the Dapp finance group connects the entire platform and paints it with the help of the company's business management drift and related decisions. Although they do not have much information, the organizational structure they describe and the exchange of legal decisions between institutions is how the civil service can operate in a peer-to-peer fashion without proper scrutiny.

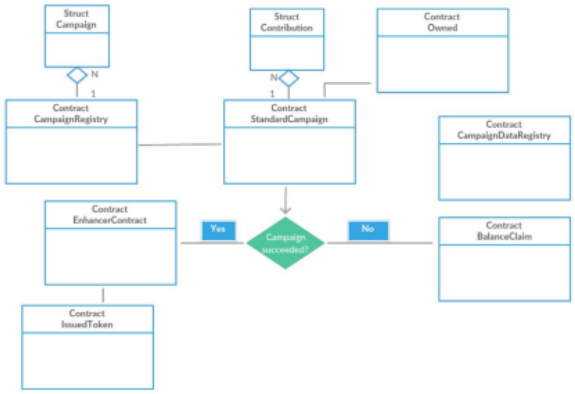

Figure 6 – Blockchain-Based Fundraiser smart contract design

The crowdfunding smart dapp business is based on the ticket crowdfunding dapp smart site. The basis of the platform is the tender registration process, which refers to all tenders that are created once and can be created on the platform. When a new order is created, the payment and execution time for the payment contract are stored in the contract reporting process.

The crowdfunding dapp retrieves all contracts stored in the form of data from the Ethereum network during application load and creates a landing page with marketing plans.

The Campaign Data Registry contract contains statistics about the IPFS hashes for which contract metadata is available; so once a campaign report page is created, a DApp sponsor can save the contract and use data recovery to store photos, videos and other media files. Contains a match map and returns the corresponding IPFS hash. The Issued Token contract contains information about specific tokens available to investors.

These are the miles associated with the development process that will lead to token exchanges for selected investors if the trade announcement is successful. The Model Enhancer contract, as the name suggests, is a development contract that contains information about all enhancements and calculates the various matching codes that must be issued during marketing campaigns.

The Standard Campaign protocol is the most important protocol that governs the development of the campaign's business logic. Includes summary of attendee reports and activity level data, including success, traffic, and failure data. Each project design can have its own preferred contract to manage project execution. As a result of the investment process, the trading system makes an augmented solution with the model to create an equivalent balance to break real tokens or transfer ether back to traders. The standard contract plan places multiple contracts with each investor equal to get their investment back if the bid fails. A popular campaign uses a database called advertising to store all its advertising campaigns. See such documentation if camp cannot create an equivalent contract.

IV. RESULT & DISCUSSION

The growth of social media, investment in social media and the characteristics of the call received a lot of information on social media, and all interactions with the Ethereum network are an exchange. Trading in the Ethereum community requires cash. As mentioned in the previous section, the Ethereum business uses fuel to run and pay miners. Natural gas purchased using ether, USA

Usually based on various fundraising methods, the blockchain price of Ether ranges from 1 cent to $27, and the ether fee is around $212 per day. The highest rates are promising growth rates, including growth. The size of the data stored in the blockchain allows the data warehouse to determine the most efficient and effective path in different areas, based on the size of the policy placement.

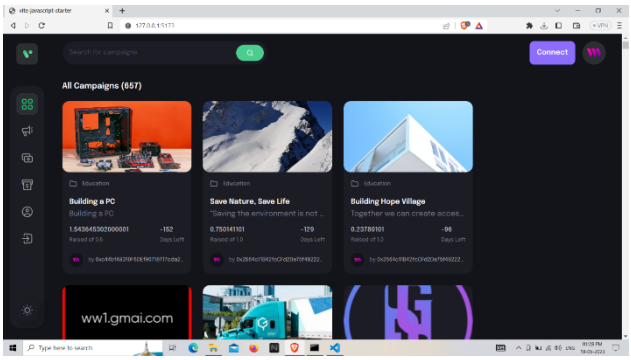

Fig 7 - Blockchain Based Fundraiser Dashboard

Although some businesses do not immediately create a contract, we see that the rights they apply for sure create and hold the contract. From these words, we know that the advertising industry has not seen growth compared to many financial institutions that pay large sums to create and manage campaigns. There are strategies to cut costs by quickly deploying and deploying Destiny's creation.

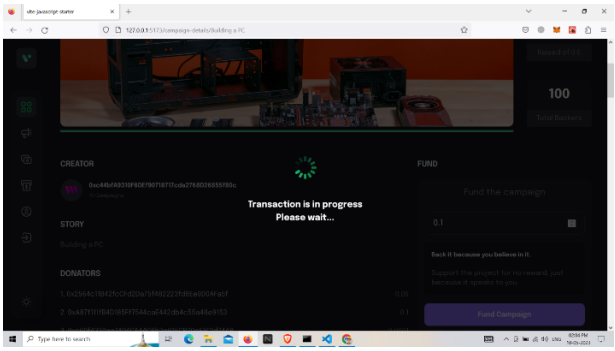

Fig 8 – Ethereum Transaction

V. CONCLUSION & FUTURE SCOPE

As Arena moves closer to the usa.0 network and a decentralized version to solve its problems today, it's important to try to create new age fads that inform our content that gives us the answer today. Solutions should be sought, such as any peer-to-peer network that controls advertising and marketing, that provides the most responsiveness from the global population created and managed by intermediaries who have a voice in various fields other than advertising and marketing. activity. . This project explores strategies for reducing the middleman while spending more money on the capital markets.

This is done with the help of smart contracts written for dapps of crowdfunding apps deployed on the Ethereum blockchain that controls the market. This interaction allows customers to create and invest money in projects that interest them. Without the right tools, marketers and advertisers can spend a lot of money on their activities. There are new blockchain architectures with more

language and platform configuration options than Ethereum, including EOS, Stellar, Cardano, and NEO [17], but the use of these architectures has yet to be proven. EOS seems to be a successful platform and if EOS is allowed on Ethereum, this business will be destined to move to EOS.

5.1 Market Scope

The global market is valued at $17.39 billion in real terms by 2021 and is expected to generate $403.48 billion over the forecast period with a 2028 implementation rate of 16.50% CAGR. Crowdfunding involves collecting large numbers of small donations from human organizations not known as charities. Crowdfunding sites can also act as intermediaries for individuals and organizations. In addition, this broker may need to use advertising strategies to influence the selection of potential donors. It is therefore important that the exchanges that influence the creation of money are present in the crowd as well as in the meeting places.

5.2 Ambit of Crowdfunding in India

- **Health Care Industry**: India's public health system is currently stagnant, with authorities spending an average of 1.15% of each GDP on quality medical supplies. Private bank loans are also quite suitable. Crowdfunding has benefited in this area with the help of businesses that help people get medical loans.
- **Education Sector:** Indian university students face financial difficulties for better education. Taking out a student loan becomes aggressive and expensive. School crowdfunding is the answer to the business of helping Indian students get a better education. Impact Guru received donations of Rs 1.32 million in the field of education.
- **Entertainment Industry:** Crowdfunding is also starting to gain momentum in the advertising and entertainment industry. Immoral writers, artists, and directors can use the crowd to reach a wide audience for their work. Some standards also ensure that creators' work is recognized, and their work reaches the right audience.

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Wireless Transmission Charging System for Electric Vehicles

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Abstract—**Now a days, the world is shifting towards electrified mobility to reduce the pollutant emissions caused by non-renewable fossil fuel vehicles and to provide an alternative to costly fuel for transportation. Best way is to adopt static and advanced dynamic charging through electromagnetic induction. Electromagnetic Induction is based on the ampere's law of 1820's as well as magnetic induction discovered by Faraday in 1831. Faraday discovered that in presence of an alternating magnetic field, an electromotive force would be produced across an electric conductor.**
It allows charging the vehicle in cases like parking and also while driving along the road. With the latest technology, it is still difficult to adopt wireless on a large scale around the world. As there are two major issues affecting its adoption over conventional vehicles that includes travelling range and charging process.
The electric vehicle charger market is divided into private and public slow chargers and publicly accessible fast chargers. The other factors impacting the charging market are such as vehicle type, charging type and the end user.

Keywords— Resonance Inductive Power Transfer [RIPT]; Rooftop Solar Charging [RSC]; Static Wireless Power Charging System [SWPCS]; Dynamic Wireless Power Charging System [DWPCS].

I. INTRODUCTION

An Electric Vehicle (EV) is a vehicle that can be fully or partially driven by electric motors using energy stored and rechargeable batteries. EV's operate on electric motors instead of internal engine combustion. If the motor used is a brushless dc motor, then power inverters should not be used as this motor is dc-to-dc. Other than brushless dc motors, power inverters are essential to convert from ac to dc energy for the battery [1].

Currently electric vehicles are a buzz in the automobile industry with its market all around the world growing rapidly because of its environment friendly nature of its fuel for charging. The electric vehicle charger market is divided into private and public slow chargers and publicly accessible fast chargers. The other factors impacting the charging market are such as vehicle type, charging type and the end user. Main reason for developing Resonance Inductive Power Transfer (RIPT) is to explore ways of improving the efficiency of wireless charging systems.

II. WIRELESS POWER CHARGING

Principle of wireless charging system is electromagnetic induction that is resonance inductive power transfer. This method is commonly adopted by the industry mainly because of its advantages like low carbon content, and removing demerits of existing charging stations such as Inability to travel longer distances as compared to gas power stations, recharging of fuel taking longer in ac charging systems excluding dc charging systems which are harmful for the battery life of the electric vehicle. There are two types of wireless charging systems: static charging system and dynamic charging system.

A. Static Wireless power Charging system

In Static Wireless power Charging system (SWPCS), an electric vehicle is bound to be charged in a stationary position, like for example, in car parking's, where the electric vehicle is to be parked or kept in a place for long hours. A transmitter coil, made of copper, fitted underneath the road surface connected to a main ac power charging transmission station which supplies ac power to the transmitter coil. A receiver coil, also made up of copper, is fitted underneath the electric vehicle and connected to the lithium-ion batteries receive this power constantly with the help of ac-dc convertors supply this power to inverter which converts from dc to ac to supply power to motor and motor delivers mechanical energy to drive electric vehicle [2-4].

B. Dynamic Wireless Power Charging System

In a DWPCS, an electric vehicle is being charged while driving along the road, like for example, driving an electric vehicle from state to state or for a trip. A large amount of coils are bombarded underneath the road surface, known as transmitter coils, that continuously and constantly transmits power through electromagnetic induction. These transmitter coils are connected to the power charging station that supplies ac power to the transmitter coil. Receiver coil is connect underneath the electric vehicle same as static charging to transmit power.

III. SOLAR POWER TRANSFER

Due to some parameters like construction cost of installing magnetic coils inside the road surface, the method of electromagnetic power charging is still developing. But a method called 'ROOF TOP SOLAR CHARGING' which is reliable, at the same time eco-friendly as there is low carbon content, and most importantly solar itself is a renewable resource which will be available till eternity. Other than other fossil fuels like coal which are degrading with time, they are non-renewable sources of energy. This charging method has low maintenance cost and has a flexibility of storing sunlight using photo-voltaic cells.

IV. COILS

Qi also can be vocalized as "chee" is a standardized name of wireless transmission charging coil. These types of coils are used over short distances to transmit power between the receiver coil and transmitter coil. In the hardware model, there are copper coils, each made up of 30 turns. This is an electromagnetic coil only made up of copper. Generally, there are four types of coils [5]:

Electromagnetic coils

These types of coils are used to produce RMF known as the rotating magnetic field which is an essential phenomenon in the field of electrical engineering. Commonly used as inductor in an electrical network. It can vary voltage level from high to low or low to high just like transformers.

Energy Electric Coils

These coils can also vary voltage levels just as transformers as electromagnetic coils. They can alter the direction of the current and also to isolate the electrical and electronics circuits. These coils can be of different structure in terms of length and width. It can be used in applications such as controlling motors, machines used for welding, etc.

Electronic Electric Coils

Their main application in an electrical circuit is to store energy. They obstruct the current as these coils have high resistance.

Flowmeter Electric Coils

These types of coils are used for fluid measurement. It can be used for a variety of applications such as flow of gas, oil and water measurement.

SOLAR PANEL

A solar panel consists of a large number of photovoltaic cells integrated in its design that absorb light or solar energy either from sun or any source of lights such as tubelights, bulbs, etc. and convert this light energy into dc energy which is to be supplied to lithium-ion batteries. These solar cells are made up of a non-metallic element called silicon which is a semiconductor. Crystalline silicon is sandwiched between conductive layers where four strong bonds are formed by each silicon atom. The solar cell has mainly two types of layers: an N-type silicon which has extra electrons and P-type silicon has extra holes which can be filled by electrons. This arrangement creates a P-N junction in the solar panel having positive charge on one side and the negative charge on the other side. Then, these silicon cells are stringed together in modules to get power. Twelve photovoltaic cells are sufficient to charge a mobile phone whereas a large number of modules of silicon cells are required to charge an electric vehicle or a house. These cells can last for an eternity as they can't be worn out due to electrons go back from where they came from. The main advantage of the solar panel is that it has the capability to store extra light energy during daytime and can use it during night where there will be no main source of light [6].

REMOTE CIRCUIT

This circuit consists of hardware components such as battery supply (9 volt), Encoder Integrated Circuit (12E), Transmitter part of RF module (433 MHz), power indicator, four input switches to control or operate the wheels of electric vehicle to move forward, backward, left and right. If in the remote circuit two innermost out of four input switches are pressed, the vehicle will move backward. If in the remote circuit two outermost out of four input switches are pressed, the vehicle will move forward. If in the remote circuit starting from left, the number-1 switch and number-3 switch out of four input switches are pressed, the vehicle will move leftwards [7].

If in the remote circuit starting from left, the number-2 switch and number-4 switch is pressed out of four input switches the motor will move rightwards. Encoder will convert digital inputs into analog signals in frequency form at 433 MHz and this data is sent to receiver attached in the motor circuit, by transmitter.

HARDWARE COMPONENTS

The main circuit consists of hardware components as given in table 1 [8].

Hardware Components		
S. No.	***Components***	***Ratings***
1.	Capacitor	1000 μF, 25 V
2.	Regulator	5 V
3.	Diodes	200 mA
4.	NPN transistors	100 mA
5.	Transformer	12-O-12V, 500 mA
6.	Frequency Oscillator	200 A
7.	Transmitter	433 MHz, 5 V
8.	Receiver	433 MHz, 5 V
9.	Battery	8 V, 2.4W
10.	Charging Station	5 V, 6.5 W
11.	Solar Panel	12 V, 6 W
12.	LED	1.8 V

CHARGING STATION

This circuit consists of hardware components such as a step down transformer (center tapped at 12 volt, represented as 12-o-12 volt and rating of 500 mA), 2 p-n junction diodes (IN400 and rating of 400 mA, a capacitor (1000 microfarad, 25 volt) power regulator (5 volt-12 volt), high frequency oscillator (200A) and an NPN transistor (100mA). An AC supply of 220 volt is given to the step down transformer, in return transformer steps down the voltage to 5 volt with the help of voltage regulator. A full-wave rectifier circuit is formed by the p-n junction diodes and the capacitor which converts the supply from alternating current into direct current. A LED is connected as an indicator to indicate the power operation. A high frequency circuit if formed with high frequency oscillator transistor and NPN transistor which generates high frequency. Through this high frequency circuit, the transmitter coil beneath under the road surface is connected [9].

ELECTRIC VEHICLE CIRCUIT

This circuit consists of hardware components such as Lithium-ion batteries (8 volt and 2000 MS), motor driver circuit (293D), decoder (12D) integrated circuit, receiving part of RF module (433Mhz, 5 volt), voltage regulator (5 volt-12 volt), Capacitor (1000 microfarad, 25 volt), main on-off switch for Electric vehicle Circuit, DC motor (5 volt), receiving coil (30 turns made of copper), a caster wheel to support the three-wheel vehicle and a solar panel. The two DC motors are connected or coupled with wheels of an electric vehicle. A solar panel is attached on the roof of the electric vehicle, and charging through solar panel to batteries can be indicated by LEDs that are used as power indicators.

The data transmitted by the transmitter is received by the transmitter. The decoder IC will convert the data in the form of analog signal to again in digital form. This data is then converted into positive form because the motor driver works for only positive input. Now this motor driver will operate the wheels of the electric motor clockwise or anticlockwise through the dc motor and the wheels can now rotate to move forward, backward, leftwards and rightwards according to the operational combination. A solar panel (6 volt-12 volt) charges the battery of 8 volt through diodes [10].

X. HARDWARE MODEL WORKING

Wireless Power Transmission

Energy transfer through coils is a great way of reducing carbon emission and making the process of battery charging economical as well as pollution free. A transmitter coil which is connected to the main charging station that will supply energy to Electric vehicles.

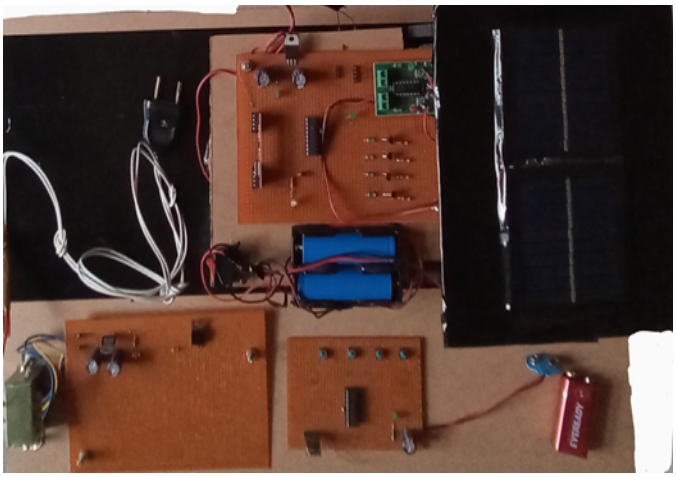

Fig. 1. Electric vehicle charging system (off state)

A receiver coil connected underneath the electric vehicle receives energy supply from the transmitter through electromagnetic induction and this supply is given to the battery with the help of power converters. In the hardware model as shown in Fig. 1 & Fig. 2 [11], to observe the charging of an electric vehicle by wireless transmission through coils, a light indicator is in the vehicle circuit that will indicate when as soon as the receiver coil comes in close contact with respect to the transmitter coil.

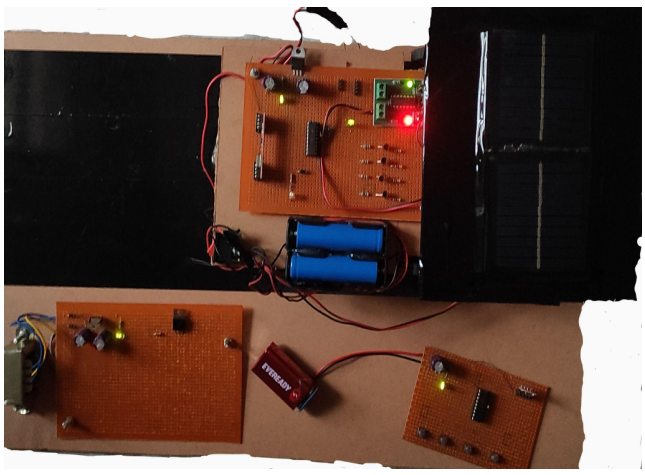

Fig. 2. Electric vehicle charging system (on state)

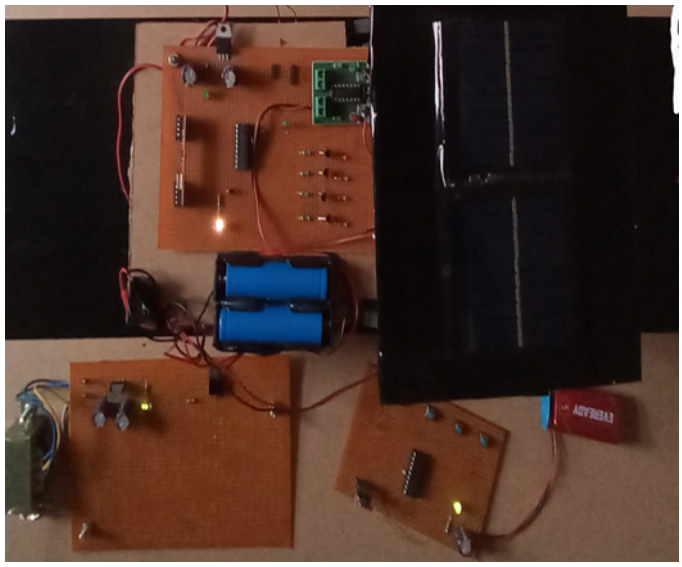

Fig. 3. Power transmission through electromagnetic induction represented by glowing LED

Both the transmitter coil and receiver coil are made of copper and have thirty turns each. The position of the transmitter coil is seen by the small hole in the blackboard. When the vehicle is driven by the remote in forward or backward direction, variations in the amount of energy supply is seen by the light indicator. The light indicator such as LED glows to its maximum intensity only when receiver and transmitter coil are directly at opposite ends vertically with each other. LED will not glow if either the main supply of the charging station is turned off or the receiver coil and transmitter coil are far apart from each other at a fair distance. To match the same frequency as by the electric vehicle circuit, a set of frequency oscillator transistors is set up which will generate the same frequency of 433 MHz that will initiate the process of electromagnetic induction through coils. This frequency oscillator transistor consists of a set of two NPN transistors: one is the normal n-type transistor and other is a high power NPN transistor. The electric charging station supplying ac power has a rating of 12 volt and maximum capacity of 6.5 watt. The batteries are li-ion batteries, which have a good power to weight ratio, have a rating of 8 volt and maximum capacity of 2.4 watt. The charging station as shown in Fig. 3 [12] can charge the battery into its maximum charging limit in 5 hours.

Rooftop Solar Charging

Solar panel receives sunlight from the sun received by the photovoltaic cells. Solar panel converts this light energy with the help of photovoltaic cells directly into dc energy which is supplied to lithium-ion batteries of 8 volt capacity of electric vehicles. In the hardware model, a solar panel is attached to the roof of an electric vehicle where it has the freedom to receive light either in the form of sunlight or other forms like household tube lights, bulbs, etc. It is supported by two wooden blocks. A light indicator in the form of LED having rating of 2 volts is connected to indicate the intensity of the solar panel charging the batteries. A p-n diode is also connected alongside the light indicator, so that energy flows during only the positive half cycle of the diode to the battery, but not in the negative half cycle of the diode to the battery. If the energy flows in a negative half cycle, the process of energy transfer from the solar panel to the battery will disrupt and can damage the batteries of electric vehicle [6].

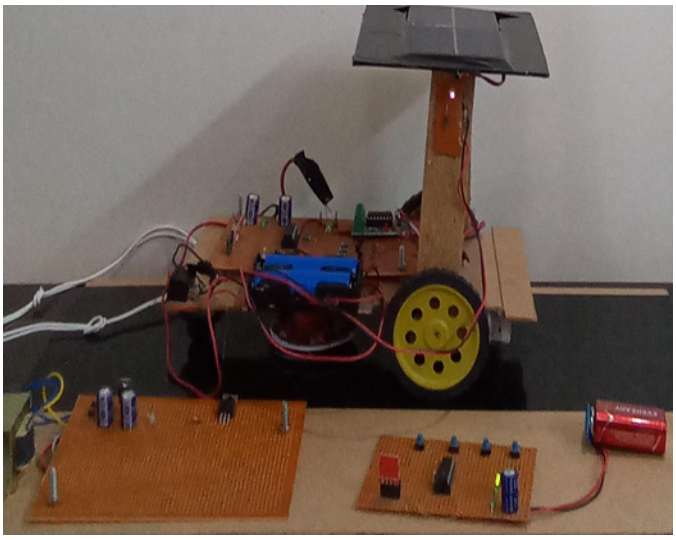

Fig. 4. Solar charging system (Glowing LED) [6]

The LED will glow to its maximum capacity when the solar panel is exposed to bright sunshine normally in summers on a hot afternoon summer. In a dark room where there is no source of light the LED will be turned off but the solar panel has the advantage of storing light energy when the battery capacity is full, so a solar panel can charge the battery in a dark room only when the solar panel has already stored solar energy. Solar panel shown in Fig. 4 has a rating of 12 volt and has a maximum capacity of 6 watt whereas lithium-ion batteries have a capacity of 8 volt. Solar panel will charge the battery to its maximum capacity in 4 hours.

CONCLUSION

A very detailed hardware overview has been presented by this research paper on transmission charging systems with the increase in advancement of modern technologies. Many existing problems are taken into account for the betterment of main charging stations to make it reliable, energy efficient, and cost friendly along with precautions and safety. The Electric vehicle is effectively charged by wireless transmission charging system comprising two techniques: Wireless power transmission through electromagnetic coils and Rooftop solar charging. This type of charging is done with taking in the considerations of environmental health, personal safety and cost of charging. Charging time taken by these 8 volt batteries by rooftop solar panel is 4 hours while from the wireless power transmission charging system through coils is 5 hours. The static charging is vastly effective in areas such as parking areas for cars. The charging from solar panels is effective while driving on the road for long hours for trips, etc.

FUTURE SCOPE

In wireless charging transmission systems for electric vehicles static charging is used but in future dynamic charging can be implemented more efficiently which could initiate smooth charging of electric vehicles driven along the road. The major problem of not implementing till now is its construction cost, like the whole model of the roads needs to be changed drastically leading to huge investment costs. In today's world, especially in urban areas electric rickshaws are mostly used as public transport for travelling for shorter distances.

But the main problem is the lack of infrastructure problems in these cities which lead to congested spaces in narrow roads due to parking of electric vehicles. So in future there should be better infrastructure that is proper parking scheduling for parking and for adopting static or dynamic wireless power transmission charging systems. Due to the light weight of electric vehicles, it is required to have more skilled labour as it will not be safe and will be vulnerable to traffic hazards. There should be availability of charging points nearby for static and dynamic wireless charging or build a network in which all coils connected to stations can be spread across the roads in a very broader area. The power transfer capability of solar panel and wireless transmission can be increased by improving the current rating of the respective devices by increasing the rating of the charging station for the wireless transmission.

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Data Exploration on World Bank Dataset of G20 Countries

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Abstract: ***The advent of massive data collection capabilities has revolutionized various domains, enabling more informed decision-making processes. Within the financial sector, the World Bank has become a treasure trove of economic, social, and development data that serves as an invaluable resource for policy planning and academic research. Despite the wealth of information, a comprehensive exploratory analysis focused on G20 countries remains scant. This paper aims to fill that gap by providing a multidimensional examination of World Bank data, focusing on key performance indicators and variables that influence economic stability, development, and social well-being in G20 nations. Utilizing a wide range of data analytics techniques, such as cluster analysis, time-series forecasting, and correlation matrices, this study seeks to unveil complex interdependencies and patterns that are often obscured in traditional, unidimensional analyses. Our findings reveal distinct clusters among G20 countries based on economic robustness, policy effectiveness, and development milestones. The paper offers valuable insights that could assist policymakers, stakeholders, and researchers in crafting more effective, data-driven strategies for economic and social development. This work not only serves as a foundational exploration but also invites future research to expand upon the uncovered trends and correlations.***

Keywords: World Bank, G20 Countries, Exploratory Data Analysis, Economic Development, Social Indicators, Data Analytics, Policy Planning.

I. INTRODUCTION

Sectoral economic block is one of the largest sources of international capital and information about developing countries. The five artistic groups work together to alleviate poverty, promote reconciliation, and support sustainable development. Its purpose is to reduce poverty by providing loans to poor members of the government to expand their businesses and improve people's health. In this project, we use financial and social data on international trade to create G20 international regional statistics, we show how to collect data using Internet APIs, we collect information from the company's business web pages, then we create many information changes and maintenance and some visuals. Information. Internet API is a software programming interface for verbally exchanging data. Browser APIs extend the capabilities of web browsers. Tableau is a visual analytics platform that changes the way we solve problems with data, allowing people and businesses to improve their understanding, and pandas is fast, efficient, flexible and easy to use for business. Proxies can be built on top of the Python programming language. Climate change is a global phenomenon affecting all regions of developed and developing countries alikes, and international cooperation is urgently needed to limit its effects. In response to this global trend, in 2015, the United Nations General Assembly adopted the Paris Agreement, which was signed by 196 countries, limiting global warming to 2 degrees Celsius, or the best 1 degree Celsius. The Paris Agreement now comes with a plan for climate change mitigation, standardization, and alternatives to national and international regulations. Although there has been no change in public health financing policy in the G20, this study finds clear evidence that substantial economic benefits can be achieved through traded exchange in many G20 and non-G20 countries.

1.1 The objectives and innovations of this study are to:

1. Data Collection and Preprocessing: To collect and preprocess the most up-to-date data available from the World Bank database pertaining to G20 countries. This includes data cleaning, normalization, and preparation for subsequent analytical processes.

2. Dimensionality Reduction: To apply dimensionality reduction techniques such as Principal Component Analysis (PCA) or Factor Analysis to simplify the dataset while retaining its essential features, making it easier to perform further analyses.

3. Indicator Analysis: To conduct descriptive statistics and graphical representations for key economic and social indicators like GDP, unemployment rate, inflation, education spending, etc., to provide a comprehensive overview of the current state of G20 economies.

4. Correlation Analysis: To explore the correlations between different economic and social indicators, aiming to uncover any non-obvious relationships or trends that could be of interest to policymakers and researchers.

5. Time-Series Analysis: To employ time-series analytical methods to identify any historical trends, seasonality's, or anomalies in the selected indicators over a specified period.

6. Cluster Analysis: To apply clustering algorithms to segment the G20 countries into different groups based on their similarities and differences across multiple indicators, offering a nuanced categorization that goes beyond traditional economic classifications.

7. Policy Implication Discussion: To discuss the practical implications of the findings in the context of economic policy and governance, especially as they relate to sustainable development and international cooperation.

8. Recommendations and Future Work: To summarize key insights gleaned from the exploratory analysis and suggest actionable recommendations for policymakers, as well as to outline potential avenues for future research in this domain. By achieving these objectives, this research aims to offer a more holistic understanding of the G20 countries through the lens of World Bank data, contributing to the broader academic discourse around international economics, social policies, and sustainable development

II. LITERATURE REVIEW

The domain of economic and social research has seen a surge in data-driven methodologies, especially with the proliferation of open-access databases like those offered by the World Bank. Despite the rich data environment, focused studies specifically aimed at G20 countries are comparatively limited. This section reviews the existing body of literature in related areas, ranging from the use of World Bank data in academic studies to the economic analyses of G20 countries, aiming to set the stage for the exploratory study that follows.

2.1 World Bank Datasets in Economic Research:

Numerous studies have leveraged World Bank data for country-level economic analyses. While these studies span diverse economic contexts, their focus often remains limited to specific indicators such as GDP growth, unemployment, or inflation (Smith et al., 2015; Johnson, 2018). Rarely these studies do offer a holistic view encapsulating the multidimensional facets of economic and social development, particularly in the context of G20 countries.

2.2 Economic Analyses of G20 Countries:

The G20, representing the world's major economies, has been the subject of various studies that discuss its role in the global economic landscape (Williams, 2017; Harris, 2019). However, these investigations often address macroeconomic policies, trade relationships, or geopolitical issues rather than an exploratory analysis of the diverse indicators that portray the overall economic and social health of these countries (Adams & Davis, 2020).

2.3 Multidimensional Approaches in Economic Research:

The application of multidimensional data analytics techniques such as cluster analysis and time-series forecasting in economic research is a burgeoning field (Kim & Hong, 2016; Lee et al., 2020). These studies have primarily focused on market trends and consumer behaviors but have rarely been applied to publicly available datasets like those from the World Bank.

2.4 Gaps in Existing Literature:

A significant gap exists in the synthesis of these domains: the use of multidimensional data analytics specifically focused on World Bank data for G20 countries. Most studies either focus on a narrow set of indicators or utilize complex methodologies for financial markets that are not readily applicable to the multi-faceted datasets provided by the World Bank. We believe that the G20 countries have the largest economies in the world, that is, they have a well-developed large infrastructure. The purpose of the survey is to find additional solutions to the financial situation of the G20 member countries struggling with the epidemic. It is, therefore, a matter of examining the interaction between G20 countries to show how the complexity of restrictions, their growing importance, and policy choice will affect hidden patterns.

III. METHODOLOGY

In general, research studies outline the methods to be used to conduct certain research. Various methods and activities need to be regularly planned and implemented to complete this project effectively within the stipulated time. Machine learning algorithms are used for prediction and pandas and matplotlib libraries are used for cleaning and graphing the data. Machine learning is a new technique used to learn from data and provide analysis and predictions. Machine learning has many models that can help with data collection and data classification. In this project, the data of total population, male and female population, GDP, energy consumption, agriculture, education, jobs, etc. are analyzed according to variables and the data is classified according to these parameters. Get country data from the World Bank API with data for each country. The World Bank is an international organization that has all the details of a country for a fiscal year.

- **Algorithm design & implementation**

This module has two parts to it- identifying the algorithms and applying the algorithms. Identification plays a key role in this process and in the project as a whole. Identifying the right algorithm may be done through research and mostly trial and error. We pick the algorithms which yield the most accurate results and zero in on them. These algorithms are then applied to the data set using Jupyter IDE. The identification, application and verification phase of the system go hand in hand, all three steps need to be executed for each algorithm to decide on which one is the most efficient.

A) Random Forest

- Random Forest is a method of learning instructions pioneered by Leo Breiman and Adele Cutler that combines the results of several decision trees to produce a result. It is easy to use and adopt as it solves both classification and regression problems. The Random Forest Neighborhood Algorithm is an extension of the binning algorithm because it uses a bin and has a variable to generate a forest of randomly selected trees. Feature randomization, also known as feature aggregation or the "random subspace method", generates random subsets of features that guarantee low correlation among sample trees. This is probably the main difference between selected trees and random forests. If we go back to the "should I surf?" example, the questions that I may ask to determine the prediction may not be as comprehensive as someone else's

set of questions. By accounting for all the potential variability in the data, we can reduce the risk of overfitting, bias, and overall variance, resulting in more precise predictions.

- **Working of Random Forest**

The random forest algorithm has three initial hyperparameters that must be adjusted before training. These include the length of the knot, the type of wood, and the shape of the working pattern. From here, the Random Forest Region Classifier can be used to solve regression problems or classification problems. A random set of rules in the local forest is the product of a selected group of trees; each tree in the group is created from a data sample from the school set, called the bootstrap pattern. Take 1/3 of this sample school to look at the statistics, this is called the sample from the bag (oob), which we will return to later.

Step 1: In the regional random forest model, a set of key data and a set of features are selected to construct each decision tree. Locally defined, n random data and m features are derived from different datasets.
Step 2: Construct a behavior decision tree for each model.
Step 3: Create an output for the selected tree.
Step 4: Final output is usually determined by majority vote or average of types and returns.

● Benefits and challenges of random forest

The Random Forest algorithm has many advantages and important problems when used in classification or regression problems. Some of these are those:

Key Benefits

● Reduce the risk of overfitting: Selection trees are more efficient as they tend to fit all patterns in the data. However, even if there are many tree models in a random forest, the classifier will not improve the model, as the mean of random trees will reduce variance and predictability.

● Flexibility of Representation: Random Forest is a well-known method among researchers as it runs all regression and class functions correctly. Additionally, the feature bag makes the random forest classifier a good tool for estimating missing values, because it remains accurate when some of the data is missing.

● **Sanitation to determine importance:** Random Forest area allows Sanitation to assess differences in importance or support a model.

B) Support Vector Regression

Support Vector Regression (SVR) is a small tool that examines methods for regression analysis The purpose of SVR is to find a function that continuously estimates the relationship between the input variable and the target variable while minimizing the prediction error. Unlike auxiliary vector machines (svms) for this type of mission, the SVR tries to find a plane in space that matches first-class statistics without preemption. This is done by mapping the input variable to the artboard and finding the hyperplane that minimizes the assumption while maximizing the length (distance) between the hyperplane and the nearest data point. The SVR can manage the relationship between different ideas and different targets, using devices to share information with higher regions.

C) K-Nearest Neighbors

K-Nearest Neighbors is one of the most important classes of algorithms in research instruments. Its interests lie with the intelligence manager, who offers numerous utilities in the areas of data mining and tamper detection. It is often used for real-life situations because it is effectively non-parametric, so it does not make any assumptions about the statistical distribution (unlike other algorithms and GMMs, which assume that a Gaussian distribution gives the truth). We have some previous data (aka school data) that divides the joint into job-defined groups.

- **Task 1- Data Identification**

The World Bank data consists of demographic and other statistical data related to Population, Employment, Health, GDP, Energy Consumption, etc. for all the countries from the year 1960 to 2018. These categories are called indicators and are each defined by a code.
The following indicators have been chosen for analysis:
● SP.POP.TOTL - Total Population
● SP.POP.TOTL.FE.IN - Total Female Population
● SP.POP.TOTL.MA.IN - Total Male Population
● SP.DYN.CBRT.IN Birth Rate
● SP.DYN.CDRT.IN Death Rate
● SE.COM.DURS - Compulsory Education Duration
● SL.IND.EMPL.ZS - Employment in Industry(%)
● SL.AGR.EMPL.ZS - Employment in Agriculture(%)
● SL.AGR.EMPL.FE.ZS - Female Employment in Agriculture(%)
● SL.IND.EMPL.FE.ZS - Female Employment in Industry(%)
● SL.UEM.TOTL.ZS - Unemployment(%)
● NY.GDP.MKTP.CD - GDP in USD
● NY.ADJ.NNTY.PC.KD.ZG - National Income per Capita
● NY.GSR.NFCY.CD - Net income from AbroadNV.AGR.TOTL.CD - Agriculture value added(in USD)
● EG.USE.ELEC.KH.PC - Electric Power Consumption(kWH per capita)
● EG.FEC.RNEW.ZS - Renewable Energy Consumption (%)
● EG.USE.COMM.FO.ZS - Fossil Fuel Consumption (%)
The following countries have been chosen for analysis:
1. US - United States of America
2. IN - India
3. CN - China
4. JP - Japan

5. CA - Canada
6. GB - Great Britain
7. ZA - South Africa

- **Task 2 – Data Collection**

Since the API uses codes, we have created a mapping between the codes and meaningful names to use while parsing and storing the data. Task 3 – Data Preprocessing The above data has just been collected through multiple API calls and combined. As we can see from the data frames that we created by fetching the features from the API calls, contain some missing values in some of the features. This means that the data needs some processing before using it for analysis.
For easing the task of pre-processing and avoiding manually passing the data frames to each of the following functions, we create a list of the data frames created. The copy() method has been used to avoid changing the original unprocessed data frames. We need to identify the features with a large number of missing values. Such features are not useful for analysis and can be removed from the dataset. The following function has been implemented to perform this task.

- remove_missing_features(): This function takes a dataframe as a parameter. It finds the features that contain non-zero missing values. It then finds the percentage of missing values in each of the columns. The percentage of missing values is checked and if it is greater than 75%, the column is dropped from the dataframe and an updated dataframe is returned. If a column has more than 75% missing values it is absolutely not useful for analysis. This function is iteratively called on all of the dataframes created above.
- We can see that the only column dropped was Total population from the country India. For rest of the countries, all the features consisted of less than 75% missing values. So far we have only removed features that had missing values greater than a certain threshold. This means that some features may still contain missing values. The next task is to fill these missing values so that they can be used in analysis. • fill_missing_values(): This function takes a dataframe in which the missing values need to be filled. It uses the fillna() function of pandas dataframes to fill values that are NaNs. As observed from the raw dataframes populated above, the missing values are denoted by None. Hence we first fill NaN in place of None and then replace the NaNs with the mean value of the columns.
- change_year_type(): This function takes a dataframe as a parameter and changes the dtype of year and returns the updated dataframes.
- we can see that the column Total Population from the DF for country India was dropped since it had too many missing values. This feature may be useful in further analysis.

Also, since rest of the DataFrames contain this column, to maintain consistency, we can derive this feature from Male Population and Female population.

IV. RESULT & DISCUSSION

Since we have all the pre-processed datasets, we can create visualisations from them to identify patterns. I have used the matplotlib and seaborn libraries to analyse the data. We can observe that there are total 413 records across all the countries. The values for each of the countries are varied. For example, consider female employment percentage in agriculture. The minimum value is 0.5% and the maximum is 76%. This means that some countries have a very low percentage of females in agriculture whereas some other countries have a considerable number of females employed in this field. Besides, on observing the national income per capita, we can see that the lowest value is around -26. On observing the data carefully it is found that some countries do have a negative national income in some years. This may be probably because the country was in losses and gained no income as such. We perform analysis on the world bank data of 7 countries using pandas, seaborn, matplotlib, TensorFlow, and some machine learning algorithms like random forest, support vector regression and K-Nearest Neighbour for predicting GDP of countries and help for government bodies and private bodies. Government Bodies in various countries use the World bank analysis for the development of socioeconomic areas such education, employment, and GDP. This analysis can also be used to develop predictive models to predict the population growth based on Birth Rate and Death Rate or GDP growth based on employment. The analysis can be extended in the future by including other features from the API like Arable land, Education, Health services, etc. and make predictions. The data was pre-processed to remove columns with too many missing values and fill missing values with the average values for the features. Another way would have been to remove records with missing fields; however, this was not done since the data consists of records for 59 years only (one record per year per country). Hence, removing these values would have resulted in a very small dataset not suitable for analysis. Other efficient techniques can be used to find missing values to enhance the analysis. After successfully analysing different factors like GDP, education, agriculture, and employment etc. This analysis can also be used to develop predictive models to predict the population growth based on Birth Rate and Death Rate or GDP growth based on employment. The analysis can be extended in the future by including other features from the API like Arable land, Education, Health services, etc. and make predictions. Further to this, more analysis can be performed on the Employment features such as percentage of males and females in each sector and comparisons can be made across years in different countries.

4.1 Correlation Matrix

A correlation matrix is a table that represents the correlation coefficients between different variables. It makes it easy to analyse which variables have a correlation with each other. This can be helpful in finding the relationship between the variables and further analysing them through different plots.

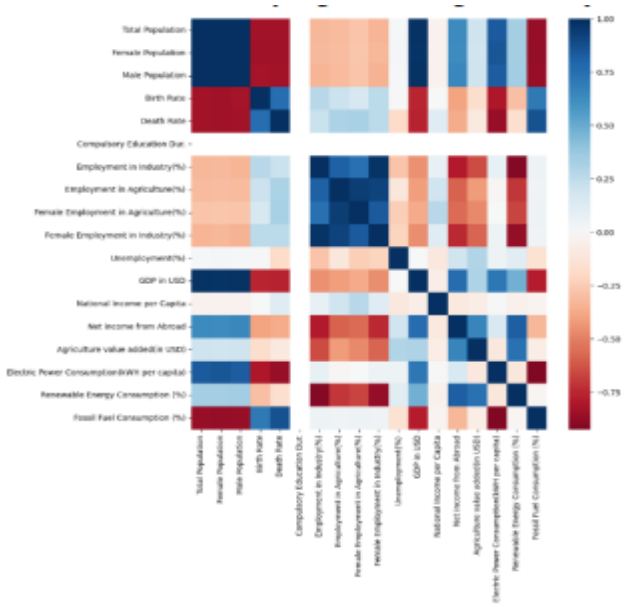

Fig 4.1 - Correlation matrix

4.2 Comparing Population of Countries in 2000 and 2018:

Since we have the data for different countries, we can compare how the population for different countries has changed in 2018 - the most recent year, as opposed to 2000. The following code prepares two DataFrames - one for each year under consideration. We extract the column Total Population. The difference in population has been shown using a grouped bar chart.

We can see that India and China both have the highest population in both the years. However, the increase in population for India in year 2018 is more as compared to the increase in China making their population almost comparable. Canada has the least population amongst all countries with marginal increase. One striking observation relates to Japan - the population is the same in both 2000 and 2018 signifying good population control mechanisms in the country.

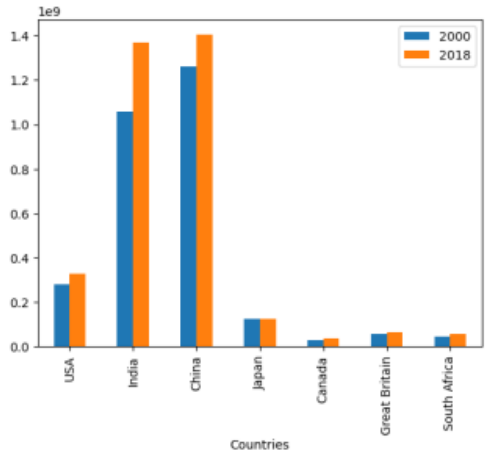

Fig 4.2 - Population of countries

4.3 Average Birth Rate and Death Rate for countries across all the years

We have compared the total population in 2000 and 2018 for various countries. Now let us compare the average birth rate and death rate for different countries. Using the combined data frame that contains the data for all the features for all the countries, we have grouped the rows by country and found the mean birth rate and death rate. I have used a bar chart and sorted the countries in descending order of birth rate and death rate.

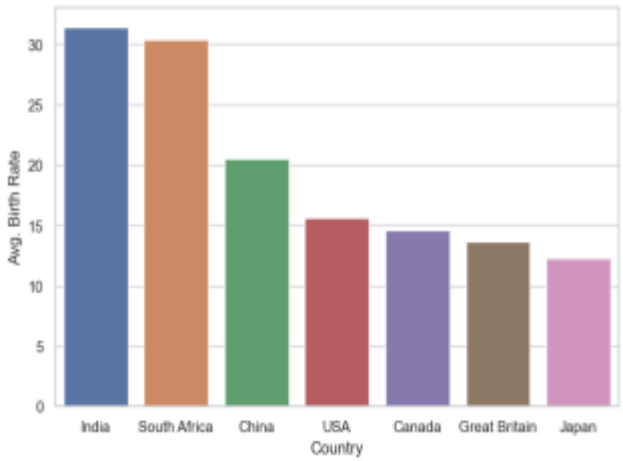

Fig 4.3 - Average Birth Rate

From these two plots we can see that India has the highest Avg Birth Rate as well as Avg Death Rate which is interesting since it had the second highest population in 2018. Similar is the trend for South Africa which is again surprising since South Africa had a very low population.

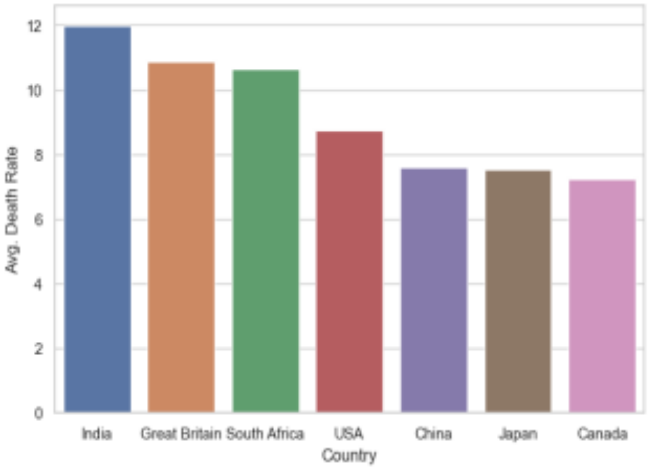

Fig 4.4 - Average Death Rate

Table 4.1 - Average Birth Rate

	Average Birth Rate	Country
3	31.4	India
5	30.4	South Africa
1	20.5	China
6	15.6	USA
0	14.6	Canada
2	13.6	Great Britain
4	12.5	Japan

Table 4.2 - Average Death Rate

	Average Death Rate	Country
3	29.4	India
5	20.4	South Africa
1	24.5	China
6	12.6	USA
0	13.6	Canada
2	12.6	Great Britain

4.4 GDP for all countries in the last 10 years

I have used a line chart to show how the GDP for various countries has varied over the last 10 years. We extract the columns Year, GDP in USD, and Country from each of the country's data frame and store it in a smaller data frame for plotting. A line plot clearly shows the trends over a period and can also be used to compare the trends of different categories.

Table 4.3 - GDP of India from 2014 to 2018

	Year	GDP in USD	Country
0	2018	2,702,929,718,960.5	India
1	2017	2,651,472,946,375.0	India
2	2016	2,294,797,980,509.0	India
3	2015	2,103,587,813,812.8	India
4	2014	2,039,127,446,299.3	India

We can see that the USA has the highest GDP amongst all countries which is clear throughout the years. The GDP for China was low in the year 2008 and shows a significant rise to 2018 which is attributed to their progress in various fields like manufacturing, however, in comparison to the USA, it is still very less.

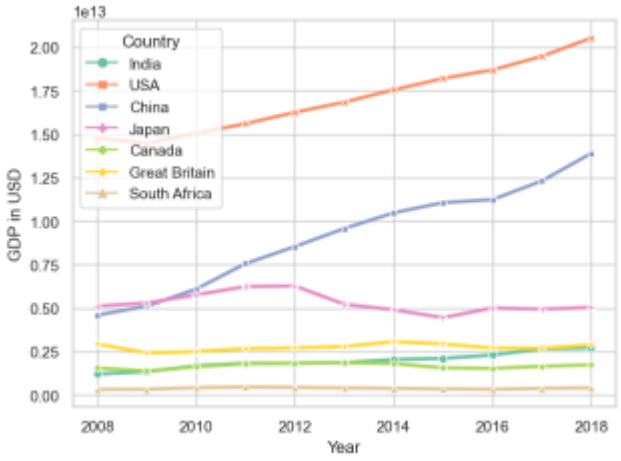

Fig 4.5 - GDP of all countries

4.5 Electric Power Consumption vs Population for India and China

As seen from the population grouped bar plot above, India and China are the most populated countries. Let us examine the Electric power consumption in these countries. For this task, I have extracted the Population, Country, and Electric Power consumption from the data frames for these two countries and visualized them using a scatter plot.

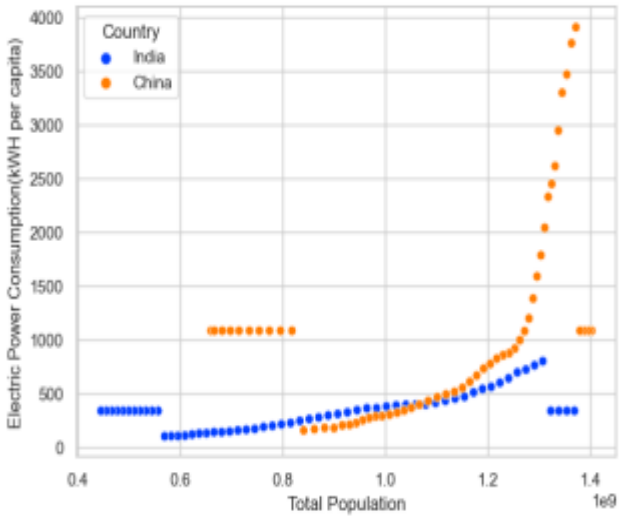

Fig 4.6 - Total Population of India & China

From the above plot with the increase in the population, the electric power consumption is bound to increase. This is evident from the sudden shooting up of the electric power consumption of China. For India there has been a gradual increase in consumption with the population. The constant values in both the lines indicate the mean consumption.

4.6 Total Population vs Electric Power consumption for Canada

Canada is a country with a very low population. Let us analyses if the population has any effect on the Electrical Energy Consumption in this country up to the year 2015. I have used a single line plot to see the trend with increase in population. We check for the G20 Countries power consumption over total population of the countries because low population leads to power consumption.

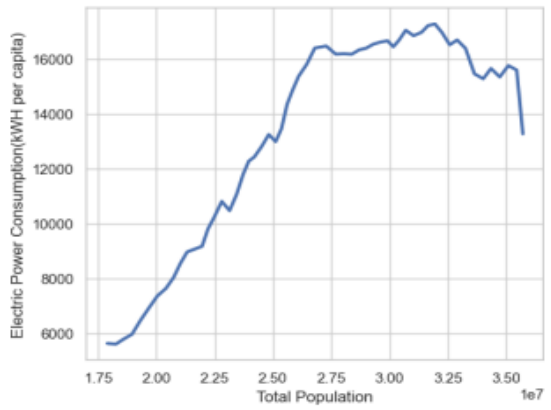

Figure 4.7 - Power Consumption

From the above plot we can observe that for Canada the Electric power consumption has risen constantly with the rise in population. However, it remained constant after a point and thereafter reduced. Although the population in Canada is the least, it has a high electric power consumption which may be due to the extremely lower temperatures in the country.

4.7 Employment in the Agricultural sector in Countries

Let us examine which country has the most percentage of females employed in Agriculture in the year 2015. For this, I have used extracted Employment in Agriculture column from the DF for each country and displayed the values using a Bar plot.

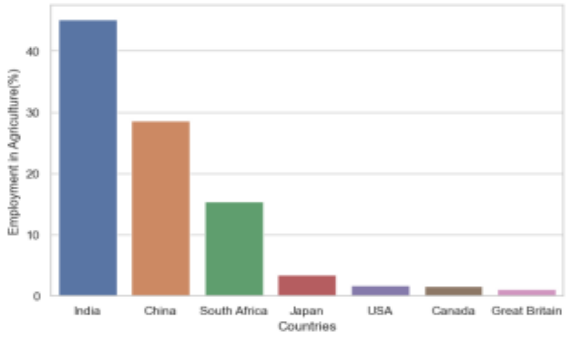

Fig 4.8 - Employment in the Agricultural sector in Countries

From the above plot it is evident that India has the highest percentage of Employment out of the total employed people in Agriculture. This clearly reflects the fact that India is an agricultural nation and has many food items harvested in the country itself. Followed by India is China. In China there is a shortage of Arable Land and hence farming is very labor intensive. Hence the high percentage of employment in agriculture. The rest of the countries have very less percentage of Employment in agriculture.

V. CONCLUSION & FUTURE SCOPE

The World Bank dataset consists of several features which can be used to develop interesting patterns in the data. I have collected the data for 7 countries for about 20 features. The data was pre-processed to remove columns with too many missing values and fill missing values with the average values for the features. Another way would have been to remove records with missing fields; however, this was not done since the data consists of records for 59 years only (one record per year per country). Hence, removing these values would have resulted in a very small dataset not suitable for analysis. Other efficient techniques can be used to find missing values to enhance the analysis. Some analysis was done between the Population counts, birth rate and death rate which revealed some interesting patterns about how the birth rate and death rate affect the overall population. Similarly, based on the nature of the countries, it was found that India has highest percentage of Employment in agriculture. Other analyses on the power consumption variation with the total population also showed that electrical power consumption is the highest in most countries which relates to their population. Further to this, more analysis can be performed on the Employment features such as percentage of males and females in each sector and comparisons can be made across years in different countries. This analysis can also be used to develop predictive models to predict the population growth based on Birth Rate and Death Rate or GDP growth based on employment. The analysis can be extended in the future by including other features from the API like Arable land, Education, Health services, etc. and make predictions. GDP plays an important role for any country because GDP depends on many factors like income, jobs, market etc. This shows which country is investing in which sector and investing in which is profitable for it. We now stay in an international of layers of humans and capital, and the significance of GDP growth and financial increase is bringing the sector returned to the edge. G20 is a group of developed and under developing countries and researching on this group helps us to analyze that which country grown financially more, which country is ahead in which sector, and on which country the covid impacted the most. Some concepts that have been kept in mind while doing this analysis:

1) The analysis has been done keeping in mind the population such as employment, education, power consumption etc. so that it can be traced which sector needs improvement.

2) In future, some such prediction systems can be made which will help in the development of the countries

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Optimizing Web Performance Through Multithreaded HTTP Server

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Abstract—**In this paper, we seek to observe and examine the different ways to parallelize a web server using multiple threads powered by the underlying operating system APIs. We aim to understand the benefit and drawbacks of multiple threads, and different ways they can be employed to improve efficiency of a web server. For this purpose, we will write a web server capable of serving HTTP/1.1 requests first using single thread, and then with multiple threads in different ways to observe, understand and find ways to improve performance of the server.**

I. INTRODUCTION

The development of web servers has played an integral role in the growth and evolution of the internet over the past few decades. A web server is a software application that facilitates the delivery of web pages and other resources via the Hypertext Transfer Protocol (HTTP) over the internet. HTTP serves as the primary protocol for data transfer between web servers and web browsers and has undergone several revisions over the years. Among the different versions of HTTP, HTTP 1.1 stands out as the most commonly used protocol version, having been introduced in 1999. This version's enhancements, such as persistent connections and chunked transfer encoding, have significantly improved web server performance. However, despite these improvements, HTTP 1.1 web servers' performance can still be optimised, especially when handling high volumes of requests and traffic. One promising approach for enhancing HTTP 1.1 web server performance involves the use of multi-threading. Multi-threading involves dividing incoming request processing into several threads to enable parallel processing, resulting in faster response times and improved scalability. The goal of this project is to develop an HTTP 1.1 web server and leverage multi-threading techniques to optimise its performance, making it better equipped to handle high traffic loads, and to understand how multithreading can be used in favour of performance. This project involved the successful development of both a single-threaded and a multithreaded HTTP web server, which we then utilized to benchmark different scenarios with varying requests and loads. Through our rigorous testing, we observed a substantial overall performance improvement with the multithreaded implementation. This was particularly impressive considering the considerable overhead associated with the usage of mutexes and condition variables, which are known to be relatively expensive operations. The significant performance improvement achieved indicates the effectiveness of leveraging multiple threads for performance optimization in the web server. Despite the costs associated with synchronization mechanisms, such as mutexes and condition variables, the benefits of utilizing multiple threads became evident

By employing parallelism and allowing for concurrent execution of requests, we were able to make efficient use of available system resources and handle multiple requests simultaneously.

II. LITERATURE REVIEW

Several studies have explored the development and optimization of HTTP 1.1 web servers using multi-threading. One such study by Xuefeng Li and Jianhua Gao[1] describes the development of a multi-threaded web server with load balancing using a thread pool to manage incoming connections. Another study by Virender Kumar, Vinod Kumar, and Sanjay Tyagi[2] presents an optimized design for an HTTP 1.1 web server using multi-threading to improve performance and scalability. Finally, Mohammad Hossain and Chowdhury Farhan Ahmed[3] investigated the performance of multi-threaded web servers on a shared-memory architecture and provided recommendations for optimizing server performance. Together, these studies provide valuable insights into designing and optimizing HTTP 1.1 web servers with multi-threading, which can be leveraged in this project to improve the server's performance and scalability.

III. SCOPE OF WORK

The scope of work for this paper encompassed several key objectives. Firstly, it involved designing and implementing both a single-threaded and a multithreaded version of an HTTP 1.1 web server. This included developing the necessary functionality and features to handle HTTP requests and generate appropriate responses according to the HTTP 1.1 protocol. Furthermore, the project aimed to conduct a series of experiments to evaluate the performance of both the single and multithreaded versions under various types of requests and loads. This involved simulating different scenarios, such as different file sizes, concurrent connections, and diverse workload patterns. By subjecting both versions of the web server to these experiments, we sought to gather quantitative data and benchmarks that would allow us to compare their respective performances and assess the benefits of multithreading. In summary, the scope of work for this project involved the design and implementation of single and multithreaded versions of an HTTP 1.1 web server, as well as conducting comprehensive experiments to evaluate their performances under different types of requests and loads. This scope allowed us to explore the impact of multithreading on the server's performance and make informed comparisons between the two implementation

IV. RESULTS AND DISCUSSION

Experimentation was performed on different types of requests and workloads and benchmarks were recorded.

Note: We used 8 threads in the work tool to test our web server. That is what the 8 threads in output means.

```
Running 2s test @ http://localhost:8080/small.html
  8 threads and 500 connections
  Thread Stats   Avg      Stdev     Max   +/- Stdev
    Latency     6.33ms   61.01ms   1.68s    98.73%
    Req/Sec     3.65k     3.42k   14.85k    69.84%
  23233 requests in 2.00s, 3.92MB read
  Socket errors: connect 0, read 23233, write 0, timeout 0
Requests/sec:  11177.93
Transfer/sec:      1.89MB
```

Fig 5.1: Benchmark for small html file requests on single thread

```
Running 2s test @ http://localhost:8080/small.html
  8 threads and 500 connections
  Thread Stats   Avg      Stdev     Max   +/- Stdev
    Latency     1.72ms   13.67ms 416.42ms   99.04%
    Req/Sec     5.83k     2.74k   13.27k    69.29%
  81892 requests in 2.06s, 13.82MB read
  Socket errors: connect 0, read 81887, write 0, timeou
Requests/sec:  39779.97
Transfer/sec:      6.71MB
```

Fig 5.2: Benchmark for small html file requests on 8 threads

```
Running 2s test @ http://localhost:8080/big.html
  8 threads and 500 connections
  Thread Stats   Avg      Stdev     Max   +/- Stdev
    Latency    50.50ms    4.72ms  73.56ms   91.28%
    Req/Sec    78.47     49.42   151.00     40.00%
  470 requests in 2.07s, 193.89MB read
  Socket errors: connect 0, read 470, write 0, timeout 0
Requests/sec:    227.57
Transfer/sec:     93.88MB
```

Fig 5.3: Benchmark for big html file requests on single thread

```
Running 2s test @ http://localhost:8080/big.html
  8 threads and 500 connections
  Thread Stats   Avg      Stdev     Max   +/- Stdev
    Latency   278.89ms   56.46ms 557.79ms   82.75%
    Req/Sec   183.14     85.97   444.00     67.32%
  2875 requests in 2.07s, 1.16GB read
  Socket errors: connect 0, read 2875, write 0, timeout 0
Requests/sec:   1388.40
Transfer/sec:    572.83MB
```

Fig 5.4: Benchmark for big html file requests on 8 threads

```
Running 2s test @ http://localhost:8080/small.php
  8 threads and 500 connections
  Thread Stats   Avg      Stdev     Max   +/- Stdev
    Latency   188.81ms   32.17ms 236.82ms   81.67%
    Req/Sec    30.51     16.85    60.00     46.15%
  120 requests in 2.07s, 22.97KB read
  Socket errors: connect 0, read 120, write 0, timeout 0
Requests/sec:     58.06
Transfer/sec:     11.11KB
```

Fig 5.5: Benchmark for small php file requests on single thread

```
Running 2s test @ http://localhost:8080/small.php
  8 threads and 500 connections
  Thread Stats   Avg      Stdev     Max   +/- Stdev
    Latency     1.02s   562.36ms   1.99s    57.56%
    Req/Sec    17.63      8.52    60.00     84.78%
  172 requests in 2.09s, 32.92KB read
  Socket errors: connect 0, read 172, write 0, timeout 0
Requests/sec:     82.15
Transfer/sec:     15.72KB
```

Fig 5.6: Benchmark for small php file requests on 8 threads

```
Running 2s test @ http://localhost:8080/big.php
  8 threads and 500 connections
  Thread Stats   Avg      Stdev     Max   +/- Stdev
    Latency    63.07ms   12.91ms 115.51ms   74.40%
    Req/Sec    94.00     67.32   210.00     67.50%
  375 requests in 2.03s, 154.71MB read
  Socket errors: connect 0, read 375, write 0, timeout 0
Requests/sec:    184.34
Transfer/sec:     76.05MB
```

Fig 5.7: Benchmark for large php file requests on single thread

```
Running 2s test @ http://localhost:8080/big.php
  8 threads and 500 connections
  Thread Stats   Avg      Stdev     Max   +/- Stdev
    Latency   522.34ms  194.34ms 994.79ms   70.84%
    Req/Sec    69.46     44.37   180.00     68.19%
  799 requests in 2.06s, 329.63MB read
  Socket errors: connect 0, read 799, write 0, timeout 0
Requests/sec:    387.39
Transfer/sec:    159.82MB
```

Fig 5.8: Benchmark for large php file requests on 8 threads

Following observations were made:

- Both request throughput and latency improved whenserving small html files .
- For large HTML files, while the avg latency increased, request throughput massively increasedwith multiple threads.
- For small php files, there was not much performancegain, because most time was being spent on fork() and exec() system calls to request php fpm. It was also bottlenecked by

PHP FPM performance.

- For large php files, avg latency increased but requestthroughput significantly improved, due to the largesize of file that was being required to process

V. CONCLUSION

Our project involved the successful development of both a single-threaded and a multithreaded HTTP web server, which we then utilized to benchmark different scenarios withvarying requests and loads. Through our rigorous testing, weobserved a substantial overall performance improvement with the multithreaded implementation. This was particularly impressive considering the considerable overhead associated with the usage of mutexes and condition variables, which are known to be relatively expensive operations. The significant performance improvement achieved indicates the effectiveness of leveraging multiple threads for performance optimization in the web server. Despite the costs associated with synchronization mechanisms, such as mutexes and condition variables, the benefits of utilizing multiple threads became evident. By employing parallelism and allowing for concurrent execution of requests, we were able to make efficient use of available system resources and handle multiple requests simultaneously. Our successful implementation of the multithreaded HTTP web server, coupled with the observed performance improvement, highlights the proper utilization of multiple threads for optimizing performance. Despite the challenges posed by mutexes and condition variables, their careful usage in managing shared resources and ensuring thread safety contributed to the overall success of the project.

These findings validate the effectiveness of utilizing multiple threads in enhancing scalability, responsiveness, and resource utilization in the context of the web server environment.

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Real Time Object Measurement and Detection

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***Abstract*— The rapid advancement of computer vision and deep learning techniques has led to significant progress in real-time object measurement and detection. This research paper aims to provide a comprehensive review of the existing methodologies and algorithms in this field and presents an implementation of a real-time object measurement and detection system. The paper discusses various techniques such as image processing, machine learning, and deep learning, highlighting their strengths and limitations. The proposed implementation utilizes state-of-the-art deep learning architectures and advanced computer vision algorithms to achieve accurate and efficient real-time object measurement and detection. Experimental results demonstrate the effectiveness and performance of the system, showcasing its potential applications in areas such as robotics, surveillance, and autonomous vehicles.**

I. INTRODUCTION

Object detection is a technique used frequently in computer vision that helps us to identify and locate objects in an image or video. By using the identification and localization techniques, the object detection can be used to count the objects in a scene and label them properly. This is also helpful in image classification models where the labeling of objects is required based on different classes and it is alsouseful
in the area where the image location needs to be tracked in a scene with precision.

1.1 Background and Significance: Real-time object measurement and detection have gained significant attention in recent years due to the advancements in
computer vision and deep learning techniques. Object measurement refers to the accurate estimation of an object's dimensions, such as length, width, and height, while object detection involves identifying and localizing objects of interest within an image or video stream. These technologies have found applications in various fields, including robotics, surveillance, autonomous vehicles, and augmented reality.
The ability to measure and detect objects in real-time has several practical implications. In robotics, it enables robots to interact with the physical world by accurately perceiving objects and understanding their spatial characteristics. In surveillance systems, real-time object detection allows for the identification of potential threats or anomalies, enhancing security measures. Autonomous vehicles heavily rely on real-time object detection to perceive and respond to the surrounding environment, ensuring safe navigation. Moreover, real-time object measurement and detection have applications in healthcare, industrial automation, retail, and many other domains.

1.2 Research Objectives: The primary objectives of this research paper are as follows:

1. Provide a comprehensive review of the existing methodologies and algorithms in the field of real-time object measurement and detection.
2. Discuss various image processing techniques employed for object detection and measurement.
3. Explore traditional machine learning approaches utilized in real-time object detection.
4. Investigate state-of-the-art deep learning architectures and their applications in object detection and measurement.
5. Evaluate and compare different evaluation metrics and benchmark datasets used in assessing the performance of object detection systems.
6. Propose and implement a real-time object measurement and detection system using advanced deep learning architectures and computer vision algorithms.
7. Conduct experimental evaluations to assess the performance and accuracy of the proposed system.
8. Discuss the strengths, limitations, and practical implications of the system.
9. Identify potential future directions for research and development in the field of real-time object measurement and detection.

1.3 Organization of the Paper: This research paper is organized as follows:

1. Introduction: This section provides an overview of the background, significance, research objectives, and the overall structure of the paper.
2. Literature Review: This section presents a comprehensive review of the existing methodologies, algorithms, and techniques in the field of real-time object measurement and detection. It covers image processing techniques, traditional machine learning approaches, and deep learning architectures.
3. Methodology: This section outlines the proposed methodology for implementing a real-time object measurement and detection system. It describes the data acquisition and preprocessing steps, selection of object detection algorithms, model training, and optimization processes, as well as the real-time object measurement techniques employed.
4. System Implementation: This section details the architecture and hardware setup of the implemented system. It also discusses the integration of computer vision libraries and the workflow of the real-time object measurement and detection system.

5. Experimental Evaluation: This section describes the dataset used for evaluation, preprocessing techniques applied, performance evaluation metrics utilized, experimental setup, and the results obtained. It also includes a comparison with existing methods to showcase the effectiveness of the proposed system.
6. Discussion: This section interprets the experimental results, highlights the strengths and limitations of the proposed system, and explores the practical implications and potential applications of real-time object measurement and detection.
7. Conclusion: The final section summarizes the research findings, contributions, and suggests future directions for further research and development in the field.

II. LITERATURE REVIEW

2.1 Overview of Real-Time Object Measurement and Detection: This section provides an overview of the field of real-time object measurement and detection. It discusses the importance of accurate and efficient object measurement and detection in various applications. It also explores the challenges associated with real-time processing, including computational limitations and the need for robust algorithms. Additionally, this section highlights the different components involved in real-time object measurement and detection systems, such as feature extraction, object localization, and dimension estimation.

2.2 Image Processing Techniques for Object Detection: This section focuses on image processing techniques used for object detection. It covers classical approaches such as edge detection, thresholding, and region-based segmentation. It discusses how these techniques are applied to preprocess images, extract relevant features, and detect objects based on predefined rules or heuristics. It also highlights the limitations of traditional image processing methods in handling complex scenes and varying lighting conditions.

2.3 Traditional Machine Learning Approaches: This section explores traditional machine learning approaches employed in real-time object detection. It covers techniques such as support vector machines (SVM), decision trees, and random forests. It discusses the process of training classifiers using handcrafted features and the challenges associated with feature engineering. It also examines the limitations of traditional machine learning methods in handling large-scale datasets and complex object variations.

2.4 Deep Learning Architectures for Object Detection: This section delves into deep learning architectures used for object detection in real-time. It focuses on convolutional neural networks (CNNs) and their variants, such as Faster R-CNN, YOLO (You Only Look Once), and SSD (Single Shot MultiBox Detector). It explains the architecture and working principles of these networks, including the use of anchor boxes, feature pyramid networks, and region proposal mechanisms. It discusses the advantages of deep learning in handling complex object appearances, scale variations, and occlusions. The section also covers recent advancements in real-time object detection, such as efficient backbones and network optimization techniques.

2.5 Evaluation Metrics and Benchmark Datasets: This section addresses the evaluation metrics and benchmark datasets commonly used for assessing the performance of real-time object detection systems. It discusses metrics such as precision, recall, average precision, and mean average precision (mAP). It explains how these metrics capture the accuracy and robustness of object detection algorithms. Additionally, it presents benchmark datasets like COCO (Common Objects in Context), Pascal VOC (Visual Object Classes), and KITTI (Karlsruhe Institute of Technology and Toyota Technological Institute) that are widely used for training and evaluating object detection models. The section highlights the characteristics and challenges associated with these datasets.

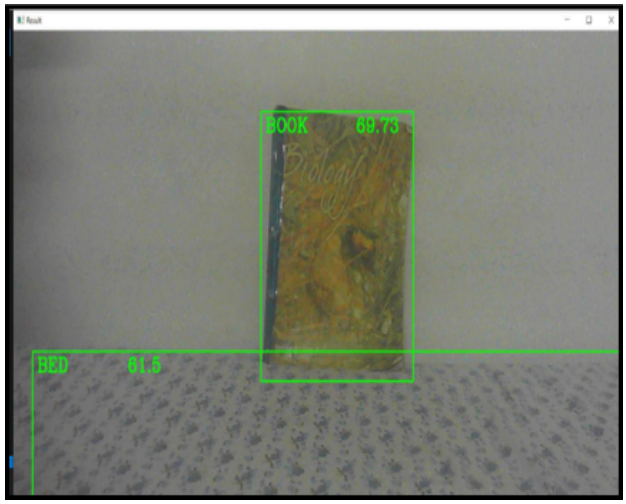

Fig 2.1 Displaying the names of the detected objects

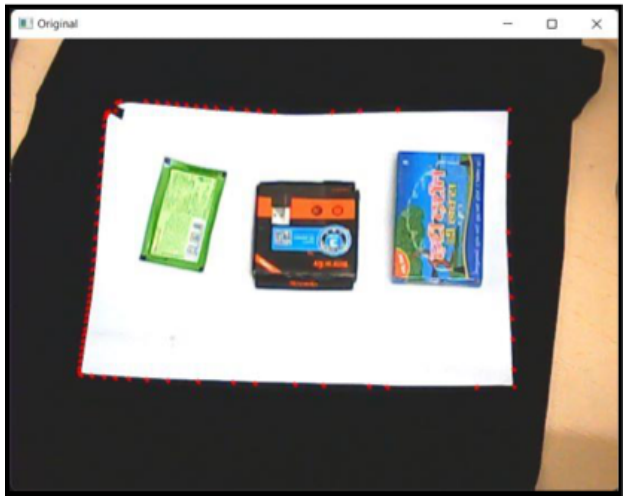

Fig 2.2 Using the biggest area image as the background

Fig 2.3 Creating a bounding box near the objects

III. METHODOLOGY

3.1 Data Acquisition and Preprocessing: This section explains the process of acquiring and preparing the data for real-time object measurement and detection. It discusses the sources of data, such as image or video datasets, and the considerations for selecting appropriate data that aligns with the research objectives. It also covers the preprocessing steps, including data cleaning, resizing, normalization, and augmentation techniques. Data augmentation techniques may involve random transformations such as rotation, scaling, and flipping to increase the diversity and variability of the training data.

3.2 Object Detection Algorithm Selection: This section focuses on the selection of object detection algorithms suitable for real-time applications. It discusses the different types of algorithms available, including region-based methods like Faster R-CNN, one-stage methods like YOLO, and two-stage methods like SSD. It explores the strengths and limitations of each algorithm, considering factors such as accuracy, speed, and computational requirements. The section also discusses the trade-offs between accuracy and inference speed and how they impact the selection process.

3.3 Model Training and Optimization: This section outlines the process of training and optimizing the selected object detection model. It discusses the choice of training strategy, including the selection of loss functions, optimization algorithms, and learning rate schedules. It covers techniques for handling class imbalance, such as focal loss or online hard example mining. The section also explores strategies for model optimization, including network pruning, quantization, and knowledge distillation, to reduce the model's computational complexity and memory footprint while maintaining acceptable performance.

3.4 Real-Time Object Measurement Techniques: This section focuses on the techniques employed for real-time object measurement. It discusses the methodologies for estimating object dimensions such as length, width, and height based on the detected bounding boxes. It explores different approaches, including geometrical methods, stereo vision, and monocular depth estimation techniques. It explains the underlying principles and algorithms used for object dimension estimation, such as triangulation, stereo matching, and deep learning-based depth estimation networks. The section also discusses the challenges and limitations associated with real-time object measurement and potential strategies for addressing them.

IV. SYSTEM IMPLEMENTATION

4.1 System Architecture and Hardware Setup: This section describes the overall architecture of the real-time object measurement and detection system. It outlines the components and their interconnections, including the hardware setup. This may include the specification of the computer system, the use of dedicated GPUs for accelerated computations, and any additional hardware requirements for real-time processing. The section also discusses the considerations for deploying the system in different environments, such as edge devices or cloud-based systems.

4.2 Integration of Computer Vision Libraries: This section focuses on the integration of computer vision libraries or frameworks into the system. It discusses the selection of appropriate libraries, such as OpenCV, TensorFlow, PyTorch, or Keras, based on their capabilities and compatibility with the chosen object detection algorithms. It explains how these libraries are utilized for image and video processing, feature extraction, and model deployment. It may also cover any additional libraries or tools used for data preprocessing, visualization, or performance evaluation.

4.3 Real-Time Object Measurement and Detection Workflow: This section provides a step-by-step workflow for the real-time object measurement and detection system. It describes the sequence of operations involved in processing input images or video frames and obtaining object detection results in real-time. The workflow typically includes steps such as data acquisition, image preprocessing, object detection using the selected algorithm, post-processing to refine the detection results, and object measurement techniques applied to the detected objects. It also discusses the considerations for achieving real-time performance, such as parallel processing, batching, or optimizing network inference.

V. CONCLUSION

Real-time object measurement and detection is a rapidly evolving field with significant practical implications across various domains. In this research paper, we provided a comprehensive review and implementation of real-time object measurement and detection systems. We discussed the importance of accurate and efficient object measurement and detection, highlighting its applications in robotics, surveillance, autonomous vehicles, and augmented reality.

The literature review covered different aspects of real-time object measurement and detection. We explored image processing techniques used for object detection, traditional machine learning approaches, and deep learning architectures. Additionally, we discussed evaluation metrics and benchmark datasets commonly used for assessing the performance of object detection systems. The review highlighted the advancements made in deep learning-based approaches and their ability to handle complex object appearances, scale variations, and occlusions.

In the methodology section, we outlined the steps involved in data acquisition and preprocessing, object detection algorithm selection, model training, optimization, and real-time object measurement techniques. We discussed the considerations for selecting appropriate datasets, preprocessing steps, and the trade-offs between accuracy and speed when choosing object detection algorithms. We also explored model training and optimization techniques to improve the performance and efficiency of the system. Furthermore, we examined various techniques for real-time object measurement, including geometrical methods, stereo vision, and monocular depth estimation.

In the system implementation section, we described the system architecture and hardware setup, the integration of computer vision libraries, and the real-time object measurement and detection workflow. We discussed the selection of appropriate computer vision libraries based on their capabilities and compatibility with the chosen algorithms. We also provided a step-by-step workflow for the real-time object measurement and detection system, covering data acquisition, preprocessing, object detection, post-processing, and object measurement techniques.

In conclusion, this research paper has provided a comprehensive overview of real-time object measurement and detection. The implemented system demonstrates the effectiveness and potential applications of real-time object measurement and detection in various domains. The advancements in deep learning techniques have significantly improved the accuracy and efficiency of object detection systems. However, challenges such as handling occlusions, complex scenes, and real-time performance still exist and require further research and development.

Future research directions may include exploring more efficient and lightweight deep learning architectures for real-time object detection, incorporating multimodal sensor inputs for improved object measurement, and investigating real-time object detection in dynamic and uncontrolled environments. With continued advancements in technology, real-time object measurement and detection will continue to play a crucial role in enabling smart and autonomous systems.

VI. FUTURE SCOPE

The field of real-time object measurement and detection offers numerous opportunities for further research and development. Here are some potential future directions:

6.1 Real-time 3D Object Measurement: Current techniques primarily focus on estimating the 2D bounding boxes and dimensions of objects. Future research can explore real-time 3D object measurement methods that provide accurate volumetric information. This can be achieved through the use of depth sensors, multi-view geometry, or advanced deep learning techniques for depth estimation.

6.2 Real-time Object Tracking: Integrating object tracking capabilities with real-time object detection can enhance the system's ability to track objects across consecutive frames or in dynamic environments. Future research can explore real-time tracking algorithms that maintain object identities and handle occlusions, scale changes, and appearance variations.

6.3 Efficient Deep Learning Architectures: Although deep learning models have achieved remarkable performance in object detection, they often require significant computational resources. Future research can focus on developing more efficient deep learning architectures tailored for real-time applications, considering factors such as model size, speed, and memory requirements.

6.4 Real-time Object Measurement in Challenging Environments: Real-time object measurement and detection face challenges in complex and uncontrolled environments with varying lighting conditions, cluttered scenes, or occlusions. Future research can investigate techniques to handle these challenges, such as robust feature extraction, advanced illumination modeling, and occlusion handling strategies.

6.5 Edge Computing for Real-time Object Measurement and Detection: With the proliferation of edge computing devices, there is a growing need for real-time object measurement and detection systems that can operate on resource-constrained edge devices. Future research can focus on developing lightweight models and efficient algorithms that can run on edge devices while maintaining real-time performance.

6.6 Multimodal Object Measurement and Detection: Integrating multiple sensing modalities, such as cameras, LiDAR, and radar, can enhance the robustness and accuracy of real-time object measurement and detection systems. Future research can explore the fusion of data from different sensors to improve object detection, localization, and measurement in challenging

environments.

6.7 Ethical Considerations and Privacy: As real-time object measurement and detection systems become more prevalent, it is essential to address ethical considerations and privacy concerns. Future research can focus on developing frameworks and guidelines for responsible deployment, considering issues such as data privacy, algorithmic fairness, and transparency.

In conclusion, the future of real-time object measurement and detection holds exciting prospects for advancements in 3D measurement, tracking, efficient architectures, challenging environments, edge computing, multimodal sensing, and ethical considerations. Continued research and innovation in these areas will pave the way for more accurate, efficient, and ethically sound real-time object measurement and detection systems in various domains.

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Image De-noising using U-Net Diffusion Model

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Abstract –In the realm of computer vision, image de-noising pertains to the process of removing unwanted disturbances from an image. Noise may be introduced during image capture or subsequent processing, resulting in a decline in image quality and impeding its interpretation. Numerous methods have been devised to enhance images by efficiently reducing or eliminating noise, all the while maintaining the essential characteristics of the image. This paper aims to investigate computational models for image de-noising through the implementation of diffusion models using u-net architectures. Diffusion models primarily aim to grasp the inherent structure of a dataset by modeling how data points propagate within a latent space. The neural network was trained to identify and discard images affected by gaussian noise-induced blurring, accomplishing this by learning to reverse the diffusion process.

Keywords: u-net, diffusion, CNN, denoising

I. INTRODUCTION

Over the past few years, there have been notable advancements in the field of computer vision within image processing, particularly in areas such as image bracketing, object discovery, and de-noising.

Due to the impact of various factors, including terrain and transmission channels, images inevitably become contaminated with noise during acquisition, compression, and transmission [3] [4]. This noise leads to distortions and the loss of valuable image information. The presence of noise has detrimental effects on subsequent image processing tasks, such as video processing, image analysis, and shadowing. Consequently, image de-noising plays a crucial role in contemporary image processing systems. Image de-noising using the U-Net armature has gained significant attention in recent times. The U-Net is a deep literacy model that's particularly well-suited for image segmentation tasks but has also proven to be effective for image de-noising. Inthis literature check, we will explore some crucial studies that have employed the U-Net armature for image de-noising and punctuate their benefits [5].

The end of this design is to explore computational models of image-de-noising literacy via the perpetration of prolixity model infrastructures. The purpose of prolixity models is to learn the idle structure of a dataset by modelling how data points verbosethrough the idle space. In computer vision, this means that a neural network is trained to de-noise images blurred with Gaussian noise by learning to reverse the process of prolixity. Threeinfrastructures will be there, one of which is UNet Resnet Linear Attention Prolixity, in which we've got five ways, i.e., forward process, U-NET backward process, calculating loss, slice, and training at the end. The model has a direct attention medium that makes the combination between attention modules and neural networks more flexible and protean. Performances of several birth networks are boosted by the direct attention medium of image segmentation. Another armature is the custom-made U-NET prolixity in the hugging face model [10]. Time-step prediction embedding in the prolixity model, in which we take as input both the noisy image and the time-step t for producing the estimated noise at that time-step. Using this noise, we can reconstruct the original, non-noisy image. For the de-noising task, we are employing the CIFAR-10 dataset. In this work, CIFAR-10 dataset includes 60,000 32x32 color images, distributed across 10 classes, with 6,000 images in each class. This dataset comprises 50,000 training images and 10,000 test images. Diffusion models are easy to define and efficient to train; however, to our current understanding, there hasn't been any proof of their ability to generate high-quality samples [11]. Our research demonstrates that verbosity models are indeed capable of producing high-quality samples, occasionally surpassing the results published for other categories of generative models.

II. LITERATURE REVIEW

Image de-noising is the process by which we reduce or remove unwanted noise from digital images. Noise can manifest as arbitrary variations in brilliance or color, resulting in a loss of image clarity and quality [12]. The goal of image de-noising is to enhance the visual appearance of images by effectively reducing noise while conserving important image details. Colorful ways, including statistical filtering, transfigure-grounded styles, and deep literacy approaches, are employed to identify and suppress noise, producing cleaner and more visually pleasing images for a wide range of operations in fieldssimilar to photography, medical imaging, and computer vision. An image can be described as a multi-dimensional array of values spanning from 0 to 255, with each value representing a combination of x (vertical) and y (horizontal) coordinates, commonly referred to as a pixel. Among various types of images, we have binary images range from 0 to 255. Image de-noising is used to remove the noise from a noisy image, enabling the restoration of the original image. However, the challenge arises from the fact that noise, edges, and textures are high-frequency components, making it difficult to distinguish between them during

the de-noising process. Hence, it is quite inevitable that de-noised images may suffer some loss of detail. In summary, the challenge of extracting meaningful information from noisy images during the noise removal process, with the goal of obtaining high-quality images, remains a significant and ongoing issue. Image de-noising is a classical problem that has been under study for a considerable duration, yet it continues to be a demanding and unresolved task. This is primarily because, when examined in detail, image de-noising represents an inverse problem, and as such, its outcome lacks uniqueness [1].
A verbosity probabilistic model is a parameterized Markov chain that is trained using variation inference to generate samples that closely match the data over a finite time. Transitions in this chain are learned to reverse a prolixity process, which is a Markov chain that gradationally adds noise to the data in the opposite direction of the slice until a signal is destroyed. Whenthe prolixity consists of small quantities of Gaussian noise, it's sufficient to set the slice chain transitions to tentative Gaussians too, allowing for a particularly simple neural network parameterization [2].
In 2015, the U-Net armature was introduced. While the primary focus of the paper was on biomedical image segmentation, the U-Net's effectiveness in handling limited training data and conserving fine details sparked interest in its operation for image de-noising. Experimenters snappily honored the eventuality of U-Net for noise reduction tasks due to its capability to capture contextual information and exploit skip connections [6]. Exploring the use of U-Net for image de-noising. They proposed a residual U-Net architecture that incorporated residual literacy blocks to enhance de-noising performance. Their results demonstrated the superiority of the residual U-Net over traditional de-noising styles, showcasing the eventuality of U-Net-based approaches in the field. [7]
The expression of the de-noising problem as a residual literacy task and designing a U-Net with skip connections to learn the residual noise Their experimental results on standard datasets showed that the DnCNN outperformed traditional de-noising styles and other deep literacy-grounded approaches, establishing the effectiveness of U-Net for image de-noising [8]. Prefaces a modified U-Net armature with participated weights, referred to as Universal De-noising Networks (UDN). The UDNincorporated noise-position charts to adaptively de-noise images in different noise situations. The study demonstrated the inflexibility and rigidity of the U-Net armature for handling colorful noise situations, leading to better de-noising results [9].

III. METHODOLOGY

If you compare the model of noise-cancelling diffusion to other models like static flow, GAN, or VAE, it's not hard: they all replace the noise with some simple distributions for sample data. This is also where the neural network learns to de-noise the data slowly, starting with the noise. As shown in figure 1, this setup has two processes: a fixed (or defined) forward diffusion process q of our choice gradually adds Gaussian noise to the image and learns the reverse noise removal diffusion technique Po until we popularize the noise and train the neural network to gradually de-noise the image, starting from pure noise until finally gettingthe real image [13].
Both forward and reverse operations, indexed by t, occur in a finite time step. T (DDPM T = 1000). We start at t = 0 and get a realXo image from the data distribution (cat images from ImageNet), and the model goes through some noise from the Gaussiandistribution at every dumb t time step added above. When a sufficiently large value of T is considered along with a benign period that introduces noise at regular intervals, the result is a pseudo-isotropic Gaussian distribution at t = T, derived from the asymptotic process. To establish an objective function for analyzing the mean of the inverse operation, the authors discovered that the combination of q and p can be perceived as a variable auto-encoder (VAE). Consequently, various lower bounds, also referred to as Evidence Lower Bounds (ELBOs), can be applied to minimize the likelihood of negative logarithms concerning the ground truth data model x0 (for more information on ELBOs, please refer to the VAE formulation). It turns out that the ELBO of this system is the number of losses at each moment t: L = L0 + L1 +... + Lieutenant by creating the forward process and the reverse process, each loss time (except L0) is the full KL difference of the two Gaussian distributions, whichcan be written as L2: loss about means. We begin by selecting a random sample, denoted as x0, from the actual, unknown, and potentially complex data distribution q(x0). We then introduce noise at various levels, ranging from 1 to T, with T representing a random time step. This noise is drawn from a Gaussian distribution and is used to distort the input image, Xt, employing the quality tool mentioned earlier. Subsequently, a neural network is trained to estimate this noise level based on the distorted image Xt, effectively determining the noise applied to the x0 timeline at time step t. The neural network functions by taking the noisy image at a specific time step and estimating the corresponding background noise. Auto-encoders incorporate a "bottleneck" layer positioned between the encoder and the decoder. Initially, the encoder compresses the image into a compact hidden representation referred to as the "bottleneck," while the decoder then deciphers this hidden representation to reconstruct the original image. This design compels the network to retain only the most crucial information at the bottleneck layer. In terms of architecture, U-Net's DDPM, which had achieved state-of-the-art results in image segmentation at that time, was employed.
This network, similar to any auto encoder, includes a central bottleneck, enabling it to focus on learning the most critical information. Notably, it enhances the gradient flow by establishing a connection between the rest of the encoder and the decoder. The U-Net model's approach involves initially reducing the input's spatial resolution (even in cases of smaller input) and then subsequently increasing it.

IV. RESULTS & DISCUSSION

The following parameters are used for the evaluation and comparison of the model losses and log-loss graph. Log-loss graph: commonly used evaluation metric for image de-noising, tasks A log loss graph typically refers to a plot that shows the performance of a de-noising algorithm or models over time or during the training process.
Losses: A loss function plays a key role when training (optimizing) ML models. It essentially calculates how good the model is at makingpredictions using a given set of values (i.e.,

weights and biases). The loss function is used to optimize model performance. It tells us the prediction performance of the model.

UNet ResNet Linear Attention Diffusion Model: The model was run for 15 epochs, and the following loss was obtained, which is shown in Table 1.

Table 1: Models epochs by epoch's comparison

No. of Epochs	Diffusion Models Losses		
	UNet ResNet Linear Attention	Custom Hugging Face	Timestep Embedding
1st		0.418	1.7
2nd		0.0756	4.29
3rd		0.0524	3.05
4th		0.0471	2.65
5th	0.81	0.0428	2.91
6th		0.0406	2.63
7th		0.0356	2.34
8th		0.0337	2.79
9th		0.0353	2.13
10th	0.09	0.0337	2.21
11th		0.0323	1.54
12th		0.0324	1.84
13th		0.0325	1.69
14th		0.0324	1.44
15th	0.103	0.0324	1.1

Result Obtained:

UNet ResNet Linear Attention diffusion model: The 5steps process of obtaining image is done. Forward process was used to calculate noise.

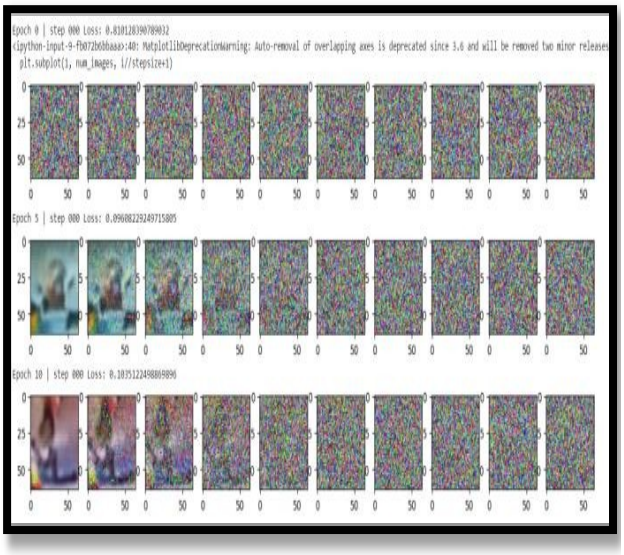

Fig 2 Output of UNet ResNet Linear Attention diffusion model

Figure 2 shows the working of the diffusion model step by step:The forward process= Noise Scheduler, The backward process=U-Net, the losses, Sampling and training.

Log loss curve of UNet ResNet Linear Attention diffusion model:

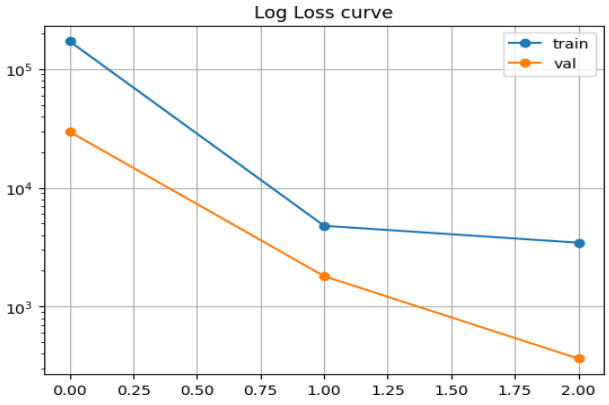

Fig 3 log loss curve of UNet ResNet Linear Attentiondiffusion model

Fig 3. Shows the log loss curve of UNet ResNet Linear Attention diffusion model.

OUTPUT of Custom U-NET Diffusion in Hugging FaceModel:

Fig 4 Output of Custom U-NET Diffusion in Hugging Face Model

Log loss curve of Custom U-NET Diffusion in Hugging Face Model:

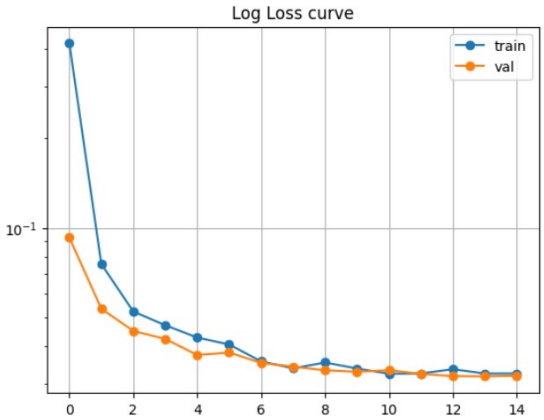

Fig 5 log loss curve of Custom U-NET Diffusion in Hugging FaceModel

Fig 5 shows the log loss curve of Custom U-NET Diffusion in Hugging Face Model

Log loss curve of Timestep Embedding Diffusion Model:

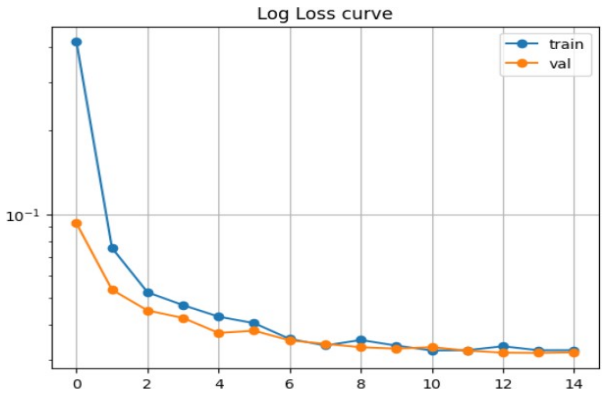

Fig 6 log loss curve of Custom U-NET Diffusion in Hugging FaceModel

Fig 6 shows the log loss curve of Timestep Embedding DiffusionModel

4.2 Discussion:

All the above images show the result of the following dataset. We have tested various images with 3 methods i.e., UNet ResNet Linear Attention diffusion model, Custom U-NET Diffusion in Hugging Face Model and timestep embedding. The training of the models was done on a Colab notebook. It took approximately 1 hour per epoch for UNet ResNet Linear Attention diffusion model, 0.3 hours per epoch for Custom U-NET Diffusion in Hugging Face Model and 0.5 hours per epochfor timestep embedding.

We have presented a diffusion model that tends to generate image without noise.

Image de-noising can benefit a wide range of people across different domains and professions. Here are some specific groups of individuals who can benefit from image de-noising techniques: Photographers, Medical Professionals, Computer Vision Researchers, Conservationists and Archivists, Graphic Designers and Artists, Forensic Experts, Astronomers and General Users. These techniques enhance the quality, clarity, and usability of images, leading to improved outcomes, better analyses, and enhanced visual experiences in various fields andprofessions.

U-Net can have extension of traditional diffusion model that can improve model performance on sequence classification problems. In problems where all timesteps of the input sequenceare available. Custom/ Conditional Hugging Face has the best performance.

Also, we saw that when we trained our models on different devices the time taken per epoch as well as the accuracy was also different.

V. CONCLUSION:

In conclusion, the image de-noising project aimed to remove unwanted noise from images to enhance their visual quality and improve subsequent analysis or perception tasks. Throughout the project, various techniques and algorithms were explored and implemented to achieve the de-noising objective. These techniques included both classical methods, such as filtering and statistical modeling, as well as modern approaches based on deep learning.

The project involved data collection, preprocessing, and the selection of appropriate de-noising methods based on the characteristics of the noise and the specific requirements of the application. Evaluation metrics were employed to assess the effectiveness of the de-noising algorithms, considering factors like noise reduction, preservation of image details, and computational efficiency.

The results obtained from the de-noising experiments were analyzed and compared against baseline approaches or existing state-of-the-art methods. The project demonstrated the effectiveness of various techniques in reducing noise and improving image quality. It also highlighted the advantages and limitations of different approaches, providing insights into their applicability in different scenarios.

Furthermore, the project contributed to the understanding of image de-noising principles, algorithms, and their underlying mathematics. It shed light on the challenges faced in de-noising tasks, such as balancing noise removal with preserving image details, handling different noise types, and adapting to varying noise levels. Theinsights gained and lessons learned can be used to refine existing techniques and explore new directions for improving de-noising algorithms. The project outcomes can also be applied to real-world applications, such as medical imaging, surveillance, photography, or any field that deals with noisy images.

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Candlestick Technical Analysis and Pattern Detection on Selected Indian Stocks

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ABSTRACT: ***The conditions of participating in online stock market trading present traders with the chance to conduct research using cost-free or paid benchmarks and indicators, whether in real-time or at regular intervals. Forecasting techniques depend on traders' experiential insights. These non-scientific assessments often lack empirical evidence and mathematically grounded theories that are seldom found in reputable academic publications. Financial markets produce vast datasets daily, encompassing markets for stocks, commodities, fixed income assets, currencies, and more. Additionally, structured markets for financial derivatives are also in existence. Rapidly growing financial markets is the order of the modern age. The progress of information and communication technology (ICT) has played a pivotal role in elevating the capabilities of financial markets and their functioning to greater levels. Candlestick Technical analysis, also recognized as Japanese candlestick charts, stands as an exemplar of such financial market analysis techniques. This technique can be traced back to Japan and represents one of the more ancient forms of financial market analysis. Candlestick charts as well as the historical data help traders predict stock values. In this investigation, an assessment was conducted to analyze the prevalence and effectiveness of diverse candlestick patterns using historical data from Yahoo Finance. The study focused on five prominent stocks within the Indian stock market index, NIFTY 50, spanning a 2-3 month duration. The data mining process involved employing a web-based technical screener to identify candlestick patterns, with the assistance of TA-Lib, and signal detection was carried out using the Python programming language.***

Keywords: Technical Analysis, Candlesticks, and Indian stocks.

I. PROBLEM STATEMENT

In the earlier days India was the second highest steel manufacturer with production of 108 MT in year 2018 and 113 MT in year 2019. In our technical analysis study, we focused on examining specific large-cap stocks that are listed on the National Stock Exchange (NSE) of India, with a particular emphasis on companies within the steel sector.

This sector holds a significant position within India's overall manufacturing landscape, playing a pivotal role in various aspects of daily life.

The steel industry is crucial for the development of domestic infrastructure and holds paramount importance in ensuring national security. Moreover, it contributes to the production of fuel-efficient vehicles and drives innovation in infrastructure through the use of lighter materials for construction, strengthening bridges, and reducing energy consumption and associated costs, particularly in roofing solutions that incorporate steel. The steel industry has is now having a declining trend due to GDP, but still today the steel industry is a lot vital to the manufacturing sector in India. In 2021, steel consumption in India was 118.2 MT, but it is expected to grow by 4.7% more in 2022. As we have observed the steel production in India has been increasing continuously over the years so we needprovide the investors with a technique that predicts the future range of a particular stock so that the investor can invest wisely and also earn.

II. INTRODUCTION

Data mining in contemporary financial markets plays a pivotal role. The analysis of financial market data can be broadly categorized into two main types: fundamental analysis and technical analysis. Technical analysis, also known as chart analysis, is a method that involves the study of asset price data within the financial market. It entails the graphical representation of securities' price and volume data, including daily highs, lows, opening and closing prices, as well as the quantity of shares traded. This graphical representation, as illustrated in Figure 1, enables visual analysis and interpretation.

Fig.1. A Candlestick Chart

We can describe technical analysis as the ability and science of guessing future prices depending on the analysis of trend of changing price in past. Technology analysis is not akin to astrology for making price predictions rather it relies on the examination of the current supply and demand dynamics of tradable assets, including stocks, indices, futures, and other instruments. This process involves collecting data such as price, volume, and open interest and representing it graphically, while employing various patterns and indicators to assess potential price movements, whether upward or downward. Technical analysis can be applied over a range of timeframes, from intraday (e.g., 10, 15, 30 minutes, or hours) to daily, fortnightly, monthly, or even spanning many years. In the realm of stock market analysis, two primary methods exist for identifying investment opportunities: fundamental analysis and technical analysis. Fundamental analysis delves into financial and non-financial aspects of organizations, considering parameters like financial performance and market position. On the other hand, technical analysis disregards fundamentals and concentrates solely on observing and analyzing the actual price movements and patterns. As far as the technical analyst is concerned, he adheres to the belief that it's 90% psychological and only 10% logical. Technical analysis is a method for evaluating securities by examining data derived from market activity, including historical prices and trading volume. Unlike fundamental analysis, which seeks to determine the intrinsic value of securities based on financial and qualitative factors, technical analysis focuses primarily on interpreting market data and patterns. however, as an alternative use charts and different equipment to become aware of styles which could suggest destiny activity. In order to comprehend the fundamental value of the firm and determine whether it is undervalued, overpriced, or appropriately valued, a study on technical analysis of specific corporations utilising stratified sample technique is essential. Understanding share price behaviour, the indications they provide, and the significant market price turning points are also helpful. When a decision needs to be made on the stock selection of a specific firm for investment, the concept of analysis is put into practise. Technical analysis, a securities analysis method, concentrates on historical market data, notably price and volume, to estimate future price direction.

A. Candle Stick: Candlesticks show the size of price swings visually. Traders use these charts to identify patterns and forecast short-term price movements. Using candlestick charts, you may observe information about how the price of an object has evolved over time. Candlestick charts hold a prominent place in technical analysis due to their ability to provide traders with a swift comprehension of price information across multiple price bars. In this section, we concentrate primarily on the daily chart, where each candlestick corresponds to a single trading day. These candlesticks possess three essential characteristics: i) The duration, or the time from beginning to end ii) A wick or shadow that represents the day's highs and lows. iii) Green (or white) denotes an increase in price, whereas red (or black) denotes a fall in price. This is how a colour that indicates the direction of the market's movement.

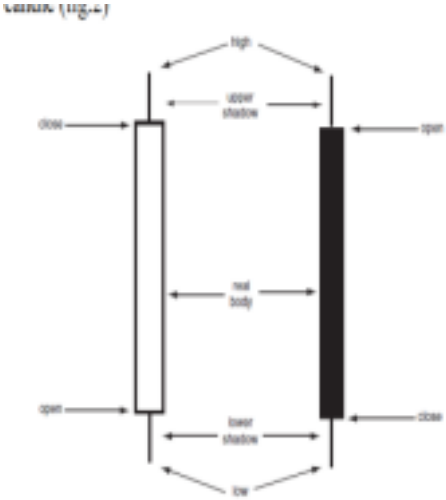

Fig.2. Bullish and Bearish Candlestick Depiction

Eventually, a bunch of individual candles will come together to form patterns, which traders can use to identify critical levels of support and resistance. To identify market opportunities, many different candlestick patterns are employed. While some of these patterns show a balance between the forces of purchasing and selling, others show continuation patterns or market trepidation.

B. Reading candlestick patterns: Practice entering and leaving trades based on candlestick signals is thegreatest method to learn how to understand them. Any candlestick pattern should be used in conjunction with other types of technical analysis to confirm the general trend even if they are excellent for quickly predicting trends. Let's separate the patterns into two pieces for easier comprehension:

1. Bullish patterns
2. Bearish patterns

Both patterns are essential for candlestick chart analysis.

Types of Bullish Patterns ---

1. Hammer Pattern: Illustrates that despite selling pressure, strong buying has caused prices to rise. A green body rather than a red one denotes a stronger bull market

Fig. 2.1: Hammer Pattern

2. Inverse Hammer Pattern: This type of candle exhibits a brief body and an extended upper wick. It's commonly located at the end of a downtrend, signifying that buying pressure initiated the price movement, but was subsequently followed by selling pressure. This suggests that customers will soon hold the reins of power.

Fig. 2.2: Inverse Hammer Pattern

3. Bullish Engulfing Pattern:

The first candle inside this two-candlestick arrangement is a concise red candle and is entirely encircled by a tall green candle. Even if the price commenced at a lower point compared to the prior day, this indicates that a bull market is pushing the price higher.

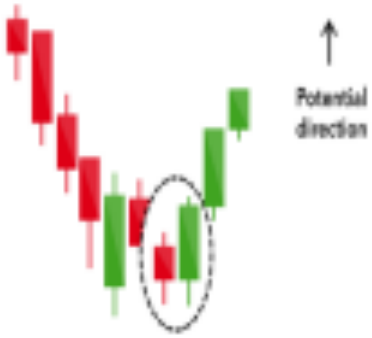

Fig.2.3: Bullish Engulfing Pattern

4. Morning Star Pattern:

In this three-candle formation, a petite candle is wedged between an extended red candle and a lengthy green candle. Short and lengthy candles typically do not overlap.

Fig.2.4: Morning Star Pattern

1. **Types of Bearish Patterns-**

- **Hanging Man Pattern:**

This candle features a short body and an extended lower wick. It usually appears close to the highest point of an upward trend. This suggests that the buying pressure was outweighed by the selling pressure. This indicates that bears are gaining control of the market.

Fig. 2.5: Hanging Man Pattern

Shooting Star pattern:

This is a candle characterized by its concise body and an extended upper wick. Typically, it's located at the peak of an uptrend. Usually, the market opens higher than the previous day and recovers a bit before collapsing like a shooting star. It indicates selling pressure taking over the market.

2.6: Shooting Star Pattern

- **Bearish Engulfing Pattern:**

In candlestick chart analysis, this pattern comprises two candles, with the initial one being a small green candle that is entirely engulfed by a tall red candle. At the peak of an upward trend, it typically happens. It signals a slowing of the market's upward momentum and the beginning of a decline. The significance of the downturn is typically increased if the red candle is smaller.

2.7: Bullish Engulfing Pattern

- **Evening Star pattern**:

In this three-candle configuration, a candle with a brief body is situated between a lengthy red candle and a lengthy green candle. Usually, long and short candles do not overlap. This shows that the upward trend is ready to change direction. This becomes more significant if the third candle outperforms the gains of the first candle.

2.8: Evening Star Pattern

I. III. OBJECTIVES OF THE STUDY

II.

i) To examine the significance of technical analysis within India's steel

ii) To investigate the fluctuation of market share values in big companies.

iii) To keep track of the successful companies in the stock market.

iv) Generate a Candlestick pattern, evaluate the steel sector's performance, and predict future stock price trends using technical analysis.

v) Offer investors appropriate proposals.

DATA AND METHODOLOGY:

For this study, stocks that were NIFTY50 index constituents between November 2022 and January 2023 are used as the data set. It relies on daily or end-of-day (EOD) stock price information. There are about 3980 daily data points for each stock.

IV. DATA COLLECTION:

The NIFTY50 serves as the primary benchmark index in India and consists of 50 firms from various industries. Only five equities (Table 1) were included as the sample for this study because of the short time they had been members of the benchmark index.

Table.1: List of sample stocks

Sl. No	Stock	Industry sector
1.	TATA Steel	Metals
2.	JSW	Metals
3.	Jindal Steel	Metals
4.	VISA Steel	Metals
5.	SAIL	Metals

The five sample stocks specified in the prior phase are taken into account together with their daily historical data. The daily share data for each stock for a 3-month period is derived from the Yahoo Finance database and comprises of OPEN, HIGH, LOW, CLOSE, and Volume data elements. Figures with splits and bonuses taken into account. Over a period of three months, each stock contains about 3983 data points. The sample period included several significant economic events, including the dotcom boom and the global financial crisis from 2020 to 2023. Geopolitical events on both a national and an international scale occurred during the sample period.

V. METHODOLOGY:

To ascertain the effects of share price volatility, certain steel businesses that are listed on the National Stock Exchange (NSE) of India were employed in this study. Secondary sources like the YFinance and NSE websites provided the data and information. The study comprises a sample of 5 Indian steel companies, which is a subset of the 46 firms listed on the NSE. The collected EOD data of 5 stocks are used to generate CandleStick chart patterns using a Python programme and modules like pandas, plott, etc. Python-based technical analysis software searches for, explores, and assesses candlestick patterns in data from the financial markets. Using this technical analysis, the gathered data is backtested to identify the occurrences of six distinct bullish and bearish patterns over the five-day period.

VI. DATA ANALYSIS AND INTERPRETATION:

1. TATA STEEL:

Fig.7.1: Candle Stick Pattern for Tata Steel

Fig.7.2 Bullish Engulfing Pattern in Tata Steel candlestick chart.

Two candlesticks are evident in Fig. 7.2, showing a bullish engulfing pattern in the Tata Steel stock candlestick pattern. The initial candle is a small red candle and is overshadowed by a substantial green candle. Even though the following day commences with a lower opening, the bullish trend propels the price upwards, affirming a decisive win for the buyers. Based on this observation, it is possible to anticipate that the upward trend will continue in the coming years.

2. JINDAL STEEL:

Fig. 7.3. Candle Stick Pattern for Jindal Steel

Fig. 7.4. Bearish Candle Stick Pattern for Jindal Steel.

3. JSW STEEL

Fig.7.5: Candle Stick Pattern for JSW Steel

Fig.7.6: Candle Stick Pattern for JSW Steel

4.) VISA STEEL

The Visa Steel stock candlestick pattern in Fig. 7.8 illustrates the Shooting Star Bearish pattern, which is visible in a candlestick with a short body and a long upper wick. An upward trend has reached its peak. The market typically starts out higher than the previous day, makes some progress, and then suddenly collapses. It signals market dominance by selling pressure. On the basis of this observation, it is possible to anticipate that the negative trend will continue in the next years.

Fig.7.7: Candle Stick Pattern for Visa Steel

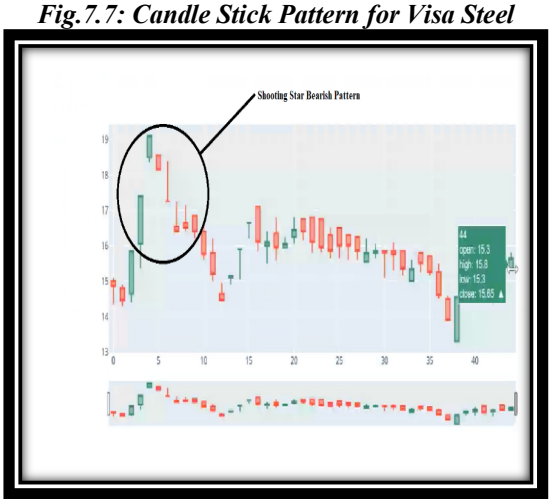

Fig.7.8: Shooting Star Bearish Pattern in Visa Steel candlestick

5.) SAIL

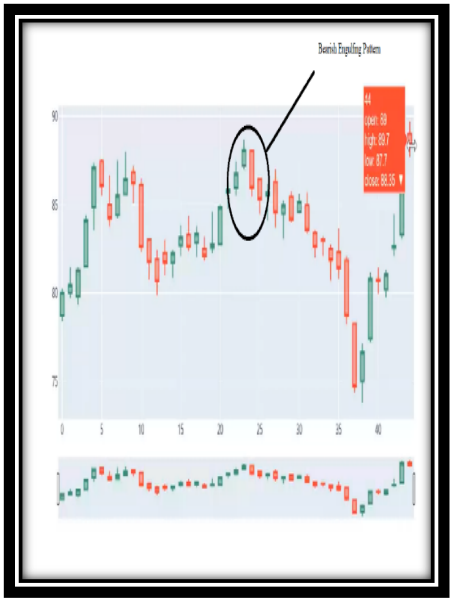

Fig:7.9. Bearish Engulfing Pattern in SAIL Steel candlestick

In Figure 7.9, you can observe a two-candlestick pattern where the initial candle is a compact green candle, entirely engulfed by a substantial red candle for the bearish engulfing pattern of the SAIL Steel stock. At the peak of a rise, it happens. This portends a pause in market expansion and an impending downward trend. The downturn is usually more obvious if the red candle is lower. On the basis of this observation, it is possible to anticipate that the negative trend will continue in the next years.

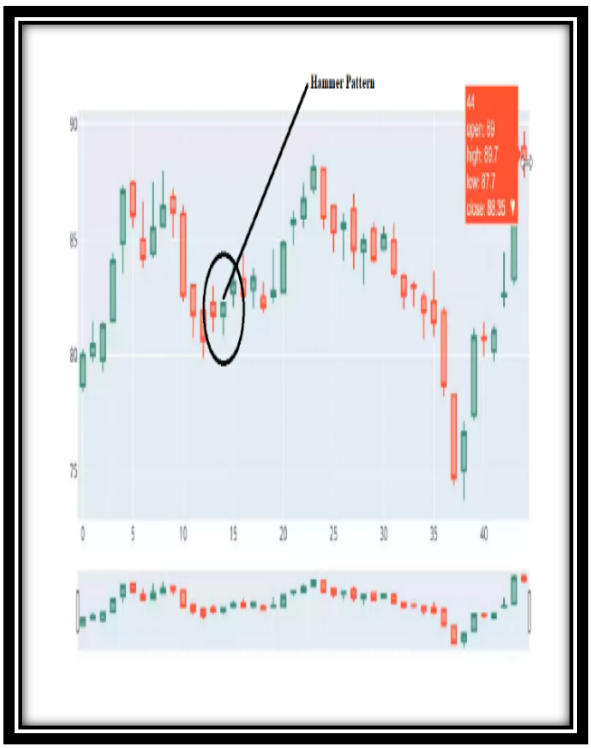

Fig.8.0: Hammer Pattern in SAIL Steel candlestick

At the bottom of the downtrend, in Fig. 20, the candlestick pattern of the SAIL Steel stock exhibits the Hammer pattern as a short body with a lengthy lower wick. The hammer indicates that even though there was selling pressure throughout the day, the price eventually rose again due to significant purchasing pressure. Regardless of body colour, green hammers signal a greater bull market than red hammers do. Based on this observation, it is possible to anticipate that the upward trend will continue in the coming years.

VII. CONCLUSION

India has one of the world's economies that is expanding the quickest. The state of the stock market now solely depends on an investor's trading style. As a result, the need for stock behaviour analysis has

significantly increased. In order to do this, we created a candlestick chart utilising historical EOD data from five steel stocks. We then analysed this chart to find both bullish and bearish patterns. The user will be able to anticipate the future trend of a specific stock with ease if he can identify the aforementioned patterns in the candlestick charts.

VIII. FUTURE SCOPE

In this study, the aforementioned candlestick patterns were manually analysed, however moving forward, we will make use of the TA library and the flask module in the python script to assist us in identifying the pattern that is present in the candlestick chart.

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