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CONTENT

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EFFICIENT AND REAL TIME COMMUNICATION BETWEEN DISABLED AND NORMAL PEOPLE

Sachin Sase, Department of Electronics and Telecommunication, Vidyalankar Institute of Technology, Wadala, Mumbai
Beena Ballal, Department of Electronics and Telecommunication, Vidyalankar Institute of Technology, Wadala, Mumbai

***Abstract*—** Deaf, hard of hearing, and other people with hearing loss utilize sign language, a nonverbal language, to communicate with hearing people. Few people have a working knowledge of sign language. People who are deaf or dumb use sign language as their first language. It is necessary to convert sign language into text or audio and vice versa to provide effective communication between hearing- and speech-impaired individuals and able-bodied individuals. There are several different language translators that have been developed to bridge the gap between them. The suggested system's goal is to translate sign language into audio and audio into sign language for reducing the communication gap between impaired and able-bodied persons and enabling them to communicate effectively with one another. It is a complete two way communication system in which first stage uses CNN to convert an ASL hand gesture into audio, and the second stage uses speech recognition to convert the audio from any language into sign language.

***Keywords*—** *Convolution Neural Network(CNN), American Sign Language(ASL), Indian Sign Language(ISL), Google Text to Speech(gTTS)*

I . INTRODUCTION

We are aware that sign language is the native tongue of the deaf and the dumb. People with disabilities communicate with one another using sign language. It entails the fusion of facial expressions, arm or body motions, and hand motions. People who are deaf or dumb frequently use sign language to communicate, although most people are not familiar with it. This research primarily aims to close this gap and prepare them to function alongside regular people. The major goal is to assist those who have a hearing impairment and are unable to talk. The development of audio to sign language conversion has been far less common than that of sign language to text conversion. This project includes of audio and sign language translation. This project combines a Python-based language translator with sign language to audio and audio to sign language conversion. It identifies sign language gestures when converting sign language to audio. To create the data set, the hand gestures are captured using webcam and pre-processed. Convolution neural network is used to train and test the model, which then makes predictions based on the data set[1]. The identified hand gesture is translated into the appropriate text and audio output.

II. LITERATURE SURVEY

In the paper “Sign Language to Text and Speech Translation in Real Time Using Convolutional Neural Network” by P. Ayush, A. Ojha[1], have built an application for desktop computer which captures a hand gesture in American sign language and convert those signs into text as well as speech.

In the paper “Audio to Sign Language Translation for Deaf People” by H. Ankita, N. Sarika[2], have created system for the deaf people through which they communicate. This system is used for audio to sign language conversion. This system receives input audio and translates into text and then shows appropriate ISL images.

In the paper “Sign Language Translation” by Harini R, Venkatasubramanian[3], have developed computer vision based system which take users sign and instantly translate it into text. This is done

in real time. Using the OpenCV library in python, sign gestures are recorded and processed. To achieve high accuracy prediction, the captured motion is scaled, turned to a greyscale image, and the noise is filtered. Convolution neural networks are used for classification and prediction.

In the paper "Sign Language to Text and Vice Versa Recognition using Computer Vision in Marathi" by S. Amitkumar and K. Ramesh[4], have suggested approach to identify discrete words from the common Marathi sign language that are captured using a camera and they have utilised a vast collection of samples. Taking into account all the alphabets and words used in sign language, the database has 1000 unique gesture images. The suggested approach aims to translate several very fundamental sign language components from sign to text and vice versa.

In the paper "Study of Sign Language Translation using Gesture Recognition" by P. Neha, R. Shrushti, S. Shruti and S. Vrushali[5], hand gesture is captured using webcam and recognized using contour recognition method. The recognized hand gesture is converted into audio output.

In the paper "Indian Sign Language Translator Using Gesture Recognition Algorithm" by B. Purva and K. Vaishali [6], A technique for translating motions made in ISL into English is suggested. Data capture is the first step in the algorithm, followed by pre-processing to track hand movement using a combinational algorithm and recognition using template matching.

In the paper "Sign Language to Speech Translation" by S. Aishwarya, P. Dr. Siba and V. Prof. Saurav[7], suggests combining the usage of Text-to-Speech translator with the use of convolutional neural networks (CNN). The proposed application can recognise the gestures and translate them from text to speech by employing the CNN algorithm.

In the paper "Real Time Sign Language Interpreter" by N. Geethu and S. Arun[8], Utilizing the convex hull method and the template matching algorithm, the system for sign language recognition for deaf and dumb persons is implemented in the ARM CORTEX A8 processor board. The image was captured using a webcam. To achieve communication between hearing and deaf people as well as normal people, this hand sign has been turned to text.

In the paper "Research of a Sign Language Translation System Based on Deep Learning" by H. Siming[9], On the basis of a neural network, common sign language recognition and hand location are examined. According to experimental findings, this method outperforms other well-known ones in terms of recognition rate in a data set which is up to 99%.

In the paper "IoT based Assistive device for deaf, dumb and blind people" by A. Karmel, S. Anushka, P. Muktak and G. Diksha [10], A simple, quick, accurate, and cost-efficient single device solution is developed. The major goal of the technology is to provide persons with disabilities a sense of independence and confidence by seeing, hearing, and speaking for them. Through this study, a new prototype for helping the blind, deaf, and hard of hearing has been developed.

In the paper "Audio to Sign Language Translator Using Python" by J.Sathya Priya, E.Ghanishka, V.Kamal Raj, Mohana Priya, Mrs.B.Sivaranjani[11], Using the speech-to-text API, audio signals are converted to text. Small, medium, and large vocabulary conversions are all included in speech to text conversion. These systems handle or take voice input, which is then converted to the appropriate text.

In the paper " Sign Language Translation Systems for Hearing/Speech Impaired People: A Review" by G. Yuvraj, A. Riya, S. Deepak and G. Prashant[12], has talked about a number of sign language interpreters and recognition methods to overcome the communication gap between able-bodied and impaired individuals.

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III. METHODOLOGY

A. Communication between dumb person and normal person

The hand gestures made by dumb individuals in sign language are translated into audio for effective communication with the normal people.

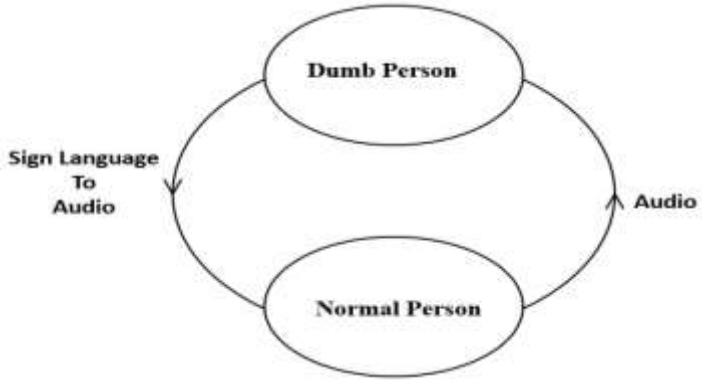

Fig. 1. Communication between dumb person and normal person

B. Communication between deaf person and normal person

The audio from normal people is translated into corresponding hand gesture.

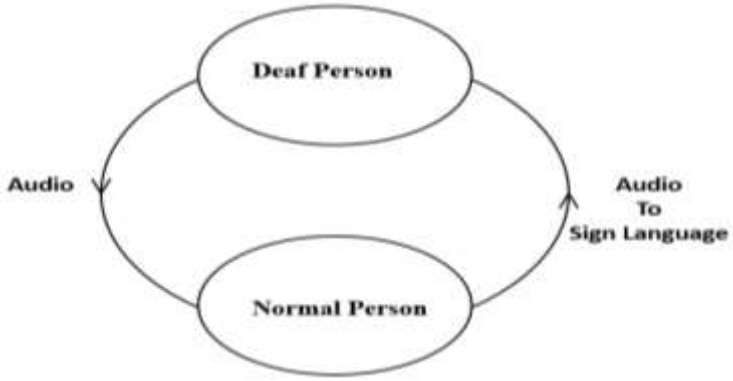

Fig. 2. Communication between deaf person and normal person

IV. SYSTEM DESIGN

A. Sign Language to Audio Conversion

There are 135 styles of sign languages across the globe. A few of them are American sign language, Indian , British, Australian etc[2]. ASL may be a complete linguistic communication that has the identical linguistic properties as spoken languages, with grammar that differs from English. ASL includes movement of the hands and face. In this project American sign language is employed.

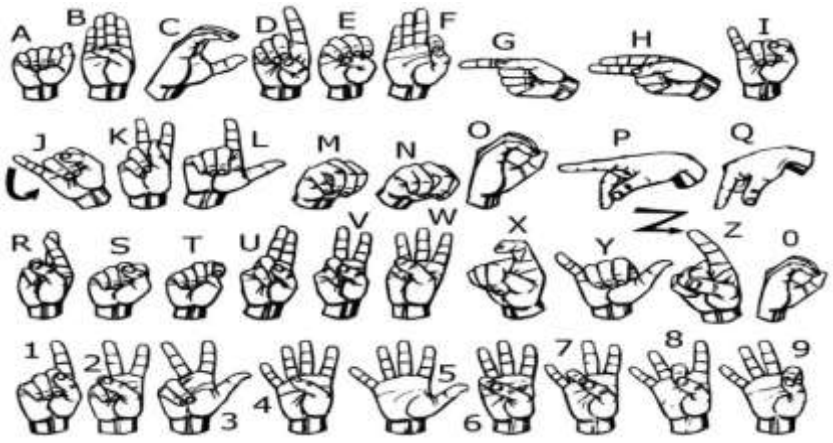

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Fig. 3. American Sign Language

1) Work flow for Sign Language to Audio Conversion

Different steps involved in sign language to audio conversion are shown below.

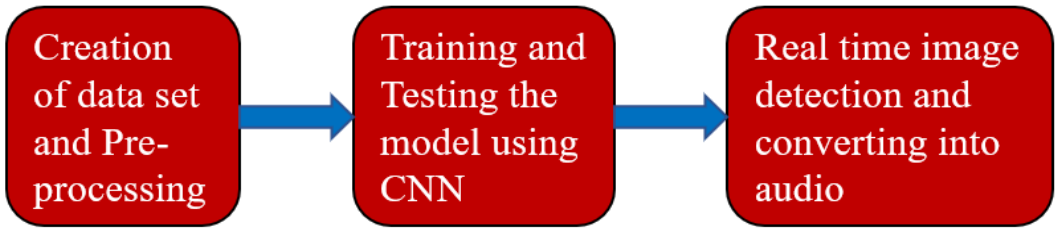

Fig. 4. Steps for Sign Language to Audio Conversion

a) Creation of data set and Pre-processing

Available data set consists of 1200 images for each alphabet and digit each of 50x50 pixels. Each image is converted into grayscale and flipped. To create own dataset thousands of images of each category need to be capture. Captured images are converted into desirable size and pre-processed by applying different filters.

Fig. 5. Image pre-processing

b) Training and Testing the model using CNN

The pre-processed image dataset is created and to get feature map from image , Convolution Neural Network is used. It is also used for image recognition and processing. It is used as image classifier where image is passed through different layers to predict the output.

i. Convolution layer:

This performs convolution operation on image in order to extract some important features. This layer takes the input and apply some filters in order to extract features. Convolution layer performs multiplication of image matrix and filter matrix also called as kernel matrix. The output produced after convolution is dot product of image matrix and kernel matrix.

ii. Pooling layer:

An image which is generated after convolution is not in proper size. It needs to be converted into suitable size without compromising with its features. There are three types of pooling. The maximum value from the specific region is chosen for the Max pooling layer, and the minimum value from the specific region is chosen for the Min pooling layer. Average value is used in average pooling.

iii. Flattening layer:

To feed the classifier, this layer converts a multidimensional matrix into a 1-dimensional array[3].

iv. Activation Function:

It gives a model nonlinearity. Any negative values present in the feature map created after the convolution layer are replaced with zero. There are various activation mechanisms, including sigmoid, tanh, ReLu, and others. The ReLu function is used in this project. It is the activation function that is most frequently utilised. Any negative input is treated as 0, otherwise it is treated as 1. ReLu's

precision is great as a result, and computation is simple[3].

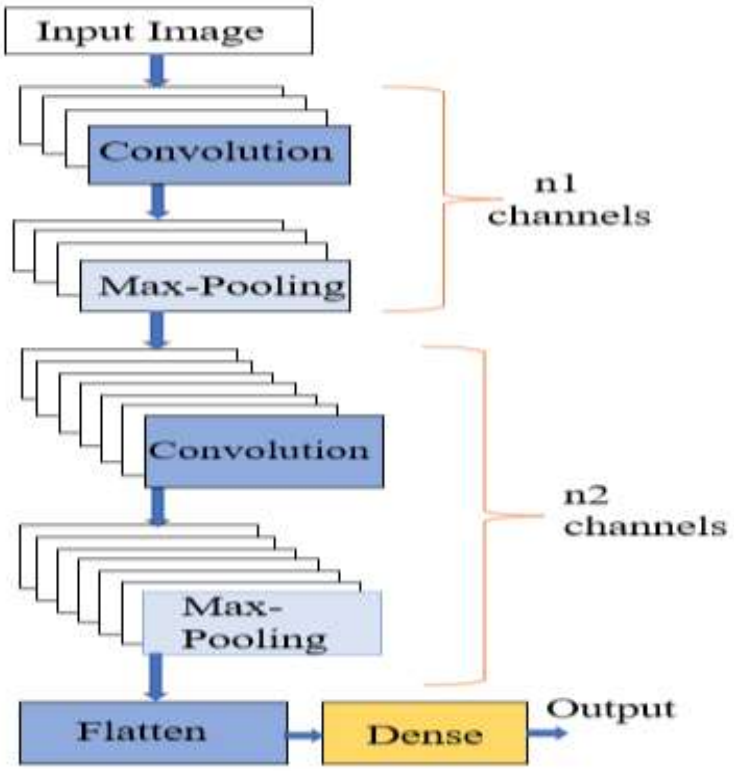

Fig. 6. Convolutional neural network

B. Audio to Sign Language Conversion

In this method audio message is converted into sign language. It takes speech from user and converts into text . This text is then converted into respective American sign language images which are predefined[2].

1) Work flow for Audio to Sign Language Conversion

Speech recognition is a python package used to identify spoken words and coverts them into text. Speech recognition package offers easy audio processing and microphone accessibility. It takes speech as input from microphone, converts it into text and then displays the American Sign Language images.

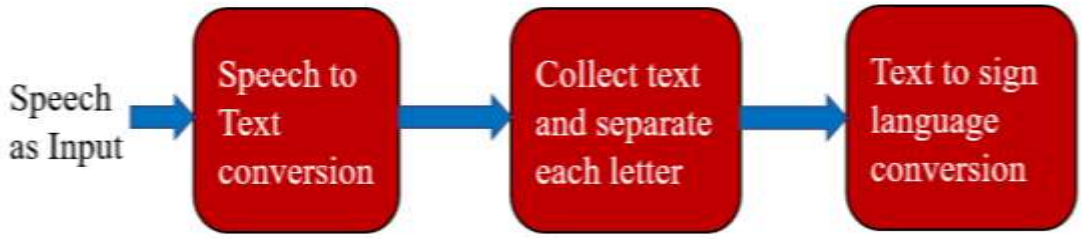

Fig. 7. Steps for Audio to Sign Language Conversion

a) Audio to Text Conversion

It uses the microphone as source for input. A speech is taken as an input from microphone. Then wait for a second to let the recognizer adjust the energy threshold based on the surrounding noise level. Listen method is used to listen for the users input. It employs google recognize method to recognize audio and convert into text which is same as spoken language. Using google translator any language text can be converted into English for further processing.

b) Text to Sign Language

It collects text and separate each letter. The separated letter is checked with predefined database which

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consists of images of all the alphabets. Then based on dictionary, corresponding to each letter sign language image will be displayed.

V. RESULTS

In Sign language to audio conversion, Shown hand gesture is recognized and converted into respective text and audio.

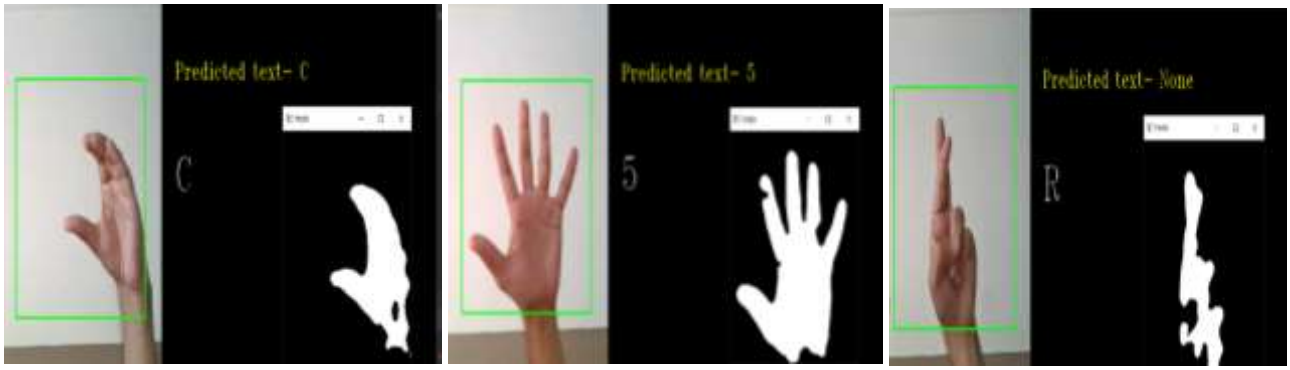

Fig. 8. Sign language to audio conversion results

In Audio to sign language conversion, Audio input is converted into text and with respect to each letter, respective hand gesture is generated.

Fig. 9. Audio to sign language conversion results

VI. CONCLUSION

The disabled people can communicate with normal people using sign language. The proposed system is complete two-way American sign language system which translates hand gesture to audio using CNN and audio to sign language using speech recognition. The system provides an interface that can easily communicate with deaf and dumb people in real time. This system helps all the hearing/speech impaired people in general. This system can translate sign language into audio and vice versa. It provides efficient and real time communication between disabled and normal people using CNN with transfer learning. This project would help them to convey their thoughts in a better and efficient

manner.

VII. REFERENCES

[1] P. Ayush, A. Ojha, Shubham and A. Thakur, "Sign Language to Text and Speech Translation in Real Time Using Convolution Neural Network" in *International Journal of Engineering Research & Technology*, 2020.

[2] H. Ankita, N. Sarika, P. Shefali and A. M, "Audio to Sign Language Translation for Deaf People" *International Journal of Engineering and Innovative Technology (IJEIT)*, vol. 9, no. 10, 2020.

[3] R. Harini, R. Janani, S. Keerthana, S. Madhubala and S. Venkatasubramanian, "Sign Language Translation" in *6th International Conference on Advanced Computing & Communication System(ICACCS)*, 2020.

[4] S. Amitkumar and K. Ramesh, "Sign language to text and vice versa recognition using computer vision in Marathi" in *International Journal of Computer Applications (0975 – 8887) National Conference on Advances in Computing (NCAC 2015)*, 2015.

[5] P. Neha, R. Shrushti, S. Shruti and S. Vrushali, "Study of sign language translation using gesture recognition" *International Journal of Advanced Research in Computer and Communication Engineering* , vol. 4, no. 2, 2015.

[6] B. Purva and K. Vaishali, "Indian Sign Language Translator using Gesture recognition algorithm" in *2015 IEEE International Conference on Computer Graphics, Vision and Information Security (CGVIS)* , 2015.

[7] S. Aishwarya, P. Dr. Siba and V. Prof. Saurav, "Sign Language to Speech Translation" in *11th ICCCNT*, Kharagpur, 2020.

[8] N. Geethu and S. Arun, "Real Time Sign Language Interpreter," in 2017 International Conference on Electrical, Instrumentation and Communication Engineering (ICEICE2017) , 2017.

[9] H. Siming, "Research of a Sign Language Translation System Based on Deep Learning," in *International Conference on Artificial Intelligence and Advanced Manufacturing (AIAM)* , 2019.

[10] A. Karmel, S. Anushka, P. Muktak and G. Diksha, "IoT based Assistive device for deaf,dumb and blind people," in *INTERNATIONAL CONFERENCE ON RECENT TRENDS IN ADVANCED COMPUTING, ICRTAC* , 2019.

[11] J.Sathya Priya, E.Ghanishka, V.Kamal Raj, Mohana Priya, Mrs.B.Sivaranjani “Audio to Sign Language Translator Using Python” International Journal of Scientific Engineering and Applied Science (IJSEAS) – Volume-6, Issue-6, June 2020 ISSN: 2395-3470.

[12] G. Yuvraj, A. Riya, S. Deepak and G. Prashant, "Sign Language Translation Systems for Hearing/Speech Impaired People," in *International conference on innovative practices in technology and management(ICIPTM*, 2021.

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COMPARATIVE ANALYSIS OF FORECASSTING TECHNIQUES FOR ITS EFFECTIVENESS

Sanober Shaikh Assistant Professor TSEC
Dr. G. T. Thampi, Principal TSEC
sanober.shaikh@thadomal.org

Abstract- It is observed that differing problem domains with varying complexity and intrinsic characteristics demonstrate varying learning abilities, when subjected to Deep Learning and Machine Learning processes, it is also resulting in varying learning outcomes with differing algorithms. This paper is trying to have close look at Prediction Models and its effectiveness in many of the functional domain. Depending on the type of input data considered, a model's resulting out of idealization of functional problems with some degree of abstraction, found to results in varying accuracy for the same input data. This paper describes the approach that shall zero in on the best prediction algorithms for different types of domains to achieve faster and better results. Pervasiveness of quantum computing shall make time complexity a non-issue of algorithms and throws up new approaches to formulate these algorithms. We are exploring the futuristic scenarios with quantum computers getting used in businesses and research laboratories working on machine learning techniques with large amount of data for training of neural networks.

Key words-Prediction Techniques, Machine Learning, Deep Learning, idealization, quantum computing, neural networks

1. INTRODUCTION

In today's digital era everyone wants to know beforehand what will happen in the future. That is why researchers are doing prediction in almost all the domains. So correct and accurate prediction is very important. Forecasting is making systematic predictions about the future based on history. Forecasting helps us to analyze current and historical data to predict future demand. A forecast model can be beneficial to all types of domains. When forecasting is accurate, it brings enormous commercial benefits. Businesses that spend time studying their own success as well as the general market are better positioned to predict the changes and adjust when the unexpected occurs. Weather forecasting is one of the critical predictions. Accurate predictions are used to save life and property before the time. In this paper comparison of different machine learning algorithms is studied.

2. LITERATURE SURVEY

The objective of this review of the literature is to locate, assess, and interpret all important research on various prediction techniques, including machine learning, deep learning, quantum machine learning, and quantum deep learning.

2.1 Different types of forecasting techniques

For accurate data prediction, different forecasting techniques such as finding different types of trends, patterns or relationships using data mining, machine learning and deep learning are used. Various problem domains such as stock market, crop yield prediction, weather forecasting, disease outbreak, GDP Growth etc. can be used. Forecasting methods include Logistic Regression (LR), Artificial Neural Network (ANN), Support Vector Machine (SVM), Random Forest (RF), Convolutional Neural Network (CNN), Recurrent Neural Network (RNN), and Auto Regressive Integrated Moving Average (ARIMA) etc. Hybrid modelling integrates different algorithms to achieve better accuracy. Based on the doma in different hybrid models are used.

2.2 Different problem domain which can benefit from forecast

Depending on the model or technique used for forecasting, forecasting systems may be divided into three categories: statistical models, artificial intelligence models, and hybrid models. A mathematical representation of the observed data is referred to as a statistical model and are mostly concerned with linear datasets. Examples of frequently employed statistical models are ARMA, ARIMA, and their variations. These models make use of historical information. AI models can be classified into two categories as Machine learning model and deep learning. Classification, LR, Decision tree, ANN, SVM, CNN, RNN, and LSTM networks are some of the popular AI models utilized for different forecasting applications. These models perform better in forecasting because they are adept at handling nonlinear datasets.

2.2.1 Forecast of weather patterns:

According to Reference [1], weather predictions are created by gathering information about the atmosphere's current condition and applying an understanding of its changing dynamics. To acquire information for weather forecasts, a range of instruments can be utilized, such as barometers, radar, and thermometers. Weather forecasting also requires the use of additional parameters, such as the current and historical weather information, observation of the motion of wind and clouds in the sky, and detection and confirmation of changes in air pressure. Accurate weather prediction is crucial in many commercial sectors. New technologies like IoT and cloud computing have made it possible for weather forecasting to utilize enormous amounts of data. The numerous forecasting models, methods, and approaches employed by various researchers in weather forecasting are described in depth in this study. Random forest is one of the most trustworthy high-dimensional ensemble classifier for data with good accuracy. RNN and LSTM are considered to be among the most effective models for time series prediction.

TABLE-1: COMPARISON OF DIFFERENT PREDICTION ALGORITHM FOR WEATHER PREDICTION

Ref	KN	RF	AN	ML	ML	SV	RN
[2]	√			√			
[3]				√			
[21]		√					
[22]		√			√	√	
[23]			√			√	√
[24]		√					

As discussed in many research papers it is observed that Random Forest [21, 22, 24, 42, 43] and Support Vector Machine [22, 23] are used in many papers as prediction models. The prediction outcomes of the random forest model are more accurate than those of regression models and SVM models. The random forest machine learning model has a strong R2 score and a minimal error value. Apart from these, many hybrid models are used for accurate weather forecasting. The approach suggested by Khashei and Bijari is a hybrid model that mixes the ARIMA and ANN models together and is more efficient as compared to typical standalone models [3]. To improve the effectiveness of forecasting models, hybrid models combine any two models.

2.2.2 Forecast of Agriculture:

According to Karthikeya, K. Sudarshan, and Disha [4], the KNN method is used to estimate agricultural productivity. Humidity, temperature, rainfall, and soil type are significant elements that influence crop variations and predictions regionally.

A precise crop production forecast model, according to authors [12] can assist farmers in choosing what to produce and when. There are several methods for predicting agricultural yields. Predicting crop yields is one of agriculture's most difficult tasks, and various models have been put out and proven thus far. This task calls for the use of several datasets since a variety of variables, including climate, soil, seed type, weather and fertilizer use, have an impact on crop productivity. They found that the technique used in these models most frequently was Artificial Neural Networks, and that the most frequently utilized characteristics were temperature, rainfall, and soil quality. CNN is the most often used deep learning approach, with DNN and LSTM. [12]

TABLE-2: COMPARISON OF DIFFERENT PREDICTION ALGORITHM

Ref	AN	SV	RF	CN	LST	KN
[34]			√			
[35]	√					
[36]			√			
[37]		√	√			
[6]			√			
[5]			√			
[12]				√	√	
[4]						√

Crop production predictions must be accurate in order to develop successful agricultural and food policy at the regional and worldwide levels. Due to its resistance to noise and overfitting, the Random Forest classification approach (machine learning-based classifier), as mentioned by Asli, Oslem, and Okuz outperform a number of tree-based methods because they are immune to noise and overfitting. As many trees as the user desires may be formed using RF, which is also quick and resilient against over-fitting. A dependable strategy to create crop maps with high accuracy for agricultural fields is to use the RF method in conjunction with the parcel-based approach [5].

RF performs better than other methods in forecasting agricultural production across all evaluated geographies and crops [5, 6, 34, 36, and 37]. According to the study's conclusions, an RF algorithm offers a lot of promise as a substitute statistical modelling method for crop production predictions. RF may over fit data in cases where there is a large concentration of training data, while its accuracy may degrade in instances where there is a low concentration of training data [6].

2.2.3 Forecast of outburst of a disease:

Spread of any vector borne disease is due to climatic variability. To forecast the outburst of disease, a variety of forecasting models are employed, including Regression techniques such as Decision Tree, Random Forest, Linear regression, Support Vector Machine etc. As discussed by Seema and Pradnya [7], time series and regression models are compared on nine cities of Maharashtra. Based on the region, accuracy of models will change. The factors considered here are only climatic variations. RMSE, MAE and R2 values are compared for both the models. Decision tree regression yields the lowest RMSE, MAE, and R2 values when compared to other regression techniques. In comparison to other time series forecasting techniques for the Maharashtrian metropolis of Mumbai, the Facebook prophet technique provides the lowest values for RMSE, MAE, and R2. Different combinations of ARIMA models provided the greatest match for the remaining cities.

Three models SVM, SSL and DNN are compared with accuracy, ROC and F1 score parameters. Performance-wise, SSL is the best according to Juhyeon Kim and InsungAhn. The prevalence of infectious illnesses varies for a variety of factors, including climate, living style, population, and more. [8]

Viral disease prediction and time series regression models are important for realizing the transmission of disease and creating efficient policies to address the issue. The basic goal of time-series regression modeling is to systematically compile historical data across time in order to develop the best model that can precisely describe the framework. Since the best time series prediction needs the best fitting model, more caution should be taken while making model adjustments. Auto regressive models like AR, MA, ARMA and SARIMA are among the most often used time series models for predicting infectious outbreaks.

TABLE – 3: COMPARISON OF DIFFERENT PREDICTION ALGORITHM FOR OUTBRST OF DISEASE

Refer	DN	KN	RF	LST	AN	SVM	DN	ARIM
[7]								√
[8]	√					√	√	
[25		√	√	√				
[26			√		√	√		
[27					√			
[28						√		

According to the findings, a hybrid strategy is more accurate in forecasting disease outbreaks.A hybrid model CNN-LSTM was suggested to estimate the number of verified COVID-19 cases using a time-series dataset [29]. The ARIMA and the GRNN model performed better at predicting hepatitis incidence in Heng [30].

It has been found that the random-forest time series model outperforms the SVM and ANN. SVM's accuracy is superior to that of RF and ANN [44].

2.2.4 Prediction Algorithm for Stock Market:

As discussed by Almira and Azra [11] Monte Carlo and ARIMA are used to predict the Stock prices. For short time prediction ARIMA model is more accurate than Monte Carlo and for longer time duration Monte Carlo gives better results.

TABLE- 4:
COMPARISON OF DIFFERENT PREDICTION ALGORITHM FOR STOCK MARKET

Reference	ANN	SVM	RF	CNN	RNN	ARIMA	Monte Carl
[14]			√				
[15]	√			√			
[16]		√					
[17]	√				√	√	
[11]						√	√

[18]	√		√				
[19]		√	√				

As referred to in the paper [32] a hybrid model consisting of the prediction rule ensembles (PRE) and deep neural network (DNN) was used for prediction the stock prices. As discussed in [45] SVM gives highest accuracy in comparison with RF and ANN.

2.2.5 Prediction algorithm in Quantum Computing:

In essence, quantum computing is employed to accelerate the algorithm. So the enormous data set's training time can be shortened as a result. The traditional computer will take a long time to produce the output if there are many factors involved in the input data set or if the data is made up of random variables and is very vast. So at this time Quantum Computing prediction algorithms can be used to do early or on time prediction.

Monte Carlo techniques are used to simulate the likelihood of various outcomes when random variables are involved. These models can be computationally expensive to operate. The result of Monte Carlo on a classical computer takes a lot of time. By that time the simulation's findings might not be relevant. The new technique from CQC (Cambridge Quantum Computing) tried to use quantum computing to simulate more random variables, increasing the scope and precision of predictions. It does this by employing a hybrid strategy in which some of the simulation is run on traditional computing systems and some of it is done on quantum computers.[38]

Authors in [39] have proposed a new hybrid approach for finance related forecasting which consists of deep quantum and deep classical neural networks. Deep classical neural networks serve as a measuring tool to derive security pricing from anticipated quantum density matrices, together with a deep quantum neural network for quantum prediction. In terms of the number of hidden layers, the deep quantum network is computationally tractable and uses a novel quantization approach for financial time series.

Scheme proposed in [40] is verified by predicting the closing prices on the stock market. Research on QNN is still in its theoretical stages right now.

Using simulated data generated by a supervised quantum machine learning model in [41], Rigetti used a hybrid quantum approach which adds a quantum convolutional layer in place of one layer of the OPC (Offshore Precipitation Capability) traditional neural network and enhanced the model's capacity to forecast bad weather.

CONCLUSION

Depending on the research problem and goals either descriptive or predictive model can be used. To make inferences from the collected data and provide a description of what occurred, descriptive models are utilized. Future forecasts are made using predictive models. To solve the issue at hand, it is essential to choose the appropriate algorithms, and both the algorithms and the supporting platforms must be able to handle the volume of data. For the same input data, various machine learning algorithms yield different results. Data input and different parameters determine which algorithm is the best in each given field.

REFERENCES:

[1] K.U. JaseenaBinsu C. Kovoor (2020) “Deterministic weather forecasting models based on intelligent predictors: A survey”, Journal of King Saud University – Computer and Information Sciences.

[2] Ramesh Medar, Prashant Y. Niranjan, Akshata B. Angadi, Pushpa Tamase (2017),” Comparative Study of Different Weather Forecasting Models”, International Conference on Energy, Communication, Data Analytics and Soft Computing

[3] Khashei, M. and Bijari, M., 2011. A new hybrid methodology for nonlinear time series forecasting. Modeling and Simulation in Engineering", 2011, International Journal of Innovative Science and Research Technology
[4] H. K. Karthikeya, K. Sudarshan, Disha S. Shetty (2020)," Prediction of Agricultural Crops.
[5] Asli Ozdarici Ok, Ozlem Akar and Oguz Gungor (2012), "Evaluation of random forest method for agricultural crop classification", European journal of remote sensing.
[6] Jig Han Jeong, Jonathan P. Resop, Nathaniel D. Mueller, David H. Fleisher, Kyungdahm Yun, Ethan E. Butler, Dennis J. Timlin, Kyo-Moon Shim, James S. Gerber, Vangimalla R. Reddy, Soo-Hyung Kim (2016), "Random Forests for Global and Regional Crop Yield Predictions", PLOS ONE.
[7] Seema Patil, Sahrnil Pandya (2021), "Forecasting Dengue Hotspots Associated With Variation in Meteorological Parameters Using Regression and Time Series Models",Frontiers in public health.
[8] Juhyeon Kim & InsungAhn (2021), "Infectious disease outbreak prediction using media articles with machine learning models", Scientific reports.
[9]Atefeh Sadat Mirarabshahi1, Mehrdad Kargari (2021), "A Disease Outbreak Prediction Model Using Bayesian Inference: A Case of Influenza", International journal of Travel Medicine and Public Health.[10] SubhashKumar Yadav, Yusuf Akhtar, "Statistical Modeling for the Prediction of Infectious Disease Dissemination With Special Reference to COVID-19 Spread".
[11] Almira Arnaut, Azra Zaimović, Nedžmija Turbo (2017), "Effectiveness Of Monte Carlo Simulation And Arima Model In Predicting Stock Prices", International Scientific Conference Economy of Integration.
[12]Thomas van Klompenburg, Ayalew Kassahun, Cagatay Catal (2020),"Crop yield prediction using machine learning:A systematic literature review", Elsevier, Journal of Computer and Electronics in Agriculture.
[13]Dhiraj Dahiwade, Prof. Gajanan Patle, Prof. Ektaa Meshram (2019),"Designing Disease Prediction Model Using Machine Learning Approach",Proceedings of the Third International Conference on Computing Methodologies and Communication.
[14]Minna Castoe (2020),"A Detailed Study of Client-Server and its Architecture", A project report.
[15] Somenath Mukherjee,Bikash Sadhukhan,Nairita Sarkar,Debajyoti Roy,Soumil De, " Stock market prediction using deep learning algorithms", CAAI Transactions on Intelligence Technology
[16] Hakob Grigoryan(2017),"Stock Market Trend Prediction Using Support Vector Machines and Variable Selection Methods", Advances in Intelligent Systems Research (AISR), volume 141 International Conference on Applied Mathematics, Modelling and Statistics Application.
[17] Subba Rao Polamuri, Kudipudi Srinivas, A. Krishna Mohan, " A Survey on Stock Market Prediction Using Machine Learning Techniques", Proceedings of the 1st International Conference on Data Science, Machine Learning and Applications, Springer Link
[18] Mehar Vijha , Deeksha Chandolab, Vinay Anand Tikkiwalb, Arun Kumar (2019)," Stock Closing Price Prediction using Machine Learning Techniques", International Conference on Computational Intelligence and Data Science
[19] K. Hiba Sadia, Aditya Sharma, Adarrsh Paul, SarmisthaPadhi, Saurav Sanyal (2019) ,"Stock Market Prediction Using Machine Learning Algorithms",International Journal of Engineering and Advanced Technology (IJEAT).
[20]S. Nagadevi, Varun Ramesh, Helloween James (2020),"Weather ForecastingUsing Machine Learning Algorithm",International Journal of Psychosocial Rehabilitation.
[21] Singh, N., Chaturvedi, S., & Akhter, S. (2019), "Weather Forecasting Using Machine Learning Algorithm. 2019", International Conference on Signal Processing and Communication (ICSC).
[22]A H M Jakaria, Md Mosharaf Hossain, Mohammad Ashiqur Rahman (2018),"Smart Weather Forecasting Using Machine Learning: A Case Study in Tennessee".

[23]Siddharth Singh, Mayank Kaushik, Ambuj Gupta, Anil Kumar Malviya (2019),"Weather Forecasting Using Machine Learning Techniques",Proceedings of 2nd International Conference on Advanced Computing and Software Engineering (ICACSE)
[24]Rajasekaran Meenal, Prawin Angel Michael, D. Pamela, Ekambaram Rajasekaran(2021), " Weather prediction using random forest machine learning model", Indonesian Journal of Electrical Engineering and Computer Science.
[25] Jia W., Li X., Tan K., Xie G. 2019, , "Predicting the outbreak of the hand-foot-mouth diseases in China using recurrent neural network", IEEE International Conference on Healthcare Informatics (ICHI).
[26] Tapak L., Hamidi O., Fathian M., Karami M.,"Comparative evaluation of time series models for predicting influenza outbreaks: application of influenza-like illness data from sentinel sites of healthcare centers in Iran". *BMC Res. Notes.* 2019.
[27] Nimai Chand Das Adhikari, Arpana Alka, Vamshi Kumar Kurva, Suhas S, Hitesh Nayak, Kumar Rishav, Ashish Kumar Nayak, Sankalp Kumar Nayak, Vaisakh Shaj, Karthikeyan, Srikant Nayak (2018) ," Epidemic Outbreak Prediction Using Artificial Intelligence", International Journal of Computer Science & Information Technology (IJCSIT).
[28] Agranee Jha, Sanchit Vartak, Kavya Nair, Anil Hingmire (2021)"Malaria Outbreak Prediction using Machine Learning", IJERT.
[29] Zuhaira M. Zain and Nazik M. Alturki," COVID-19 Pandemic Forecasting Using CNN-LSTM: A Hybrid Approach".
[30] Wei W., Jiang J., Liang H., Gao L., Liang B., Huang J., Zang N., Liao Y., Yu J., Lai J., Qin F., Su J., Ye L., Chen H (2016), "Application of a combined model with autoregressive integrated moving average (arima) and generalized regression neural network (grnn) in forecasting hepatitis incidence in heng county, China". PLoS ONE.
[31]Tanzila Saba, Amjad Rehman, Jarallah S. AlGhamdi (2017), "Weather forecasting based on hybrid neural model".
[32] Srivinay, B. C. Manujakshi, Mohan Govindsa Kabadi and Nagaraj Naik (2022),"A Hybrid Stock Price Prediction Model Based on PRE and Deep Neural Network", open access article, MDPI.
[33] S. Sarvesh; R. V. Sidharth; V. Vaishnav; J Thangakumar; S Sathyalakshmi," A Hybrid Model for Stock Price Prediction using Machine Learning Techniques with CNN
[34]Phusanisa Charoen-Ung and Pradit Mittrapiyanuruk (2018), "Sugarcane Yield Grade Prediction Using Random Forest with Forward Feature Selection and Hyper-parameter Tuning", Part of the Advances in Intelligent Systems and Computing book series.
[35] Dr. T. Venkat Narayana Rao, S. Manasa (2019), "Artificial Neural Networks for Soil Quality and Crop Yield Prediction using Machine Learning".
[36] Patrick Filippi, Edward J. Jones, Niranjan S. Wimalathunge, Pallegedara D. S. N. Somarathna, Liana E. Pozza, Sabastine U. Ugbaje, Thomas G. Jephcott, Stacey E. Paterson, Brett M. Whelan & Thomas F. A. Bishop (2019),"An approach to forecast grain crop yield using multi-layered, multi-farm data sets and machine learning" SpringerLink.
[37] Xiangying Xu, Ping Gao, Xinkai Zh (2019), Design of an integrated climatic assessment indicator (ICAI) for wheat production: A case study in Jiangsu Province, China.
[38] "Algorithm Speeds Monte Carlo Predictions on Quantum Computers (2021)", Blog on Software Development.
[39] EricPaquet, FarzanSoleymani (2022), "QuantumLeap: Hybrid quantum neural network for financial predictions", Elsevier, Expert Systems with Applications.
[40] GeLiu, WenpingMa (2022), "A quantum artificial neural network for stock closing price prediction", Elsevier, Information Sciences.
[41]"https://www.globenewswire.com/news-release/2021/12/01/2344216/0/en/Rigetti-Enhances-Predictive-Weather-Modeling-with-Quantum-Machine-Learning.html", Global newswire by notified

[42] S. Dhamodaran, Ch. Krishna Chaitanya Varma & Chittepu Dwarakanath Reddy, "Weather Prediction Model Using Random Forest Algorithm and GIS Data Model", International Conference on Innovative Data Communication Technologies and Application, ICIDCA 2019: January 2020
[43] R. Meenal, Prawin Angel Michael, D. Pamela, E. Rajasekaran, "Weather prediction using random forest machine learning model", Indonesia journal of electrical engineering and computer science
[44] Leili Tapak, Omid Hamidi2, Mohsen Fathian and Manoochehr Karami (2019),"Comparative evaluation of time series models for predicting influenza outbreaks: application of influenza-like illness data from sentinel sites of healthcare centers in Iran".
[45]Gustav Gerholm, Adam Linderberg (2021), "Comparison of machine learning models for market predictions with different time horizons", Degree project, first cycle,

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SPLICED IMAGE FORGERY DETECTION USING FSM

Shantanu Tondlekar, Sherin Thomas, Ryan Marian, Tejas Jagdale and Anand Pardeshi,
Department of Information Technology, Fr. C. Rodrigues Institute of Technology, Vashi, Navi Mumbai, India

Abstract: In recent times, determining an image is authenticate or fabricated is big challenge. With advancement in technology an image can be tampered or forged within seconds. Detecting these kinds of forgeries has become significant issue at present. An image can be considered as important evidence but if it is forged it will be of no use. It is necessary to develop methods for differentiating between computer-generated photos and altered ones. With the view of detecting these forgeries we are going to develop Image Forgery Detection Model which will consist of RRU-Net along with FSM. RRU-Net which stands for Ringed Residual Structure and Network Architecture combines two different methodologies namely residual propagation and the residual feedback. FSM stands for Feature Similarity Module will be used to detect long-range dependencies. Combining FSM with RRU-Net to increase accuracy is our proposed system and from image patches of varying sizes, we will extract the differences in the image's attributes between unmodified and modified sections. After detecting the forged area, the final region will be displayed in coloured form. In future, the system will be helpful to detect various spliced image forgeries that surface on the various social media platforms.

Keywords: RU-Net, residual propagation, residual feedback, spliced image.

I. INTRODUCTION

In many applications, digital images are considered as an important data. It can be used as proof in a variety of settings, including courts, the military, computer-assisted medical diagnosis systems, social networks, and more. It is necessary to ensure the authenticity of an image and to keep their contents tamper free based on their importance. Digital photos can be easily manipulated by users and regular people utilising online computer programs. This results in the difficult detection of these fake images by the eye. It is very much required to examine whether two types of images are genuine or fabricated because of many fraud tools being available. To put it differently, it is important to have methods for spotting fraudulent photographs.

The main approaches of discovering an image forgery are broadly classified into two types namely active and passive approach [1], as shown in Fig. 1. The fundamental component of the active technique is adding watermarks and digital signatures to photos as they are being created. The passive method allows us to conceal key image details and transform accurate information into inaccurate information. Five categories can be used to classify digital image forgery: Image splicing, retouching, morphing, and enhancement, as well as copy-move forgery.

In splicing forgery technique, two or more images are digitally spliced into a single composite image. For example, consider two images (Figures 2 and 3), both images are spliced together to form a single composite image (Figure 4). When observed carefully, the border between the spliced areas is very difficult to be noticed by the naked eyes.

Based on the particular image property that has been utilised, existing image splicing forgery detection techniques can be divided into four types: detection methods based on the hash techniques [2], compression property [3], device property [4] and essential image property [5].

The above-mentioned methods are focused on a specific image property, and therefore in real-world applications, have the following limitations: 1) The hash technique based detection method cannot be categorised as a sort of blind forgery detection because this method depends on the hash of the original, un-tampered image. 2) Only JPEG format image forgery can be detected by the

detection method based on the image compression property. 3) If some obscure techniques, such as fuzzy operations, are used after splicing then the detection methods based on the essential image properties may fail. 4) Finally, detection techniques based on the imaging device property becomes invalid if the device noise intensity is low.

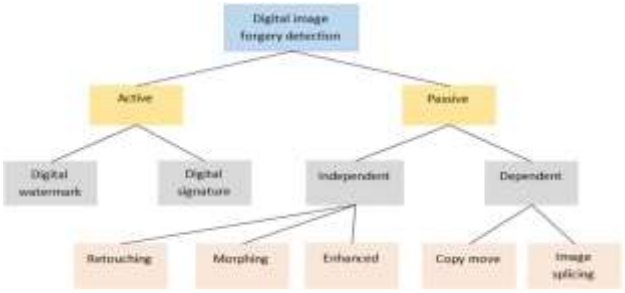

Fig. 1: Type of digital image forgery detection.

Fig. 2: Original Img 1

Fig. 3: Original Img 2

Fig. 4: Spliced Image

II. RELATED WORK

The majority of splicing forgery detection methods are passive. i.e they are not dependent on any kind of prior information of the image[6]. DCT coefficients, minimum and maximum filter methods were utilised by Alahmadi et al. [7] and Min and Dong [8]to extract characteristics from image blocks and identify splicing forgery. Many algorithms use multiresolution methods like DWT [8]. However, Block matching is not the only method used to detect splicing forgeries; SIFT characteristics are also employed as an alternative[9]. On the CASIA v2.0 and CASIA v1.0 datasets, the Columbia Color DVMM dataset, and the majority of the splicing forgery detection algorithms are assessed. The method for detecting image splicing proposed by Ng et al. is based on 3D moments of the image spectrum [10]. For the purpose of detecting picture splicing, Shi et al. [11] utilised DCT coefficients, 1D and 2D moments and Markov chain probabilities. The algorithm's accuracy was assessed using the CASIA v2.0 dataset and is reported to be 84.86%.

With the recent advancements in omnipresent computing and digital media, particularly digital images, the task of detecting image fraud has elevated to become one of the most crucial for the safe and genuine transfer of multimedia information. DCT and LBP characteristics were employed by Alahmadi et al. [12] to detect picture splicing. Pham et al. [13] identified Markov characteristics to spot splicing-related anomalies in pictures. SVM was employed to classify data. Fractional entropy was derived from DWT [15] coefficients by Jalab et al. [14], and SVM was utilised for classification.

A unique tampering detection method based on maximum and minimum filter was created by Min and Dong in [8]. The combination of a maximum filter and a minimum filter draws attention to the minimal and maximum pixel differences between genuine and fake images. The efficacy of the forgery detection system in composite regions was enhanced by the examination of interpolation and non-interpolation. For the purpose of detecting picture splicing, Jinwei et al. recently developed a unique deep learning method in [16].

III. PROPOSED METHODOLOGY

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Fig. 5 depicts the conceptual layout of the anticipated splice forgery detection method. To detect suspicious forging areas in the host image using the proposed technique, RRU-Net[17], a specially created U-Net, provides a hierarchical progression from residual propagation and the residual feedback. Feature Similarity Module (FSM) sits between encoder and decoder layer ofthe RRU-Net. The encoder layer feeds the encoder output to the FSM, which then helps in extracting the long-range spatial contextual information. This helps the model on focusing more on the forged region ignoring rest of the non-essential parts of the image. The decoder layer takes the FSM output and process it to detect the final forged region. The forged region is highlighted in the final output. The projected RRU-N ıd D, respectively.

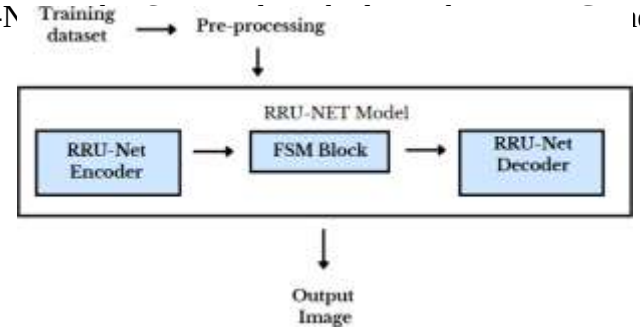

Fig. 5: System Design of Proposed Spliced Image Forgery Detection System.

A. *Residual Propagation*

The differences of the intrinsic nature of image attributes are the notable basis for locating spliced image forgery, nevertheless, the gradient degradation problem destroys the basis as the network architecture goes deeper. In order to solve this gradient degradation issue, the RRU-Net adds the residual propagation layer to each stacked layer. A building block of residualpropagation is defined as:

$$y_f = F(x, \{W_i\}) + W_s * x, \quad (1)$$

where, x and yf represents the input and output of the building block, Wi is the weight of layer i, the function F(x, Wi) means the residual mapping to be learned. The residual propagation imitates the recall mechanism of the human brain. A human brain may forget the preceding knowledge when it learns various additional new knowledge, so it needs the recall mechanismto help arouse those preceding fuzzy memories.

B. *Residual Feedback*

The residual feedback is used in RRU-Net to enhance the differences of intrinsic nature of image attributes. It is an automatic learning mechanism. It does not focus on one or many specific images attributes. The residual feedback mechanism pays more attention to the discriminating features if input information. It uses sigmoid activation function on input information to augment differences of intrinsic nature of image attributes between forged and un-forged areas. The residual feedback in a buildingblock is defined as

$$y_b = (s(G(y_f)) + 1 * x \quad (2)$$

where x represents input, yf is the results of residual propagation defined in Eq.(1), yb is the enhanced input. The functionG represents linear projection, which changes the dimensions of yf. The sigmoid activation function is represented by s. In variance to recall mechanism that residual propagation imitates, the residual feedback behaves as the human brain consolidation mechanism. The residual feedback can augment the differences of intrinsic nature of image attributes between the forged and un-forged areas.

[

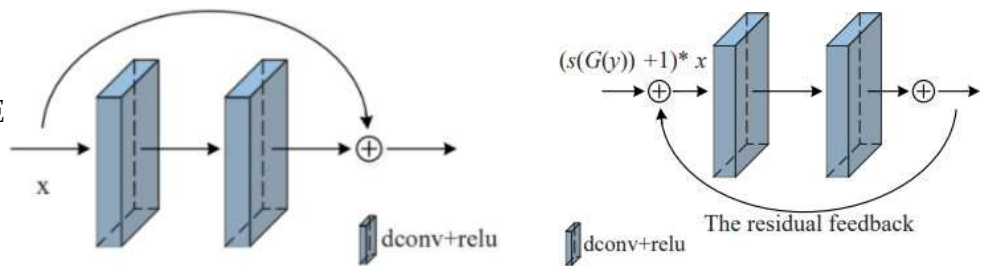

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Fig. 6: Residual propagation. Fig. 7: Residual feedback.

C. Ringed Residual Structure and Network Architecture

The ringed residual structure that blends the residual propagation and the residual feedback. The residual propagation imitates the recall mechanism of the human brain, which recollects the input feature information to resolve the degradation problem in the deeper network; the residual feedback amplifies the input feature information by consolidating the intrinsic nature of image attributes between the forged and un-forged areas. To conclude, the ringed residual structure assures the differentiating intrinsic nature of image attributes be clearer when the features are drawn from the layers of network, which results in achieving stable and better recognition performance than traditional feature extraction-based recognition techniques and current CNN-based recognition techniques. Fig. 8 represents the RRU-Net network architecture, it is an end-to-end intrinsic nature of image attribute segmentation network, which is capable of detecting the splicing image forgery without the need of any pre-processing and post-processing.

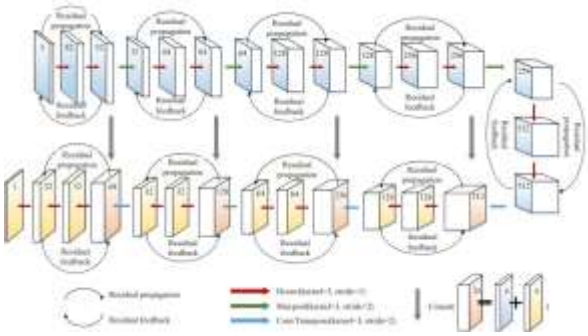

Fig. 8: Architecture of RRU-Net.

D. Feature Similarity Module (FSM)

Feature Similarity Module (also called as FSM) can be used to extract long range dependencies. FSM facilitates us with extraction of dense contextual information in a more effective way, which can improve segmentation. FSM is used between the encoder and decoder layer of RRU-Net which can help in better extraction of spatial information. This module draws a variety of position-sensitive spatial information and encodes it into feature maps. FSM can be easily plugged into other fully convolutional neural networks which can result in various applications that can perform different tasks.

This module basically removes irrelevant features from the feature map that is fed to the convolution layer. Then it defines the relationship between two different values of the feature maps. It defines the impact of one value of feature map on other value.

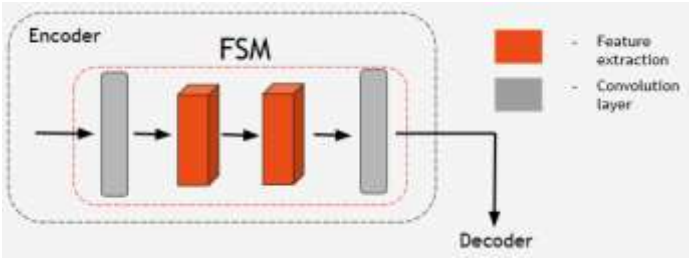

Fig. 9: Architecture of FSM.

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IV. WORK FLOW

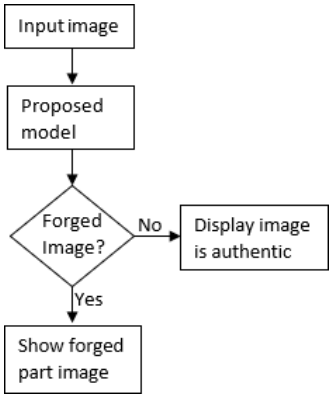

Fig. 10: Flowchart of the proposed system.

V. RESULTS

We have trained the model with a limited dataset of 184 images. With such a limited dataset also we are able to get some fineresults with clear highlighted forged parts.

Fig. 11: Output 1.

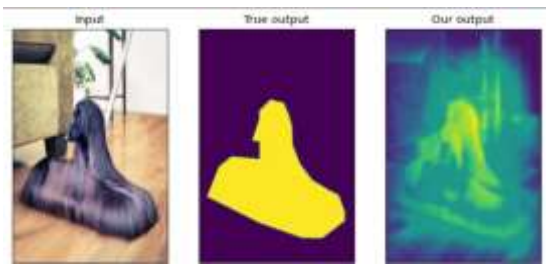

Fig. 12: Output 2.

Fig. 13: Output 3.

Fig. 14: Output 4.

VI. CONCLUSION

The suggested technique makes use of RRU-Net with FSM to acquire the anticipated outcomes and identify the final found tampered locations in the image. The RRU-Net in use is a ringed residual structure that blends the residual propagation and the residual feedback. The RRU-Net uses FSM to further improve the results based on the detection outcomes. The effectiveness and applicability of the suggested method will next be examined on the two publicly available datasets CASIA and FORENSICS and compared with other cutting-edge detection techniques to identify image counterfeiting.

REFERENCES

[1] S. Velmurugan, T. Subashini, and M. Prashanth, “Dissecting the literature for studying various approaches to copy move forgery detection,” Int. J. Adv. Sci. Technol., vol. 29, pp. 6416–6438, Jun. 2020.

[2] P. Xunyu, “Digital image forensics with statistical analysis,” Handbook Of Digital Forensics of Multimedia Data and Devices, John Wiley & Sons, NJ, USA, 2015.

[3] Micah K. Johnson and Hany Farid. Exposing digital forgeries in complex lighting environments. IEEE Transactions on Information Forensics and Security, 2(3):450–461, 2007
[4] Hongmei Gou, Ashwin Swaminathan, and Min Wu. Noise features for image tampering detection and steganalysis. In ICIP (6), pages 97–100. Citeseer, 2007.
[5] Wen Chen, Yun Q Shi, and Wei Su. Image splicing detection using 2- d phase congruency and statistical moments of characteristic function. In Security, Steganography, and Watermarking of Multimedia Contents IX, volume 6505, page 65050R. International Society for Optics and Photonics, 2007.
[6] G. Muhammad, M. H. A. Hammadi, M. Hussain, and G. Bebis, "Image forgery detection using steerable pyramid transform and local binary pattern," Machine Vision and Applications, vol. 25, no. 4, pp. 985–995, 2014.
[7] A. A. Alahmadi, M. Hussain, H. Aboalsamh, G. Muhammad, and G. Bebis, "Splicing image forgery detection based on DCT and Local Binary Pattern," in Proceedings of the IEEE Global Conference on Signal and Information Processing, pp. 253–256, Austin, TX, USA, September 2013.
[8] G. H. Min and H. H. Dong, "Identification method for digital image forgery and filtering region through interpolation," Journal of Forensic Sciences, vol. 59, no. 5, pp. 1372–1385, 2014.
[9] A. Costanzo, I. Amerini, R. Caldelli, and M. Barni, "Forensic analysis of SIFT keypoint removal and injection," IEEE Transactions on Information Forensics and Security, vol. 9, no. 9, pp. 1450–1464, 2014.
[10] T. T. Ng, S. F. Chang, and Q. Sun, "Blind detection of photomontage using higher order statistics," in Proceedings of the international symposium on circuits and systems, pp. 688–691, Vancouver, Canada.
[11] Y. Q. Shi, C. Chen, and W. Chen, "A natural image model approach to splicing detection," in Proceedings of the 9th ACM Workshop on Multimedia & Security, pp. 51–62, Dallas, Texas.
[12] A. Alahmadi, M. Hussain, H. Aboalsamh, G. Muhammad, G. Bebis, and H. Mathkour, "Passive detection of image forgery using DCT and local binary pattern," Signal, Image and Video Processing, vol. 11, no. 1, pp. 81–88, 2017.
[13] N. T. Pham, J. Lee, G. Kwon, and C. Park, "Efficient image splicing detection algorithm based on markov features," Multimedia Tools and Applications, vol. 78, no. 9, Article ID 12405, 2019.
[14] H. Jalab, T. Subramaniam, R. Ibrahim, H. Kahtan, and N. Noor, "New texture descriptor based on modified fractional entropy for digital image splicing forgery detection," Entropy, vol. 21, no. 4, pp. 371–385, 2019.
[15] R. C. Gonzalez and R. E. Woods, in Digital image processing, vol. 4, Addison-Wesley, MA, USA, 1992.
[16] W. Jinwei, N. Qiye, L. Guangjie, L. Xiangyang, and K. J. Sunil, "Image splicing detection based on convolutional neural network with weight combination strategy," Journal Information Security and Applications, vol. 54, pp. 1–8, 2020.
[17] Yang Wei, Xiuli Bi, and Bin Xiao. RRU-Net: The Ringed Residual U-Net for Image Splicing Forgery Detection. IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshop, 2019.

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NEUTRINOS; DETECTION, SOURCES AND THEIR FLUXES.

Dr. Abhilasha Saini, Asst. Prof. Atharva College Of Engg., Mumbai.
Dr. Sudhir Bhardwaj, Asst. Prof. Bikaner Tecnical University, Bikaner.
Dr. P.N.Nemade, Prof. Atharva College Of Engg.,Mumbai .

Abstract— This paper is presenting a brief, about the hypothetical assumptions and the prediction of neutrino generation in various nuclear level phenomena. The investigational picture of various neutrino flavours, during different nuclear-reactions and decays, is also depicted. Detailed information about the multiple sources of neutrino's creation; such as astrophysical neutrinos, geo-neutrinos, cosmological source and man-made sources is also provided. The paper is a trial, to confer a brief theoretical description of the naturally generated neutrinos and the processes involved. Further the necessary information, about the practical investigations, for the man-made facilities operated at elevated energy magnitudes for neutrino's generation; such as accelerators at Brookhaven National Laboratory or CERN and reactors are presented.

Keywords— *Neutrino generation; CERN; astrophysical neutrinos; cosmological source.*

I. INTRODUCTION

The neutrino particle's inceptive proposal was delineated by Pauli in 1930 and it was introduced as an uncharged, feeble in interactivity, spin half particle [1]. The neutrino was hypothetically imagined, as to untangle the indelible issues in regards with the continual energy-spectrum of electrons, during the degradation process of β particles (disobey of energy-momentum conservation) in nuclear physics. Later to the speculations, made about the neutrinos, the nuclear process of Beta degradation was investigated on the basis of theory by Fermi [2, 3, and 4] and Perrin [5]. Fermi suggested the "four fermion current-current type point interaction" having the interactivity magnitude i.e. the coupling constant GF for illustrating the pace & complete profile of beta-degradation process. He contemplated the interactivity-currents being vector and analogically ensuing the quantum electrodynamics (QED).

Investigational outcomes for the shaping of beta-spectrum, via miscellaneous beta degradation nuclear processes revealed about neutrino-mass, that it should be too low comparative to the electronic mass. Bethe and Peierls [6] made the first theoretical investigations, for total scattering-cross-section on ($\underline{\upsilon} + p \rightarrow n + e^{+}$) reaction and interactivity magnitude used as GF governed from nuclear beta-degradations. They established that, the studied cross-section value was excessively small-scale being investigated, except if the neutrino-flux magnitude or the detector's material's mass are raised to high values.

Therefore, the later advancements regarding the investigations of neutrinos were delayed. But Reines & Cowan in 1956 [7, 8] eventually established this hypothesis along with investigational outcomes. From there till now, there is a successful progression in developmental aspects of physics of neutrino-particles.

Further progressive theories and experimentations on neutrinos suggested that

- Neutrinos are supposed to have triple flavours i.e. $\underline{\upsilon_e}(\upsilon_e)$, $\underline{\upsilon_\mu}(\upsilon_\mu)$, $\underline{\upsilon_\tau}(\upsilon_\tau)$ and are too minuscule. There categorization is made as per respective lepton flavor like i.e. Lj (for j = electron, Muon, taon) also consigned lepton number Lj = +1 for neutrino's & (−1) for antineutrino's flavors.
- Every flavor's neutrino and its anti-particle are charge-less, fermion-particles also having ½ and antineutrinos of each flavor are neutral, spin half fermions and accompanied helicity-term whether −1 (+1).
- This neutrino-particle's interactivity with charged leptons & quarks, occurs via the interchange of bulky charged vector-fields Wμ ± with correlative magnitude, between the

neutrino-charged lepton and quark-quark currents for any of the flavor. The above mentioned currents transmute, like V μ − Aμ, also established like the charge-fetching bi-linear covariant which transport linear-momentum & energy (Popularly and phenomenologically recognized as the V − A theory [9, 10, 11].

Phenomenologically the V − A hypothesis, about the feeble-interactivity, is rightly describing these neutrino's interactivity with matter, typically for low- energy magnitudes. But the scattering cross-section, from charged leptonic & and nucleonic particles, for the elevated energies of neutrinos, undergoes divergences (estimated by high-order perturbation theory). Later a consolidated conjecture, for weak as well as e-m leptonic interactivities was contrived by Weinberg [12] and Salam [13]. The integrated theoretical explanation, of electro-weak intractability is perceived by the standard model (SM).

A. Study of investigational outcomes and properties of neutrinos:

Detection of neutrinos:

Exploratory trials for the findings of neutrino & its anti-particle were explicitly commenced later to the theoretical beta-degradation explanation by scientists like Nahimas [14] in 1935, Rodeback and Allen [15], Leipunski [16], Snell and Pleasonton [17], and others. But the experimental conclusion about the reporting of antineutrinos, was conferred by Reines and Cowan [7, 8] as

$$\underline{\upsilon_e} + p \rightarrow n + e^+ \quad (1)$$

Davis [18, 19] obtained for the reaction ($\underline{\upsilon}$ + 37 Cl → e^- + 37 Ar), the restriction on Cross-section σ^- as to be less than $9.0 \times 10^{-45}\ cm^2$ whereas it was theoretically guessed to be roughly of the order of $\approx 2.6 \times 10^{-45}\ cm^2$. The outcome was greatly significant, to predict the non-production of electrons and referred to υ_e & $\underline{\upsilon_e}$ as to be distinct particles. Thus to handle this phenomenology, a novel quantum number designated as the electron lepton-number: Le and its +1 value is allocated to υ_e & electron also −1 value to $\underline{\upsilon_e}$ & e^+. Scientists Markov [20], Pontecorvo [21], & Schwartz [22] recommended for utilizing the facility like proton-accelerators for generating the neutrino-shaft of elevated energy magnitudes through pion-particle's degradation process:

$$\upsilon + n = \mu^- + p \qquad \upsilon+n=e-+p \quad (2)$$

$$\underline{\upsilon} + n \rightarrow p + \mu^+ \qquad \underline{\upsilon} + n \rightarrow p + e^+ \quad (3)$$

Investigations attempted at the Brookhaven Laboratory & at CERN, suggested the existence of neutrinos via pion degradations occurred with muons, but never with an electron or positron (As mentioned in the equations 2 &3).

Moreover, this established the presence of a distinct neutrino flavour, than that which occurred through beta decaying. Hence a novel lepton-number L_μ is granted to the muon-family and the conservation law was also equally applicable, for the new lepton-numbers respectively. The revelation of τ-lepton was made in 1975 [23] and its feebly-decaying process noticed, the existence of a new flavor of neutrinos υ_τ. Later experimentally manifested during 2000 at the Fermilab & then through the atmospheric neutrino investigations [24, 25].

B. **Various neutrino generation sources and their fluxes**:

The Standard Model depictures triply-flavoured neutrinos as υ_e, υ_μ & υ_τ along with their anti-partcles. In the early stages, the investigations were executed utilizing the reactor anti-neutrinos, also with the solar neutrinos. Moreover with the developed accelerating equipment, scientists were able to utilize (υ_μ) and $\underline{\upsilon_\mu}$ shafts. The categorization of sources of neutrinos, as well as its anti-particle, is done into dual classes, as the naturally found sources & the man-made one Fig.(1). The naturally generated neutrinos materialize from the sun's interior, the earth's interior & mantle etc. It is invariably whether the origination, collision or the ending of a star outturn into neutrino-production. Explicitly a massive neutrino-flux is discharged, in the time of supernovae eruption. The neutrinos in

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our surroundings exist as an artifact of Big-bang event. Apart from this, multiple sources of astro-physical neutrinos, exist for example the cosmogenic neutrinos, or caused via the viciously colliding energetic protons with bulky nuclei etc. Furthermore several man-made sources are there, such as generation at particle-accelerators, nuclear-reactors, spallation neutron source (SNS) facilities, etc. The entire energy-stretch for the creation of neutrinos & their antiparticles through miscellaneous sources spreads from μeV (10^{-6} eV) to EeV (10^{18} eV) as pictured in Fig. 2 [26].

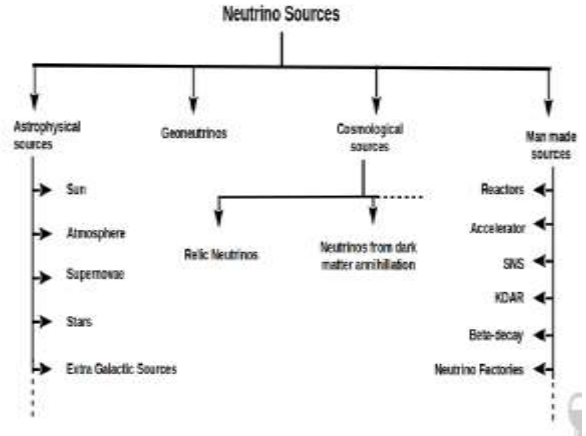

Fig. 1: Multiple sources of creation of neutrinos [26].

Sun's core is responsible for creating the neutrinos, whereas the nuclear reactors as well as earth are interior is accountable for antineutrinos production. Moreover, the all remaining sources involve both, the particle, neutrinos & its anti-particles as outcome. The neutrinos, as the artefact of the Big Bang event, the neutrinos through disseminated supernovae & the elevated energized cosmogenic neutrinos are yet to be encountered experimentally (courtesy C. Spiering) [26].

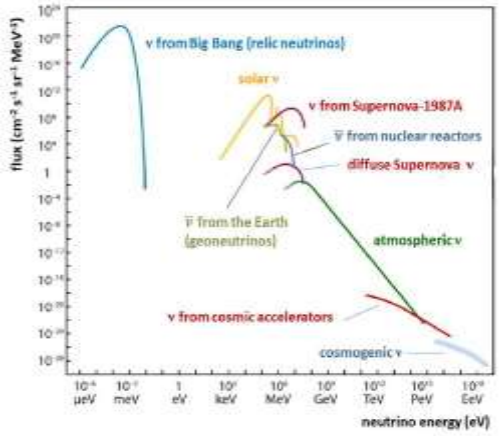

Fig. 2: Neutrinos fluxes on earth via various originations (measured as particles per square cm, sec.,steradian and MeV).[26]

C. Naturally Generated neutrinos

It is well known, that in the entire star's ancestry, even in the sun the energy generation, occurs due to the proceedings of nuclear fusion, which materialize in the star's midst. Mostly the reaction that prevails in sun or smaller stars is the p-p series reaction, whereas in more gigantic ones than sun, the sequence of Carbon-Nitrogen-Oxygen (CNO) reaction is notable. Basically the fusion of hydrogen to helium, eventuates as the progression of chain reactions, which is undertaken to create deuterium-nucleus in addition to release of positron & υ_e. The mentioned activity can be elaborated in terms of an equation as

$4p+2e- \rightarrow 4He+2\upsilon_e+26.7MeV.$ (4)

Out of this nearly 7×10^{10} υ_e/cm^2/sec neutrinos land up to the earth. The degradation of non-primary cosmological particles, such as pion, kaon etc. outturn into atmospheric-neutrino count. They usually generate through the interactivity of preliminary cosmic rays, (chiefly containing protons) with earth's atmosphere. The process can be depicted as:

proton + Aair → neutron + π^+ + X ;

neutron+ Aair →proton + π^-+ X. (5)

Eventually these pions or kaons are accountable, to the upturn of anti-neutrino particles.

$\pi^\pm \rightarrow \mu^\pm \quad \underline{\upsilon_\mu}(\upsilon_\mu)$, (100%)

$\mu^\pm \rightarrow e^\pm \quad \underline{\upsilon_\mu}(\upsilon_\mu)\ \underline{\upsilon_e}(\upsilon_e)$, (100%)

$K^\pm \rightarrow \mu^\pm \quad \underline{\upsilon_\mu}(\upsilon_\mu)$ (63.5%); $\pi^\pm\ \pi^0$ (20.7%); $\pi^\pm\ \pi^+\ \pi^-$ (5.6%)...

These no-primary crests are of the order of giga eV scale and broadened to elevated energy-values. Thus the neutrino-flux declines swiftly, with a surge in energy. Till the magnitude of energy roughly ranges up to one hundred Tera eV, this particle-flux is prevailed by the degradation of pions & kaons.

When a bulky star is in the ending episode, the supernova neutrinos are generated and consequently entirely every flavor's neutrinos & anti-neutrinos fetch an enormous proportion of energy, while blowing up the core collapse-supernovae. Active Galactic Nuclei are supposed to be the originators of highly energized neutrinos and they are able to speed up the proton particles to maximal of $\sim 10^{20}$ eV energy. The AGN's have highly-intensified fields in its vicinity, that are accountable for the interactivity between photo-hadron, that eventually up-thrust neutrino count.

On the other hand the cosmogenic neutrinos are generated through interactivity of cosmic rays, to the cosmic-microwave surrounding radiation, such as the nucleons. Moreover these neutrinos whether are unconfined or in confined state, within having the Lorentz boost factor $\Gamma \geq 10^{10}$. Therefore, they boost up the built of photo-pion, and further these pions degrade to raise to neutrino count:

$N + \gamma \rightarrow N' + \pi^\pm$; N,N′ = proton or neutron. (6)

There is a fact about earth's inner part that it gives-off the heat at a pace of roughly 47 TW and a proportion of this is availed by the process of degradation of radioactive-isotopes in the midst of the earth. This decay is further resulted into the generation of antineutrinos and approximately 10^6 $\underline{\upsilon_e}/cm^2$ antineutrino-counts, thrust-out to the earth's surface. In natural sources of neutrinos and its anti-particle, the earth's inner part as well as the mantle are accountable, due to the presence of few elements such as 40K, 232Th, 238U, etc. These elements undergo a sequential degradation, in addition to occurrence of beta-decay. These decays consequently conclude to the outcomes like

$238\ U \rightarrow 206\ Pb + 8\alpha + 6e^- + 6\bar{}\nu e + 51.7\ MeV.$ (7)

$40\ K \rightarrow 40\ Ca + e^- + \underline{\upsilon_e} + 1.311\ MeV$, etc. (8)

These Processes are liable to geo-neutrinos emission. The novel studies now suggest, that the details related to the spatial distribution of such radio-nuclides, are able to provide an estimated dimension of the earth's middle part & mantle as well. The emergence of cosmic microwave background radiation, noticed by Penzias and Wilson [1965], closely resembles the cosmic-neutrino background (CVB) which is famously perceived as the artifact of the Big-Bang event. These CVB neutrinos are those that disengage to matter while the created universe roughly was one sec. Older and theoretical investigations, propound the thermal condition of artifact neutrino as near to 1.95 Kelvin, also the average density roughly to the order of $330/cm^3$.

D. Man-made sources: Accelerator and Reactor (anti) neutrinos

It is critical to interpret the nature & properties of neutrinos, which are generated through the accelerators & reactors. Scientists Markov [20], Pontecorvo [21], and Schwartz [22], brought the proposal to execute the investigations on neutrinos, by the use of accelerators and later they

initiated a probability of experimentations to generate neutrino beam, through pion's degradation at the proton-accelerators. More experimentation with highly energized neutrinos also came in picture when improved synchrotron accelerators became available [in 1960]. Also the AGS at Brookhaven & the PS at CERN are set-off to elevated energy magnitudes of the order of Giga eV and higher, which has allowed us to examine neutrino interactivity. During 1962 the neutrinos were generated with the run of accelerators at Brookhaven and CERN, exhibiting the distinctness of νe & νμ. In the experimentations the accelerators were used to provide highly energized protons and later they encountered a target (some material which can tolerate excessive thermal conditions).

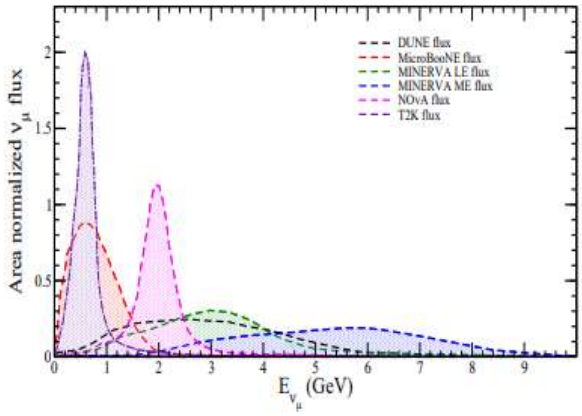

Fig.3: Various neutrino-spectra with dependability on neutrino energy for the accelerator neutrons.[29]

Under such an environment, a proton accelerates to comparative velocity of light, smashes the target and proton's energy leads to generate the hadronic jets. In the jet, various particle-creation takes place, though majorly are the pions & kaons. Such charge-carrying pions-particles do not show stability and thus degrade further to generate muons as well as neutrinos. The charged meson may easily be collimated & directed with the electro-magnets. With the use of these magnetic-horns, pions as well as kaons, are positioned towards the detector, for acquiring the neutrino-jet into a defined direction. Therefore, an appropriately devised electro-magnetic horn set-up, is helpful for intensifying the neutrino flux. In order to gauge the flux of neutrino-particles with precision, meson's momentum as well as the angular-spectra should be quantified closely. During 1965, one technique for deducing the neutrino's flux (in terms of function of proton count encountering the target) had been imposed at Brookhaven lab and further this was employed for experiments at CERN (in 1967). Therefore during seventies, various accelerators started performing at different energies for the neutrino-experiments, such as proton accelerator at Fermilab (three hundred to four hundred giga eV) the proton accelerator (seventy giga eV) at Serpukhov also the SPS (three hundred giga eV) at CERN [27, 28].

CONCLUSION

The neutrinos are fermion particles incorporated in the Standard Model of Particle physics and have interactivity through weak interaction & gravitation. They are under-sized, carry zero charge and too diminutive. Hence one cannot estimate it's mass. As the scale of weak-force is too minuscule, the interactivity in gravity is immensely feeble. Thus neutrinos don't get involved in the strongly interacting fields and therefore the neutrinos usually traverse through matter unhindered and may not be detected.

These neutrinos can be generated via multiple radioactive-degradation processes, such as nuclei or hadronic beta-decay, the naturally occurring reactions happen at the star's inner part. The other ways to create such neutrinos is via unnatural-man made sources like the reactions at nuclear reactors, particle accelerators. They also come into the picture during an event of supernovae and in the

collision process between highly energized particle shafts with bulky atoms. In the field of particle physics, functional testing and explorations are going on neutrinos and few are to investigate and anticipate behavioral aspects of neutrino behavior. Some other work is related to unrevealed properties which are not yet known.

As because of too diminutive weight and neutral charge mean they interact exceedingly weakly with other particles and fields. As a result of that, this peculiarity of neutrinos may be utilized for probing the environs for exploration as different radiations (electro-magnetic or radio) could not. These neutrino-particles have been much advantageous to examine the astro-physical origins, outside the range of our Solar System, since neutrinos do not get diminished considerably, while traversing via the interstellar medium.

References:

[1] W. Pauli, Phys. Today 31N9 (1978) 27.
[2] E. Fermi, Ric. Sci. 4 (1933) 491.
[3] E. Fermi, Nuovo Cim. 11 (1934) 1. doi:10.1007/BF02959820.
[4] E. Fermi, Z. Phys. 88 (1934) 161. doi:10.1007/BF01351864.
[5] F. Perrin, Compt. Rendus 197 (1933) 1625.
[6] H. Bethe, R. Peierls, Nature 133 (1934) 532. doi:10.1038/133532a0.
[7] F. Reines, C. L. Cowan, Nature 178 (1956) 446. doi:10.1038/178446a0.
[8] C. L. Cowan, et al., Science 124 (1956) 103. doi:10.1126/science.124.3212.103
[9] E. C. G. Sudarshan, R. e. Marshak, Phys. Rev. 109 (1958) 1860. doi:10.1103/PhysRev.109.1860.2.
[10] R. P. Feynman, M. Gell-Mann, Phys. Rev. 109 (1958) 193. doi:10.1103/PhysRev.109.193.
[11] S. Weinberg, Phys. Rev. Lett. 19 (1967) 1264. doi:10.1103/PhysRevLett.19.1264.
[12] A. Salam, Conf. Proc. C 680519 (1968) 367. doi:10.1142/9789812795915_0034.
[13] M. E. Nahmias, Math. Proc. Cambridge Phil. Soc. 31 (1935) 99. doi:10.1017/S0305004100012986.
[14] G. W. Rodeback, J. S. Allen, Phys. Rev. 86 (1952) 446. doi:10.1103/PhysRev.86.446.
[15] A. I. Leipunski, Proe. Cam. Phil. Soe 32 (1936) 301.
[16] A. H. Snell, F. Pleasonton, Phys. Rev. 97 (1955) 246. doi:10.1103/PhysRev.97.246.
[17] R. Davis, Phys. Rev. Lett. 12 (1964) 303. doi:10.1103/PhysRevLett.12.303.
[18] R. Davis, Jr., D. S. Harmer, K. C. Hoffman, Phys. Rev. Lett. 20 (1968) 1205. doi:10.1103/PhysRevLett.20.1205.
[19] M. A. Markov, Neutrino preprint JINR-D577 (1960), Nauka, Moscow, Russia (1964).
[20] B. Pontecorvo, Zh. Eksp. Teor. Fiz. 37 (1959) 1751.
[21] M. Schwartz, Phys. Rev. Lett. 4 (1960) 306. doi:10.1103/PhysRevLett.4.306.
[22] M. L. Perl, et al., Phys. Rev. Lett. 35 (1975) 1489. doi:10.1103/PhysRevLett.35.1489.
[23] K. Abe, et al., Phys. Rev. Lett. 110 (2013) 181802. doi:10.1103/PhysRevLett.110.181802.
[24] U. F. Katz, C. Spiering, Prog. Part. Nucl. Phys. 67 (2012) 651. doi:10.1016/j.ppnp.2011.12.001.
[25] U. Dore, P. Loverre, L. Ludovici, Eur. Phys. J. H 44 (2019) 271. doi:10.1140/epjh/e2019-90032-x.
[26] K. Mahn, C. Marshall, C. Wilkinson, Ann. Rev. Nucl. Part. Sci. 68 (2018) 105. doi:10.1146/annurev-nucl-101917-020930.
[27] Cherney, Michael G.; McShane, Thomas S.; Waggoner, William T.; Seger, Janet E., Nucl. Phys. A ,issue1-2, Vol.757, 102 (2005).
[28] G. Aad et al. (ATLAS Collaboration), Observation of a Centrality-Dependent Dijet Asymmetry in Lead-Lead Collisions at √sNN = 2.76 TeV with the ATLAS Detector at the LHC, Phys. Rev. Lett. 105, 252303 (2010).
[29] Zhang, H.; Abe, K.; Hayato, Y. et al. In: Astroparticle Physics, Vol. 60, 01.(2015), p. 41-46.

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EXPLORING THE EFFICIENCY AND EFFECTIVENESS OF AN AUTOMATED ROBOTIC VACUUM CLEANER

Shripad Jagtap, Tanvi Kanchan, Avishkar Dige, Satyam Palkar Student, Dept. of EXTC Engineering, ACE, India, jagtapshripad-extc@atharvacoe.ac.in
Kavita Bani Assistant Professor, Dept. of EXTC Engineering, ACE, India, kavitabani@atharvacoe.ac.in

Abstract:
As advancements in technology continue, people are seeking ways to automate tedious tasks to save time and energy. Recently, robots have become a significant area of research in robotics because of their high productivity and usefulness in assisting humans. Typically, robotic cleaners are recognized for their cleaning capabilities. Some robots are equipped with proximity sensors to help them avoid obstacles, while others use laser mapping techniques. Currently, two main types of automated vacuum cleaners are available: VSLAM-based and LIDAR-based. While VSLAM is more cost-effective, its mapping capabilities are not as advanced as LIDAR. On the other hand, LIDAR offers better mapping accuracy, but is more expensive. With our project, we aim to create a combination of both the above mentioned technologies, i.e it will be cost effective but have a mapping almost as good as LIDAR.

Keywords **—** Intelligent Floor Cleaning Robot, VSLAM, Automation, 3D Sensing, Raspberry Pi, Arduino, Vacuum Dusting, Collision Prevention, Path Planning

I. INTRODUCTION

In recent years, scientists have been looking for ways to make household tasks, such as floor cleaning, faster and more efficient. To this end, robots have become increasingly common in households. There has been a significant rise in the use of technologies like IOT, microcontrollers, and microprocessors like Arduino, Atmega, 8051, and Raspberry Pi to develop and design robotic vacuum cleaners. Microcontroller-based automated vacuum cleaner robots are becoming increasingly popular due to their ability to perform cleaning tasks quickly and efficiently. These robots are equipped with microcontrollers, sensors, motors, and other components that enable them to detect obstacles in their path and autonomously navigate around them. They can also be programmed to clean specific areas and are increasingly being used in homes and businesses to reduce the need for human intervention. This kind of technology eliminates the need for human intervention, thereby reducing errors and the time taken to complete tasks.

II. LITERATURE SURVEY

The first study [1] that was analyzed in the review had a robotic vacuum cleaner as the main subject. It was controlled by Arduino Leanardo and had ultrasonic sensors that helped it navigate through obstacles. The data from the sensors was used to guide the brush motors and prevent collisions with wheel motors.

The second study [2] that was looked at incorporated IoT technology and a microcontroller 8051, as well as a smart bin and vacuum cleaner. This system was designed to separate waste using 8051 and a moisture sensor, as well as the vacuum cleaning process. Ultrasonic sensors were used to determine if the dustbins were full and a GSM module was used to send a text message to the designated user when the bins needed to be emptied.

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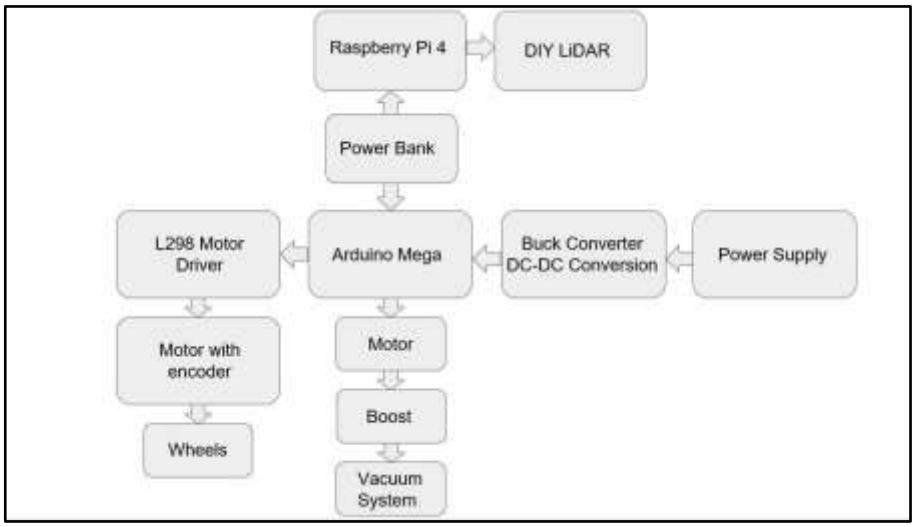
In the third paper [3], the project utilizes Arduino, a Wi-Fi module, and proximity sensors to construct a vacuum cleaner robot. When the robot is powered, the motor drivers will begin working, allowing the robot to move forward. However, if an obstacle is detected within 3 cm of the robot, the command is given to reverse the motor operation, thus allowing the robot to move in the opposite direction.

The fourth paper [4] details the design of a vacuum system that utilizes both Raspberry Pi and Arduino as its primary controllers. The use of LIDAR for mapping and proximity sensors for path generation allows the robot to autonomously navigate its environment. Additionally, a GPS module is used for positioning and the authors have implemented an autonomous process for battery recharging, called 'auto docking and charging process', which eliminates the need for human assistance, making the robot fully autonomous.

III. DESCRIPTION OF SYSTEM

1. Block Diagram

The Arduino Mega and Raspberry Pi are linked through a serial cable, which is used to transfer data between the devices using serial communication protocol. Serial communication involves transmitting data one bit at a time in a sequential order over a communication channel or computer bus. The Arduino Mega controls the two motors through the motor driver. The motor driver is a device that is made to regulate the speed and direction of two motors simultaneously. It is constructed using the L293D IC, which is a 16 Pin Motor Driver IC. This IC is created to give bidirectional drive currents that range from 5V to 36V. The Raspberry Pi with DIY LIDAR is a high-level controller which issues commands to the Arduino, which is a low level controller. This configuration makes sense because the Arduino is better suited to interact with the motors and motor driver. We use Li-ion batteries for power supply. We also use a power bank for Raspberry Pi and LIDAR. The motor which is connected to the Arduino is boosted for a better vacuum system. If an obstacle (wall, furniture, etc) gets detected by the LIDAR, it sends that data to the Raspberry Pi. The Raspberry Pi uses the genetic Algorithm for internally computing and commanding the robot.The Raspberry Pi then sends messages to the Arduino to either take turns towards the left or the right, or to continue to move forward and clean the mapped area.



2. Electronic System

- ***LIDAR***

Lidar is a technique used to measure the distance to an object or surface by targeting it with a laser and measuring the time it takes for the reflected light to return to the receiver. It can also be used to create digital 3-D representations of areas on the Earth's surface and ocean bottom by varying the wavelength of light. It is suitable for terrestrial, airborne, and mobile applications. Lidar utilizes ultraviolet, visible, or near-infrared light to image objects and can target a wide range of materials, including non-metallic objects, rocks, rain, chemical compounds, aerosols, clouds, and even single molecules. A narrow laser beam can map physical features with very high resolutions, allowing an aircraft, for example, to map terrain with a resolution of 30 centimeters (12 inches) or higher.

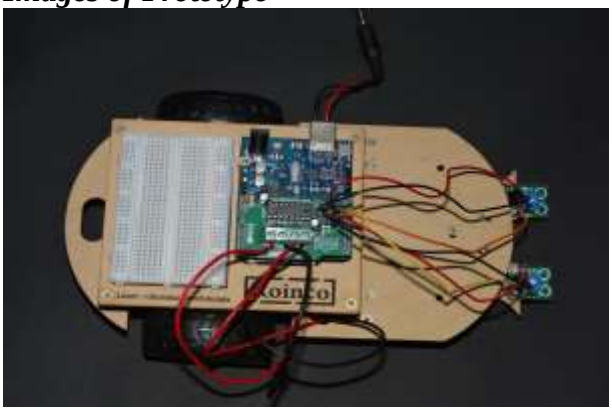
- ***INFRARED SENSOR***
  Infrared sensors are electronic devices that emit a signal in order to sense and detect aspects of their environment. [5] They can be classified into two types, active and passive. Active infrared sensors consist of both a transmitter and receiver, and can use either a light-emitting diode (LED) or laser diode as a source. On the other hand, passive infrared sensors include only receivers and use an external object, such as an infrared source, to emit energy, which is then detected through the receivers.
- ***ULTRASONIC SENSOR***
  The HC-SR04 is an ultrasonic sensor that utilizes sonar technology to measure the distance between an object and the sensor. It has an excellent noncontact detection range and provides precise and reliable measurements.
- ***MICROCONTROLLER***
  The ATmega2560 is a low-power CMOS 8-bit microcontroller built on an AVR enhanced RISC architecture. It is able to process powerful instructions in a single clock cycle, allowing for maximum efficiency with minimal power consumption. It contains an 8-bit RISC CPU with In-System Self-Programmable Flash, providing a cost-effective solution for many embedded control applications. Its high speed and flexible design make it an ideal choice for many applications.
- ***MOTOR DRIVER***
  The L298N is an integrated monolithic circuit consisting of two H-bridge motor drivers in a single package. [6][9]It is a high voltage, high current dual full-bridge motor driver designed to accept TTL logic levels. It has separate enable pins for each bridge, enabling and disabling them individually. The emitters of the lower transistors of each bridge are connected together and can be used to connect external sensing resistors. It can drive a DC motor with a maximum current of 4A and operates on a supply voltage up to 46V. It also has an inbuilt overtemperature protection feature which protects the circuit when the internal temperature exceeds the maximum operating temperature limit.
- ***GEARED MOTORS***
  The 100 RPM Single Shaft BO Motor - Straight offers great torque and speed at lower operating voltages, making it a great choice for many applications. It features a small shaft with matching wheels for an optimized design that is suitable for in-circuit placement. The motor can be used with a 69mm Diameter Wheel for Plastic Gear Motors and is an alternative to metal gear DC motors. It operates on a voltage of 3-12V and is great for building small and medium sized robots.
- ***BUCK CONVERTER***
  The LM2596 DC-DC Buck Converter Step Down Module is a switch-mode power supply that offers high efficiency and is capable of driving a 3-A load with excellent line and load regulation. It operates at a switching frequency of 150kHz, allowing for smaller filter

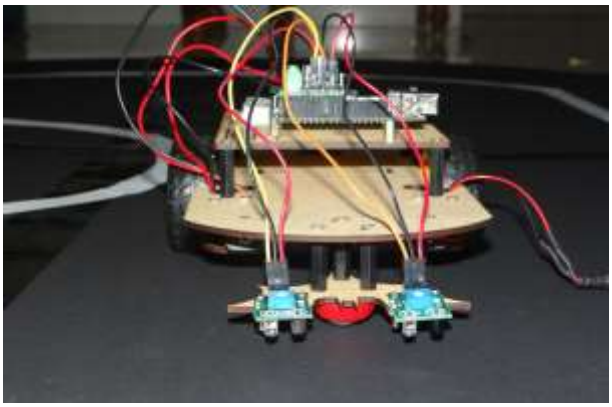
components than what would be required with lower frequency switching regulators. This module is equipped with a high precision potentiometer, and can work with Freeduino UNO, other mainboards, and basic modules. It is internally compensated to reduce the number of external components needed to simplify the power supply design. When the output current is greater than 2.5A (or output power is greater than 10W), it is recommended to add a heat sink. Compared to three-terminal linear regulators, the LM2596 converter offers significantly higher efficiency, especially with higher input voltages.

- ***RASPBERRY PI***

  The Raspberry Pi 4 has undergone extensive compliance testing and meets a variety of regional and international standards. [7][8] The most impressive change for the Pi 4B is that it is available with three different amounts of fast DDR4 SDRAM memory; 1GB, 2GB, or 4GB. This, combined with its faster 1.5GHz quad-core processor, allows the Pi 4B to run large programs and tasks more quickly than before. It also has Bluetooth 5.0, two USB 3.0 ports, and true Gigabit Ethernet for fast wireless and wired communication. The dual-band wireless LAN now comes with modular compliance certification, enabling the board to be integrated into end products with reduced compliance testing, which can improve both cost and time to market.

3. Images of Prototype





IV. EXPERIMENTATION AND RESULTS

Based on our prototype, three studies were carried out. Basic component functionality was examined in the first experiment. The robot's mechanical, electrical, and control components underwent testing to ensure proper operation."1" denotes proper operation, while "3" is the highest possible value, indicating that all system components operate effectively. 100% of the findings for this trial indicated that every component was operating effectively. The robot's ability to clean was tested in the second trial. In this experiment, the robot is operated manually, and a specific amount of garbage is put in a predetermined location.

$$\text{cleaning performed by the robot} = \frac{\text{weight of content}}{\text{total content weight}} * 100$$

The outcomes of this experiment fluctuated between 2-68%.

Attempt No.	Type of Waste	Waste Collected (in gms)	Efficiency
1	Wet Waste	1.27	2.54
2	Wet Waste	2.31	4.62

3	Wet Waste	2.91	5.83
4	Wet Waste	1.30	2.61
5	Dry Waste	22.14	44.28
6	Dry Waste	24.23	48.47
7	Dry Waste	22.31	44.62
8	Dry Waste	21.54	43.09
9	Plastic Waste	31.09	62.19
10	Plastic Waste	29.18	58.36
11	Plastic Waste	34.34	68.69
12	Plastic Waste	32.40	64.81

During the third experiment, the robot's ability to avoid collisions was evaluated using the formula:

$$\text{Rate of Collisions} = \frac{\text{number of collision taking place}}{\text{number of obstacles placed in the environment}} * 100$$

The outcomes of this experiment fluctuated between 20-50%. On the whole, the robot system demonstrated an efficiency level of 68% when tested in a controlled setting.

The battery system for the robot consists of two packs of 10 cells each, which are 3.7V and 3600mAh Li-ion batteries. Each pack has 10 cells connected in series, creating a total voltage of 37V. When the two packs are connected in parallel, the current rating is increased, resulting in a total capacity of 7200mAh or 7.2Ah, and an input power rating of 266.4Wh. The robot's power consumption is 30W for the vacuum system and 72W for 4 DC geared motors, for a total consumption of 102W. If fully charged, the robot can operate continuously for 3.7 hours. However, the robot has the capability for autonomous docking, meaning it can recharge itself without human intervention, making the battery life less of a concern.

V. CONCLUSIONS

After thorough prototyping and testing, it is evident that automated robotic vacuum cleaners have undergone modern development processes, where new technologies such as Arduino and Raspberry Pi have been implemented and tested. Integrating these technologies with IOT, modern sensors and motors has allowed for a more efficient cleaning process at a lower cost. [10]The drawback is that these devices are not fully autonomous, and require some human involvement. This issue can be resolved by incorporating advanced technologies such as Artificial Intelligence and Machine Learning in computer science. Algorithms are used in some cases for optimization, but this is not as effective as what Machine Learning can provide. By employing Machine Learning technologies such as Object Detection, we can further optimize the performance of these devices. We will construct an IOT-based ARVC that can function effectively in an unfamiliar environment by utilizing a makeshift LIDAR system. [11]This will enable the robot to map out the room with precise and accurate detail, leading to improved cleaning with fewer collisions and more efficiency. This robot will minimize

human interaction and effort when it comes to household cleaning, allowing for a more productive and comfortable lifestyle.

REFERENCES

[1] J. Alan et al., "Design of an Automated Sweeper for Public Parks," 2018 International Conference on Mechatronics, Electronics and Automotive Engineering (ICMEAE), 2018, pp. 114-117, doi: 10.1109/ICMEAE.2018.00028.

[2] S. Amitha et al., "Segregated Waste Collector with Robotic Vacuum Cleaner using Internet of Things," 2020 IEEE International Symposium on Sustainable Energy, Signal Processing and Cyber Security (iSSSC), 2020, pp. 1-5, doi: 10.1109/iSSSC50941.2020.9358839.

[3] P. B. Jarande, S. P. Murakar, N. S. Vast, N. P. Ubale and S. S. Saraf, "Robotic Vacuum Cleaner Using Arduino with Wifi," 2018 Second International Conference on Inventive Communication and Computational Technologies (ICICCT), 2018, pp. 1513-1517, doi: 10.1109/ICICCT.2018.8473256.

[4] H. A. S. H. Prayash, M. R. Shaharear, M. F. Islam, S. Islam, N. Hossain and S. Datta, "Designing and Optimization of An Autonomous Vacuum Floor Cleaning Robot," 2019 IEEE International Conference on Robotics, Automation, Artificial-intelligence and Internet-of-Things (RAAICON), 2019, pp. 25-30, doi: 10.1109/RAAICON48939.2019.11.

[5] L. Wang, J. Chang, X. Zheng, J. Liu, M. Yu, L. Liu, et al., "Survey of ecological environmental conditions and influential factors for public parks in Shanghai", *Chemosphere*, vol. 190, no. 1, pp. 9-16, 2018.

[6] M. Ghalamzan E, A and M. Ragaglia, "Robot learning from demonstrations: Emulation learning in environments with moving obstacles", *Robotics and Autonomous Systems*, vol. 101, pp. 45-56, 2018.

[7] Himadri Nath Saha, Sourav Gon, Annesha Nayak and Sumandrita Moitra, "Iot Based Garbage Monitoring and Clearance Alert System", *2018 IEEE 9th Annual Information Technology Electronics and Mobile Communication Conference (IEMCON)*, pp. 204-208, 2018.

[8] Padmakshi Venkateswara Rao, Pathan Mahammed Abdul Azeez, Sai Sasank Peri, Vaishnavi Kumar, R. Santhiya Devi, Amirtharajan Rengarajan, et al., "IoT based Waste Management for Smart Cities", *2020 International Conference on Computer Communication and Informatics (ICCCI)*, pp. 1-5, 2020.

[9] Rekha Raja, Ashish Dutta, and KS Venkatesh, New potential field method for rough terrain path planning using genetic algorithm for a 6-wheel roverRobotics and Autonomous Systems,volume-72,pages-295– 306,2015,Elsevier

[10] Mohammad Sazzadul Hoque, Md Mukit, Md Bikas and Abu Naser An implementation of intrusion detection system using genetic algorithm,arXiv preprint arXiv:1204.1336,2012

[11] Yusuf Abdul lahi Badamasi, "The Working Principle Of Arduino", NTNN, 2014

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A STUDY OF MATHEMATICAL ASPECT OF GOOGLE PAGE RANK ALGORITHM

Divya Acharya Department of Humanities and Applied Sciences, Atharva College of Engineering, Mumbai University,Malad-95
Ancy Dsouza Department of Humanities and Applied Sciences, Atharva College of Engineering, Mumbai University,Malad-95
Priyanka Malgaonkar Department of Humanities and Applied Sciences, Atharva College of Engineering, Mumbai University,Malad-95
Deepika Panchal Department of Humanities and Applied Sciences, Atharva College of Engineering, Mumbai University,Malad-95

Abstract: Page Rank algorithm is the core concept used in Google Search Engine . It is a widely known algorithm which helps in giving rank to the web pages and hence, it determines the order in which they are to be displayed during a search .It was developed in 1998.Almost all web search tools still use the Page Rank algorithm as their foundation. In this paper, we will get an overview of application of linear algebra and graphs in Google's Page Rank algorithm.

Keywords: *Stochastic matrix, Reducible matrix, damping factor.*

I. INTRODUCTION :

Eigen values and Eigen vectors is a well known concept in Linear Algebra associated with linear Transformations and hence matrices. Following is the definition :

Eigen Value: A be an order n matrix . A real or a complex number λ is an Eigen value of A if there exists an $n \times 1$ matrix $X \neq 0$ satisfying, $AX = \lambda X$. [1]

II. APPLICATION OF LINEAR ALGEBRA:

Let us see how eigen values and eigen vectors concept is used in page rank algorithm to get the order of preference of web pages.

We can use graph to represent the linking of web pages and further define

"Hyperlink Matrix" , H =(H_{ij}) to describe the linking as follows,

Suppose, a page i has p_i outlinks. Let $H_{ij} = 1/p_i$, if page i has link to page $j \neq i$,

$= 0, otherwise.$

H has dominant eigen value λ = 1and we find eigen vector X corresponding to it.

The page corresponding to largest entry i.e, pagerank in X will get the preference in the search.

.To compute the Eigen vector, different iterative methods can be used. One of these method is **Power Method**:

In this , we start by picking a vector J^0 and then define a sequence of vectors J^k by,

$$\mathbf{J^k = H.\ J^{k+1}}$$

The method is based on the following principle:

" The sequence J^k will converge to the Eigen vector J." [2]

The above method has some restrictions if

(i) there is a dangling node.

(ii) a group of pages forming a sink.

Hence the matrix H may require some modifications. It is achieved as follows

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(i) For a dangling node

The ith row of H, however, has only zero entries if page i has no outlinks.. It is called as a dangling node. Due to this nodes, pagerank of some or all pages may become 0.
In order to fill these type of rows we modify H to S by defining,

$$\boldsymbol{S = H + eu^T},$$

where e = (e_i) is a column matrix of order $n \times 1$ and $e_i = 1$,if page i has no outlinks
= 0 otherwise;
and u =(u_i) is a column matrix with $u_i \geq 0$ and $||u||_1 = 1$.

Choose u = 1/n **B**, where **B** = $\begin{bmatrix} 1 \\ 1 \\ \cdot \\ \cdot \\ 1 \end{bmatrix}_{n \times 1}$, i.e, all entries are 1 in **B** and n is the number of nodes in the graph. [2]
Above definition of matrix S ensures it does not have a zero column in it and hence iterative methods will give eigen vector with positive entries.
(Such a matrix S is stochastic matrix.)

For example, consider

H = $\begin{bmatrix} 0 & 0 \\ 1 & 0 \end{bmatrix}$, using power method we get J0 = $\begin{bmatrix} 1 \\ 0 \end{bmatrix}$, J1 = $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$ which fails to be an eigen vector

(ii) A group of pages forming a sink.

Sometimes we can also come across a group of pages which may form a **sink** (ex3 in result)and due to this sink the iterative method to find eigen vector may not converge.
And due to this sink other pages may not get page ranks even if they may be having link.

Thus, if there is a sink present then S is a block matrix given by,

S = $\begin{bmatrix} * & 0 \\ * & * \end{bmatrix}$ which is a reducible matrix and as in above example PageRanks of some pages can be zero inspite of each of them having links. [2]
To overcome this, S is modified to an irreducible matrix G as follows,
G is defined as,

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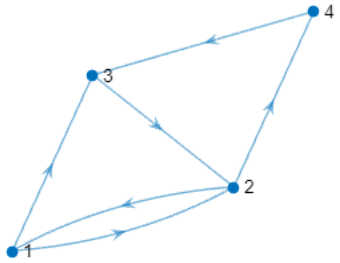
$$\mathbf{G = \mu S + (1 - \mu)uB^T}, \qquad 0 \le \mu < 1,\ u_i \ge 0, \qquad \|u\|_1 = 1$$

G is called "Google matrix."
A damping factor μ of 0.85 is used.
The iterative methods used to get eigen vector converge faster for $\mu = 0.85$.
G is stochastic and irreducible having a clear dominating eigenvalue that is 1.
If the eigenvalues of S are, 1 and $\lambda_2, \lambda_3, \ldots, \lambda_n$ where $|\lambda_j| \le 1$ for j = 2 to n, then the eigenvalues of G are 1 and $\mu\lambda_2, \mu\lambda_3, \ldots, \mu\lambda_n$.
Thus, PageRank vector is achieved iteratively from G using power method. [3]

III. RESULT:

"Hyperlink matrix" gives following eigen vector:

For example, consider ex1. where the webpage linkage is represented using Matlab.



The Hyperlink Matrix is given by

$$H = \begin{bmatrix} 0 & 1/2 & 0 & 0 \\ 1/2 & 0 & 1 & 0 \\ 1/2 & 0 & 0 & 1 \\ 0 & 1/2 & 0 & 0 \end{bmatrix}^T \quad \text{and eigen vector } X = \begin{bmatrix} 0.250000 \\ 0.375000 \\ 0.250000 \\ 0.125000 \end{bmatrix}$$

As score of page 2 is 0.375 which is more than others, it will get more preference than other pages

Dangling node give following result:

Power method fails to give an eigen vector.

$$\text{Eigen vector} = \begin{bmatrix} \text{NaN} \\ \text{NaN} \\ \text{NaN} \\ \text{NaN} \end{bmatrix}$$

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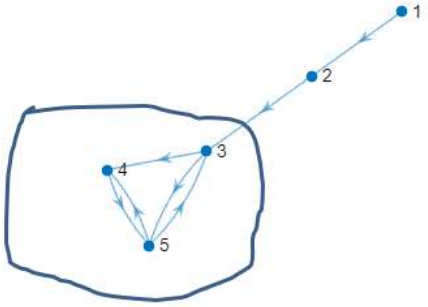
Sink gives following eigen vector:

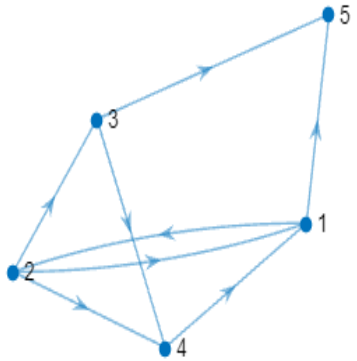
For example, consider ex3.




```
X =    0
       0
  0.2222 is the eigen vector
  0.3333
  0.4444
```

"Google Matrix" gives following eigen vector:

Using matlab we get following page rank for corresponding link of pages.



Eigen vector X =

$$\begin{bmatrix} 0.288461538461538 \\ 0.230769230769231 \\ 0.115384615384615 \\ 0.173076923076923 \\ 0.192307692307692 \end{bmatrix}$$

rank= $\begin{bmatrix} 1 \\ 2 \\ 5 \\ 4 \\ 3 \end{bmatrix}$

Page 1 will get preference than other pages.

[4]

III. CONCLUSION:

In this paper, we have seen a review of how the concept of eigen values of Linear Algebra has an application in the Page Rank algorithm. It uses power method which is an iterative method to calculate the eigen vector. The hyperlink matrix H is corrected to a stochastic matrix S because of dangling nodes and then to Google matrix G which is irreducible and row stochastic. It uses the value of damping factor μ = 0.85. The PageRank vector is prone to changes in the damping factor μ.

IV. REFERENCES:

[1]. María José Beltrán Meneu1 , Marina Murillo Arcila2 , Enrique Jordá Mora, A Teaching Proposal For The Study Of Eigenvectors And Eigenvalues, Journal Of Technology And Science Education Jotse,

2017 – 7(1): 100-113 – Online Issn: 2013-6374 – Print Issn: 2014-5349
Https://Doi.Org/10.3926/Jotse.260

[2]. David Austin, Grand Valley State University,How Google Finds Your Needle in the Web's Haystack in Feature Column from the AMS.
[3]. Amy N Langville and Carl D Meyer. Google's PageRank and beyond: The science of search engine rankings. Princeton University Press, 2011
[4]. https://personalpages.manchester.ac.uk/staff/yanghong.huang/teaching/MATH36032/html/labdemo16.html

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THE EFFECT OF SLEEP LENGTH ON ACADEMIC PERFORMANCE OF STUDENTS

Vinayak Sawant, Assistant Professor, Department of humanities and applied sciences, Atharva College of Engineering, Malad.
Shreepad Prabhu,Assistant Professor, Department of Mathematics, S.R.M. College, Kudal.
Deepika Panchal, Assistant Professor, Department of humanities and applied sciences, Atharva College of Engineering, Malad.
Priyanka Malgaonkar, Assistant Professor, Department of humanities and applied sciences, Atharva College of Engineering, Malad.

ABSTRACT:
Overall longer duration of sleep correlated with better grades. Factors such as sleep, stress, family background etc. makes an effect on academic performance of students. Sleep deprivation impairs learning processes and memory consolidation. Sleep habits and academic performance are correlated. Sleep length and SGPA are dependent.

Key Words: *Sleep length , SGPA, Chi- Square Test, d.f. (degrees of freedom)*

INTRODUCTION:

Sleep loss is one of the most striking problems of modern society [1]. Very often, to cope with so many things to do every day, we prefer to give up some sleep in the hope that doing so won't cause harm and will allow us to do more things. The aim of this study is to focus on the effect of sleep length on academic performance of the students. Under this study we have considered the hypothesis that, "There exists a relationship between Sleep Length and SGPA of students". This hypothesis is tested using **Chi-square** test [2] and Data is analyzed using pie-chart.

HYPOTHESIS

There exists a relationship between Sleep Length and SGPA of students.

AIM & OBJECTIVES

To test the effect of Sleep Length on the SGPA of college students. To check suitability of Standard Sleep Time for students as advised by National Sleep Foundation.

METHODOLOGY

Data Collection:

1) Sample survey through Google forms.

Data Analysis:

1) Chi-square Test [2].
2) Pie-Diagram.

DATA- ANALYSIS

TABLE: OBSERVED FREQUENCIES

		SGPA		
		Less than 6	**Between 6 to 10**	**Total**
Sleep Length	**Less than 6**	435	53	488
	6-8	134	335	469
	More than 8	40	9	49

	Total	609	397	1006

TABLE: EXPECTED FREQUENCIES

		SGPA		
		Less than 6	**Between 6 to 10**	**Total**
Sleep Length	**Less than 6**	295.4	192.6	488
	6-8	283.9	185.1	469
	More than 8	29.7	19.3	49
	Total	609	397	1006

TESTING OF HYPOTHESIS

H_0 : Sleep Length and SGPA are Indepenent.

H_1 : Sleep Length and SGPA are dependent.

O - Observed frequencies

E - Expected frequencies

$$\chi^2_{Cal} = \sum \frac{(O-E)^2}{E}$$

O	E	$\frac{(O-E)^2}{E}$
435	295.4	65.97211
134	283.9	79.14762
40	29.7	3.572054
53	192.6	101.1846
335	185.1	121.3939
9	19.3	5.496891

d.f.(Degrees of freedom)= 2

$\chi^2_{Cal} = 376.7672$

$\chi^2_{0.01} = 9.215$

$\chi^2_{0.05} = 5.991$

	Sleep Length (In Hrs.)	**SGPA**
	More than 8	**Less Than 6**
	Less Than 6	**Less Than 6**
	6-8	**Less Than 6**
	More than 8	**6-10**
	Less Than 6	**6-10**

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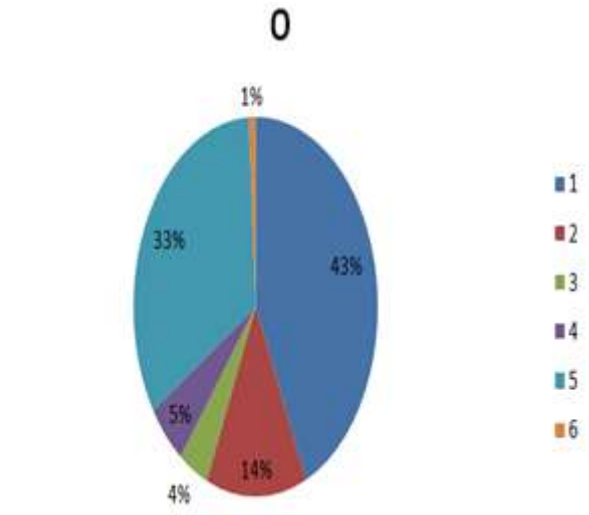
	6-8	6-10



RESULTS

1. Since calculated value of $\chi^2_{Cal} = 376.7672$ is much greater than the table value of $\chi^2_{0.01} = 9.215$ for 1% level of significance and $\chi^2_{0.05} = 5.991$ for 5% level of significance, null hypothesis H_0 is rejected.
2. Pie chart indicates that ,
   i) 43% students sleep for less than 6 hours and their SGPA is less than 6.
   ii) 33% students follow the standard rest period(6-8 hrs) and have SGPA greater than 6.

CONCLUSIONS

The Data analysis shows that:

1) Sleep habits and academic performance are correlated.
2) Sleep length and SGPA are dependent.
3) Students who follow the standard rest period (6-8hrs) have better SGPA.

References:

[1] Giuseppe Curcio, Michele Ferrara, Luigi De Gennaro, *Sleep Loss, Learning Capacity, and Academic Performance*, Elsevier, Sleep Medicine Reviews (2006) 10, 323–337.
[2] S. C .Gupta, *Fundamentals of Statistics*, Himalaya Publishing House.
[3] Glyn Davis, Branko Pecar, *Business Statistics using Excel*, Oxford University Press.
[4] P. N. Arora , *Biostatistics*, Himalaya Publishing House.

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IMAGE COMPRESSION USING SINGULAR VALUE DECOMPOSITION

Priyanka Malgaonkar, Assistant professor, department of humanities and applied sciences, Atharva College of Engineering, Malad.
Deepika Panchal, Assistant professor, department of humanities and applied sciences, Atharva College of Engineering, Malad.
Divya Acharya, Assistant professor, department of humanities and applied sciences, Atharva College of Engineering, Malad.
Vinayak Sawant, Assistant professor, department of humanities and applied sciences, Atharva College of Engineering, Malad.

Abstract: Image compression is the process of reducing the size of an image file while retaining its quality. When we compress a digital photograph or graphic file, it maintains the same image resolution but shrinks the amount of processing data that a computer uses to view or display that image which ultimately reduces the memory used for the storage of image files. There are various algorithms used for image compression. Linear Algebra (SVD) plays an important role in image compression. In this paper, we will discuss what is Singular Value Decomposition (SVD), how to compute singular value decomposition(SVD) and the size of stored images is reduced by removing small singular values. We will use MATLAB to get the final output.

Keywords: *Image compression, Singular Value Decomposition, MATLAB*

I Introduction

To store a large amount of data much storage space is required. We often share information through pictorial data but many times we are running out of storage space and the speed of our devices get reduced. Image compression aims to minimise the amount of data needed to represent an image. The algorithm for image compression's primary objective is to represent images using the fewest number of bits.

In order to save an image using less memory while maintaining the image quality, we explore employing the technique of Singular Value Decomposition to compress the size of the saturation matrices while keeping the most crucial elements..[3][6]

II Singular Value Decomposition: What is it?

To perform singular value decomposition (SVD), a matrix A must be transformed into the form $A = U\Sigma V^T$ With the use of this computation, we are able to keep the crucial singular values that the image needs while letting go of the values that are not as crucial to maintaining the image's quality.
The square roots of the eigenvalues of the n × n matrix A^TA, which are normally arranged by magnitude in decreasing order, make up the singular values of a m × n matrix A.

How to compute the SVD of Matrix

we solve one example of SVD using the theory process. Let $A = \begin{bmatrix} 3 & 2 & 2 \\ 2 & 3 & -2 \end{bmatrix}$

We begin by forming matrix AA^T

$$AA^T = \begin{bmatrix} 17 & 8 \\ 8 & 17 \end{bmatrix}$$

Next step is to calculate Eigenvalues of AA^T. For that compute determinant of $(AA^T - \lambda I)$. Find characteristic equations i.e. det $(AA^T - \lambda I) = 0$.
After solving we will get the characteristic equation as $\lambda^2 - 34\lambda + 225 = 0$.
The roots of this equation are $\lambda = 25, 9$.
Therefore the singular values are $\sigma_1 = 5$, $\sigma_2 = 3$. Now we have to form matrix V.
We find orthonormal set of eigenvectors of A^TA. The eigen values of A^TA are 25, 9 and 0.

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For $\lambda = 25$ we have, $A^TA - 25I = \begin{bmatrix} -12 & 12 & 2 \\ 12 & -12 & -2 \\ 2 & -2 & -17 \end{bmatrix}$

We then solve the homogeneous equation$(A^TA - 25I)\, X_1 = 0$. We get $X_1 = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$

We then normalize the eigenvector by dividing by its magnitude. We get $v_1 = \begin{bmatrix} 1/\sqrt{2} \\ 1/\sqrt{2} \\ 0 \end{bmatrix}$

We do this for each eigenvalue and form a matrix $V = [v_1 \quad v_2 \quad v_3] = \begin{bmatrix} 1/\sqrt{2} & 1/\sqrt{18} & 2/3 \\ 1/\sqrt{2} & -1/\sqrt{18} & -2/3 \\ 0 & 4/\sqrt{18} & -1/3 \end{bmatrix}$

We list non-zero singular values down the major diagonal in decreasing order to decide matrix Σ.
Hence $\Sigma = \begin{bmatrix} 5 & 0 & 0 \\ 0 & 3 & 0 \end{bmatrix}$.

So at this point we know that $A = U\,\Sigma\,V^T = \mathrm{U} \begin{bmatrix} 5 & 0 & 0 \\ 0 & 3 & 0 \end{bmatrix} \begin{bmatrix} 1/\sqrt{2} & 1/\sqrt{2} & 0 \\ 1/\sqrt{18} & -1/\sqrt{18} & 4/\sqrt{18} \\ 2/3 & -2/3 & -1/3 \end{bmatrix}$

We can compute U by the formula $u_i = \frac{1}{\sigma} Av_i$. This gives $U = \begin{bmatrix} 1/\sqrt{2} & 1/\sqrt{2} \\ 1/\sqrt{2} & -1/\sqrt{2} \end{bmatrix}$.

The SVD is $A = U\,\Sigma\,V^T = \begin{bmatrix} 1/\sqrt{2} & 1/\sqrt{2} \\ 1/\sqrt{2} & -1/\sqrt{2} \end{bmatrix} \cdot \begin{bmatrix} 5 & 0 & 0 \\ 0 & 3 & 0 \end{bmatrix} \begin{bmatrix} 1/\sqrt{2} & 1/\sqrt{2} & 0 \\ 1/\sqrt{18} & -1/\sqrt{18} & 4/\sqrt{18} \\ 2/3 & -2/3 & -1/3 \end{bmatrix}$

III Application to Image compression

When we look at the white colour on our screen, there is no white pigment on the screen. It is a combination of red, green, and blue colours that are depicted on the screen by minuscule pixels. When viewed from a distance, the saturation of each pixel in this grid-like pattern causes it to appear a distinct colour. These red, green, and blue pixels range in saturation on a scale of 0 to 255; with 0 being completely off, and 255 being completely on.[2] A picture can represent data in a matrix because of the pixel's grid-like nature.

Consider a grayscale image. Red, green, and blue values must match in order to make an image grey. We can represent a pixel as having a value of 0 through 255 and then repeat that value across the red, green, and blue saturation to get the corresponding shade of grey.[2]

Let's say we have a grayscale image with a size of 5184 x 3456 pixels. A matrix that is also 5184 x 3456 and with values ranging from 0 to 255 can be used to represent each of those pixels; the matrix's dimensions are5184 x 3456. Now, we should have to keep track of exactly 5184 x 3456 digits if we want to store that image. If it was coloured, it would be triple that of a grayscale image, which equals 1.64 MB for a grayscale image or 4.92 MB for a coloured image. To save memory on the image we can compute singular value decomposition and then calculate some level of precision.

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a) Implementation in Grayscale image

In MATLAB, we use and modify existing code from Dr Brady Matthews' paper "Image Compression using Singular Value Decomposition" to load an image, isolate the corresponding saturation matrix, and then modify the matrix based on its singular values[2][3].

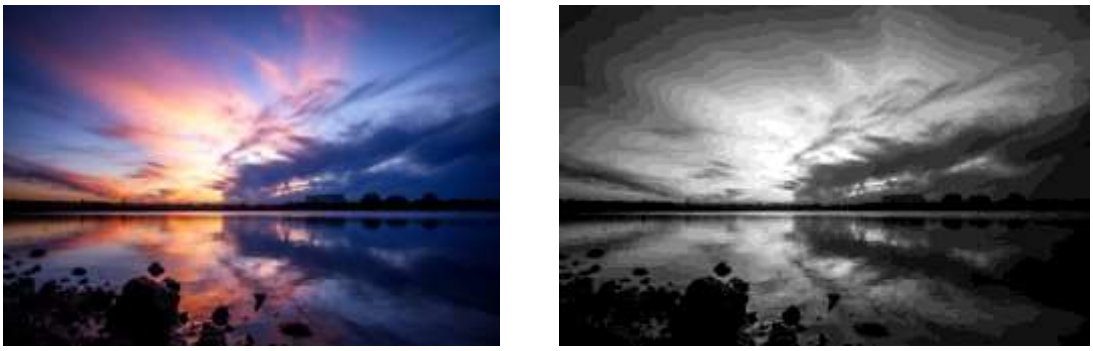

Fig. 1 Coloured and Grayscale image.[4]

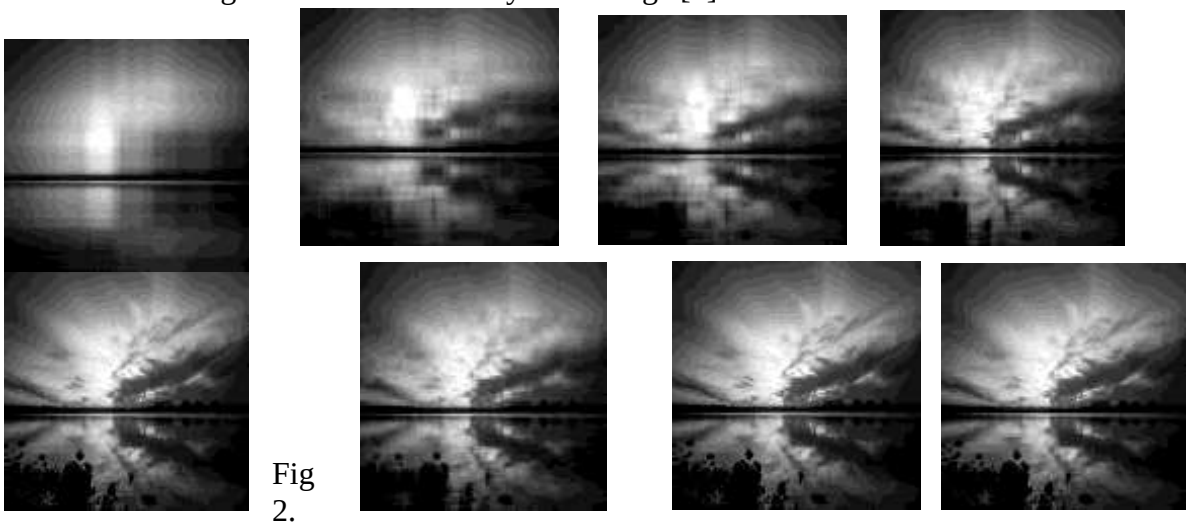

Fig 2.

Images formed using MATLAB with singular values {{2,6,12,20}, {25,50,100,150} }

From fig 1. And 2 we get the following results:

Original Image	689 KB (7,06,400 bytes)
with a singular value of 50	440 KB (4,51,239 bytes)
with a singular value of 100	480 KB (4,92,335 bytes)
with a singular value of 150	500 KB (5,12,000 bytes)

This shows that these modes save quite a bit of memory. The inaccuracy in the picture compression process and how the image differs from the original image are displayed in the following graph. The error is calculated as the difference between our new image and our original image, and this difference is then plotted on a graph. We can infer from figs. 3 and 4 that when more singular values are used, the rate change of the error loss becomes less significant. [3]

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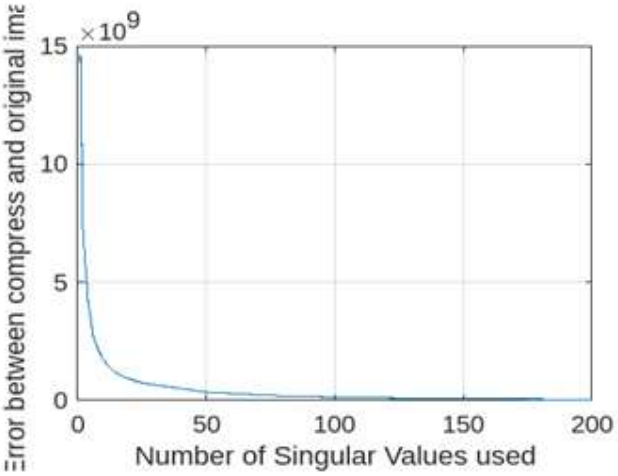

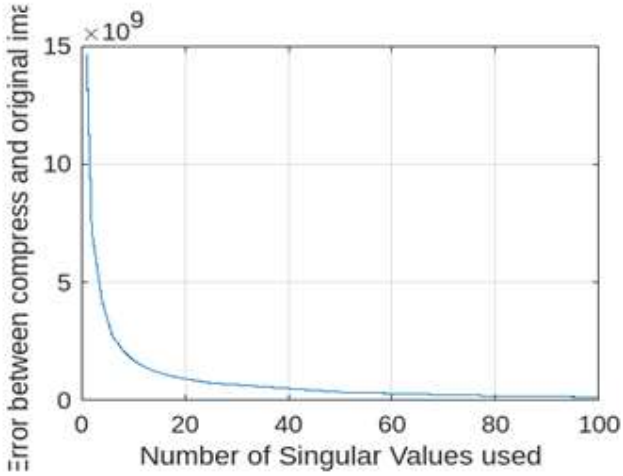

Fig.3 By taking singular values up to 200 Fig. 4 By taking singular values up to 100

b) *Implementation in colour image*

As Shown above we used image compression for the grayscale image. Now we will expand this process for a colour image. For this, we choose a colour image of the flower as shown in fig. 5

Fig. 5 [5]

Each pixel in the full colour image has colour saturation representation values of 0 to 255 for red, green, and blue. Since the image becomes more complicated as a result, more storage space is needed to save it. We can determine the contribution each colour makes to each pixel by comparing how each one is represented to the full-colour image, as seen in fig 6

Fig. 6

Since each of these three colours contains a unique matrix of image information, we must first divide the full-colour image into its red, green, and blue layers before we can perform the SVD method. Each of the colour matrices will have its smallest singular values removed, and we'll use those values to modify the matrices before reconstructing the full-colour image. The quality of the image in Fig. 7 improves as we compute the SVD and only reinsert particular singular values. There isn't much we can tell about the original image from a value with just one single. We can more easily identify the image as a flower as singular values are added back in [2].

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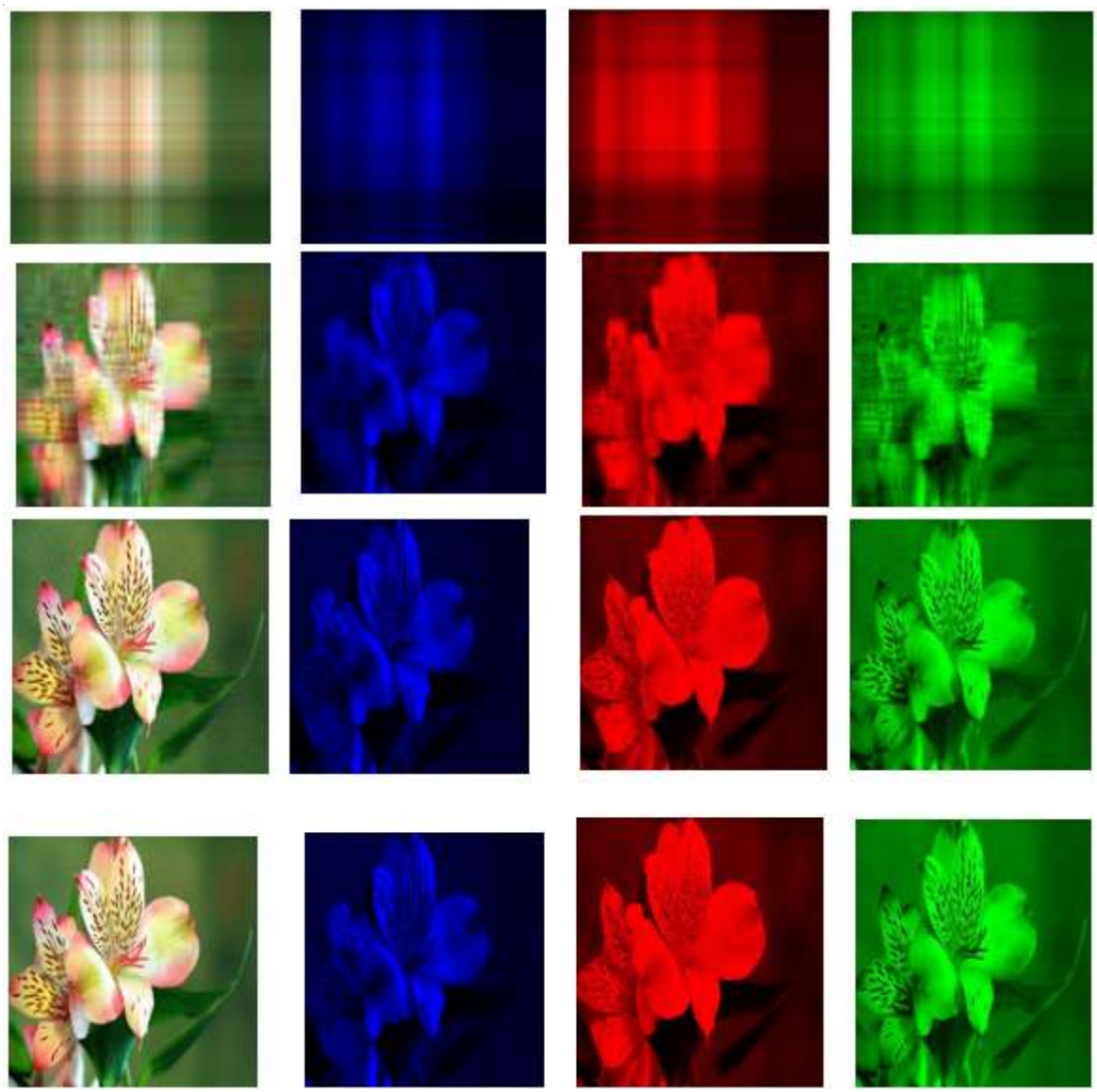

Compressed Image

If we compared the original and compressed images, we can see a noticeable difference in storage size. i.e our main challenge of saving storage space is fulfilled. The original image took 1.64 MB of memory and the compressed image with 100 singular values is taking 775 KB of memory which is almost 50% of the original image. Comparing them side by side, they appear to be nearly identical, but their storage capacities and information matrices are substantially less. Instead of naturally lowering the number of pixels in these comparisons, we have kept the original amount by removing unimportant singular values.

Conclusion:

We apply singular value decomposition to both greyscale and colour image and from above result we can say that, our main aim to compressed data without reducing the quality of an image is achieved. For the colour image, when we apply singular value 100, we are able to save half of the memory. In the future, we can apply this process to every frame of videos will definitely save significant amount of storage. This process will also help in face recognization.

References:

1) Lay, David C., Linear Algebra and its Applications, 3rd updated Edition, 2005
2) Mathews, Brady, "Image Compression using Singular Value Decomposition (SVD)," 2014.
3) Elizabeth A. Compton and Stacey L. Ernstberger, PhD, " Singular Value Decomposition: Applications to Image Processing", 2020
4) Gaston Abascal, "Tigre, Buenos Aires, Argentina" https://unsplash.com/s/photos/Tigre%2C-Buenos-Aires%2C-Argentina, 2018.
5) Anthony Pexels, "pexels-anthony-)-132468.jpg", 2020.
6) H R Swathi, Shah Sohini, Surbhi and G Gopichand, "Image compression using singular value decomposition"

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PIGEN - A PERSONAL CLOUD STORAGE AND FILE-SHARINGPLATFORM

Anjan Nair, Ciba Patel, Manish Bandi, Vedant Narayankar, Trisha Ghosh, Kavita Bani,
Department of EXTC, Atharva College of Engineering Mumbai, India

Abstract—This project presents the development of personal cloud storage and file transfer systems with the help of Raspberry Pi 3 and Hard disk drive devices. The main aim of the project is to save your files locally on your Hard Disk Drive connected to the Raspberry Pi as well, access files remotely even if you arenot connected to the WI-FI which is also connected to Raspberry Pi, and share them with anyone you wish to.

Keywords – Personal Cloud Storage, file transfer, Raspberry Pi 3, Hard disk drive, remote access.

I. INTRODUCTION

In today's fast-paced world we humans produce a lot of data. The data produced is roughly estimated to be 2.5 quintillion bytes. We make use of cloud services Amazon Web Service (AWS), Microsoft Azure, Google Cloud Platform (GCP), etc. These services are not free and sometimes they are unaffordable for users such as students. We have come up with a solution of making personal cloud storage using the user's new hard disk drives which will also solve the problem of e-waste. Waste hard drives are unique among waste electronic equipment as they store vast amounts of personal information and thus require careful handling to ensure data security, environmental preservation, and sustainable development. An integral partof the services is a file-sharing feature that the user can use to easily share any of the files they want while ensuring that the security and integrity of the file are maintained.

In the constantly changing technological landscape, the security of our data and the need for ample storage space to manage it are paramount concerns. This project focuses on addressing these issues. Third-party cloud services pose privacy risks as they can be accessed by multiple users, offer limited storage and control over our data, and come with a steep cost. By using Raspberry Pi, we can convert our external hard drive into a personal cloud storage solution with full control over the amount of memory available and our data. We can access this data from anywhere with internet access, effectively treating our external hard drive as a cloud storage device. Cloud storage prevents users from carrying unnecessary storage devices, they just haveto create an account on one of these cloud as mentioned above services and pay on a monthly or yearly basisto use cloud storage services.

PiGen is the conjunction of two syllables Pi and Gen. Pi comes from raspberry Pi and Gen refers to the new generation. Our project has a file-sharing feature embedded in it, so like in the olden days when pigeonswere used for communication or sending important information so our project signifies the work of pigeons.Hence the name PiGen.

II. PROBLEM STATEMENT

We want to design and implement a personal cloud storage and file-sharing system, with the help of Raspberry Pi 3. In this type of system, the user will have to sign up through our website and then need to connect his hard disk drive to the Raspberry Pi to access it. After logging in to the website he/she can easilyaccess the file or upload the files or share it with other users.

III. FLOW CHART

It shows the basic flow of our project. The user has been signed in for using our services in this flowchart.

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If the user has not signed in and is new to our services then he/she just has to sign in using credentials suchas email-id and he/she also has to create a password so that his/her files as secured and only he can access his files. After that, he will be redirected to the PiGen website page where he can share, upload and store his/her files.

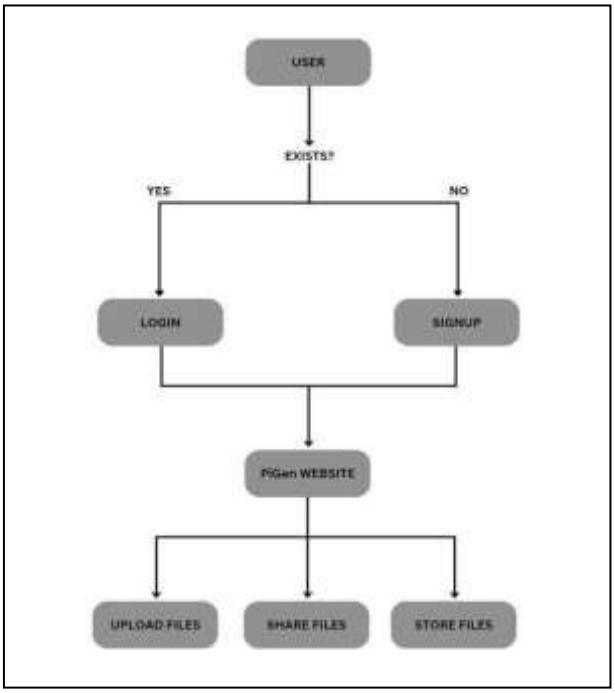

Figure 1 – Flow Chart of the Website

IV. RELATED WORK

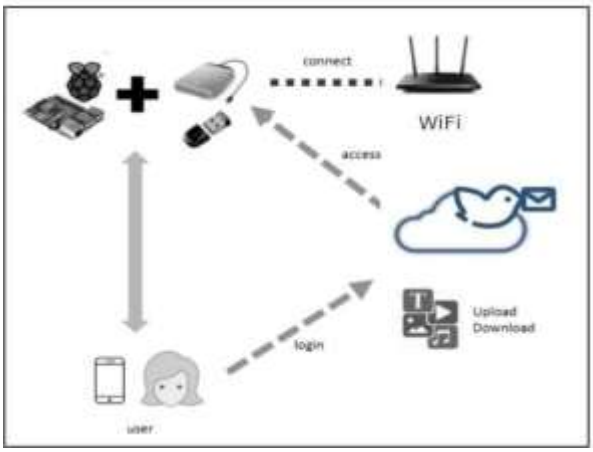

Figure 2 – Project layout [9]

The creation of personal cloud storage requires a careful and thorough approach to determining its components, modules, and data in order to fulfil specific requirements. The design is a comprehensive representation of how the data inputs and outputs, as well as the flow of data, in personal cloud storage, are organized. This design is frequently depicted through the use of Raspberry Pi as a model. The objective of designing personal cloud storage is to produce a technical solution that satisfies the functional needs of cloud storage, including scalability, reliability, security, accessibility, and ease of use. It also

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addresses the problems faced by the developer and outlines the processes, flow, and activities involved in the personal cloud storage process. The design in the above figure depicts that the User has to create his/her account on our PiGen Cloud and log in to upload and download files from it. We use an external hard disk to store its files on the cloud and it is connected to the Raspberry Pi. The Raspberry Pi is wirelessly connected to the Laptop/Mobile through a Wi-Fi connection.

V. BLOCK DIAGRAM AND DESCRIPTION

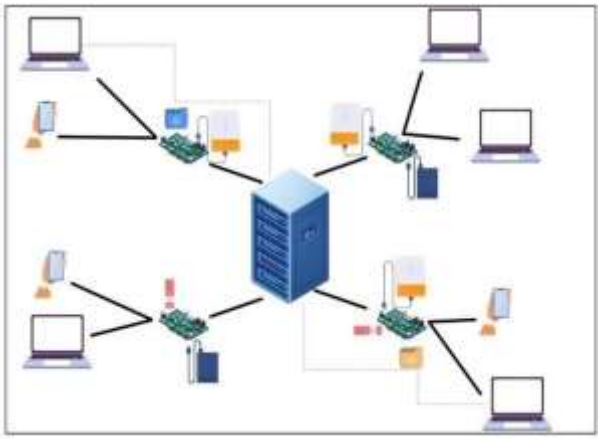

Figure 3 - Block diagram

We will be using a Raspberry Pi and hard disk drive to store our files. All the users will be connected to aserver that would act as a central database server and through that, they will be able to share the files. The user can even access the hard disk remotely.

VI. CIRCUIT DIAGRAM

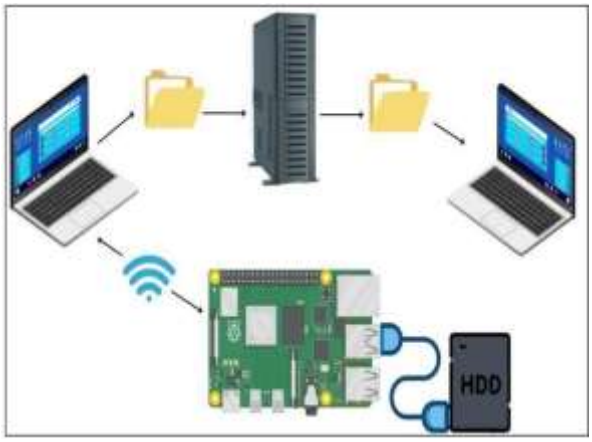

Figure 4 - Circuit diagram

The Hard Disk Drive or storage device can be accessed remotely through our PiGen website. The Raspberry Pi is connected to the User's PC through Wi-Fi technology. The server is used for the sharing offiles present on the Hard Disk Drive to the other user's PC.

VII. ADVANTAGES

It boasts a straightforward web design compared to other cloud services. Utilizing existing hard drives helps reduce electronic waste. Users have control over their storage space through their own hard drives. Enhanced security features, including encryption, ensure all data is secure. Large hard drives provide

amplestorage for a large amount of data.
Additionally, users can access their personal data from anywhere with this cloud storage solution.

VIII. APPLICATIONS

A. Users can upload files or even folders using our PiGen website.

Figure 5. – File Upload

B. File details

We get full details about the file such as file name, file size, and even the date when the file was uploaded.

Figure 6. – File Details

C. Features (Download/ Delete / Copy)

We can easily download or delete and even share the file with the generated link.

Figure 7 – Features

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IX. COMPONENTS

A. SOFTWARE USED

1. VS Code: We have used visual studio code editor as an IDE for writing our HTML, CSS, and JavaScriptcode for our website, so every individual can easily use it. We have used the above for building the frontendpart of our website.

Figure 8 – Logo of VSCode [10]

2. MongoDB: We have used MongoDB software to store the login credentials of the user and store themsecurely in a database. It will store the user credentials such as email ids, passwords, and usernames.

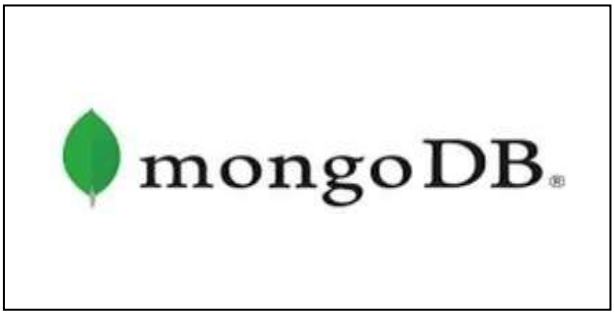

Figure 8 – Logo of mongoDB [11]

B. HARDWARE USED

1. The Raspberry Pi 3 Model B+ is the newest iteration in the Raspberry Pi 3 line and features a powerful 64-bit quad-core processor running at 1.4GHz, as well as dual-band 2.4GHz and 5GHz wireless LAN, Bluetooth 4+ and Low Energy technology, quick Ethernet, and the ability to support PoE through a separate PoE HAT. Its dual-band wireless LAN has built-in certification, making it easier to integrate into end-user products, saving time and money in the process. The physical design of the Raspberry Pi 3 Model B+ is consistent with the Raspberry Pi 2 Model B and Raspberry Pi 3 Model B.

Figure 9 – Raspberry Pi [12]

1. Hard Disk Drives A hard disk drive (HDD) is a computer storage device made of flat disks covered

withmagnetic material. It can store large amounts of information. Data is stored on these disks through magnetization. The disk spins and a magnetic head reads and writes binary digits by changing the direction of magnetization on the disk. An HDD consists of multiple disks, heads for reading/writing, a motor and circuitry all protected in a metallic case. The term "hard disk" also refers to a computer's internal storage. In the early 21st century, some personal computers and laptops started using solid state drives (SSDs) which use flash memory instead of HDDs for storage.

Figure 10 – Hard Disk [13]

X. COMPARISON OF IDEA WITH PRESENT SYSTEM

Cloud provider	Storage(GB/Month)	File Ownership
Amazon S3	$0.023	Public
Azure	$0.021	Public
Google Cloud Platform	$0.023	Public
PiGen	One-time purchase of required components	Private

Table 1 – Comparison Study with the present system

XI. FUTURE SCOPE

We can use the leftover storage space of the user and share it with another user who has his storage full and charges them a minimal fee for this service. We can also make it available for mobile users by making mobile applications so that more in-app features can be accessed by the user. For added user privacy on- thefly encryption can be added so that corporate users can adopt this for transferring files safely and in a private manner without worrying about anyone accessing it. Allowing the owner of the Raspberry Pi PiGencloud to add more users to his account and thus create a “Family” account can also be achieved. A major penetration in the market can be achieved by providing the hardware pre-configured without the user needingto deal with the technical details of the setup. Something like buying and setting up an Alexa can be done here

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XII. RESULT

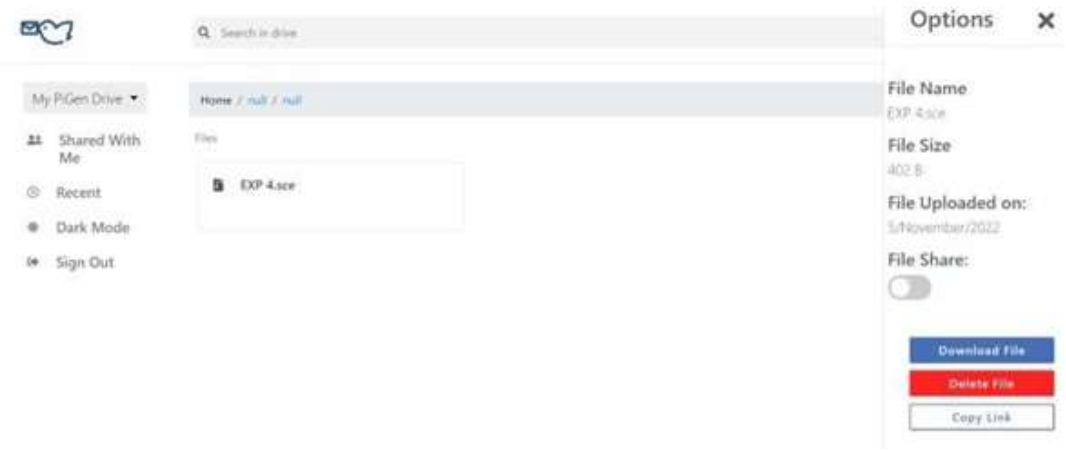

Figure 11 – Pigen Website

We have successfully built the front-end part of our website using HTML/ EJS, CSS, and JavaScript. Built the backend with the help of NodeJs and used EJS to render the output on the client side.

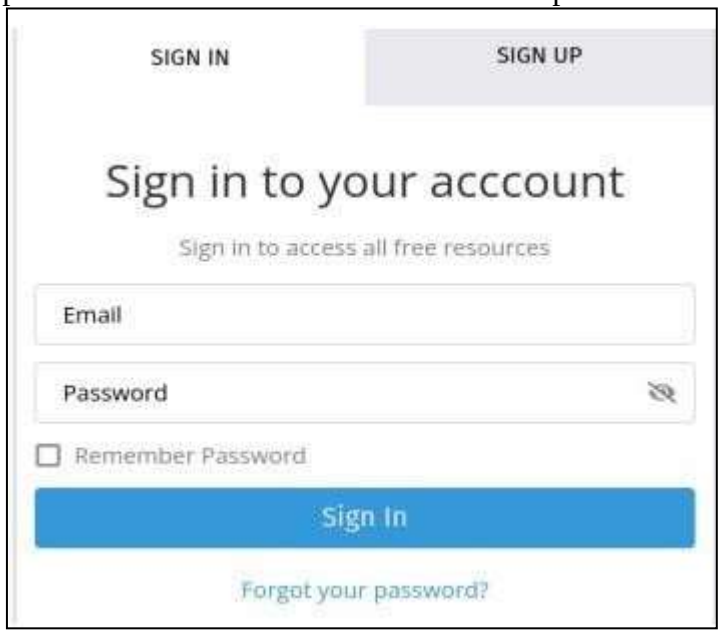

Figure 12 – Sign in and sign up

We have tested the sign-in and sign-up. The authentication of the page also helps in security and increases the efficiency of our website.

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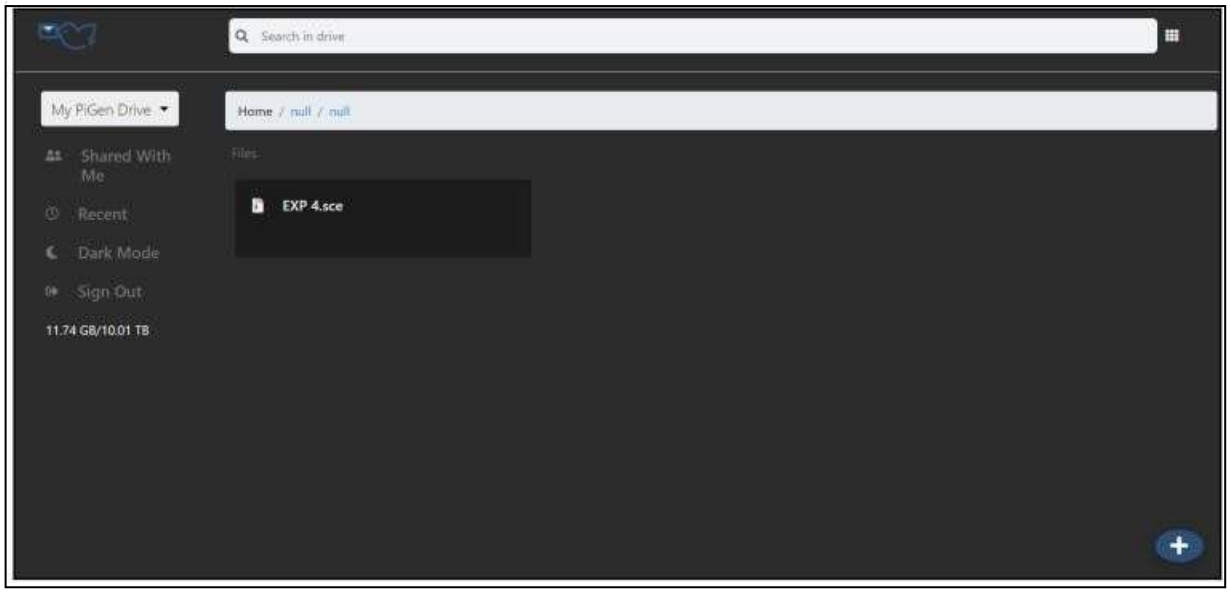

Figure 13 – PiGen Website in dark mode

. We have also tested the dark mode of our website which will help users to work as per his/her preference.

XIII. CONCLUSIONS

Daily, we read about Google's monopoly on users' data, although lawmakers and governments are starting to take notice of this now it's time we own our data without needing to depend on big tech companies. We have made a personal cloud storage and file-sharing system for the users. A user-friendly website has been added as a layer to the cloud service so that even non-technological users can access the website without any assistance. With features such as downloads, remote access, and link sharing a user can easily adopt this self-hosted cloud storage.

REFERENCES

1. Katalin Ferencz, Jozsef Domokos, IoT Sensor Data Acquisition and Storage System Using Raspberry Pi and Apache Cassandra, IEEE CANDO-EPE 2018, IEEE International Conferenceand Workshop in Obuda on
2. Electrical and Power ´ Engineering, Nov. 20-21, 2018, Budapest, Hungary
3. Raul Gracia Tinedo, Marc Sanchez Artigas, Adrian Moreno Martinez, Cristian Cotes, and PedroGarcia Lopez, Actively Measuring Personal Cloud Storage, 2013 IEEE Sixth International Conference on Cloud Computing
4. S. Emima Princy, Mr. K. Gerard Joe Nigel, Implementation of Cloud Server for Real-Time DataStorage using Raspberry Pi, 2015 Online International Conference on Green Engineering and Technologies (IC-GET 2015)
5. Fairuz Rauff, Maalik Ithing, Zuraidy Adnan, Personal Cloud Storage using Raspberry Pi, International Journal of Computer Applications (0975 – 8887) Volume 180 – No.22, February2018
6. Network-attached storage. (2022, August 24)
7. Develop Your Own Personal Cloud using Raspberry Pi
8. Raspberry Pi 2 Server Essentials by Piotr J Kula, Released April 2016, Publisher: Packet Publishing

9. https://www.ijcaonline.org/archives/volume180/number22/rauf-2018-ijca-916331.pdf
10. https://blog.hpc.qmul.ac.uk/vs_code_apocrita.html
11. https://www.beltsysplus.com.br/wp-content/uploads/2018/08/mongoDB-logo-1.jpg
12. https://www.indiamart.com/proddetail/single-board-computer-23158143255.html
13. https://boomit.ca/wp-content/uploads/2020/12/Toshiba-Hard-Drive-2.5-500GB-7200RPM.png
14. https://www.mongodb.com/
15. https://code.visualstudio.com/

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ANALYSIS OF CO-SORTS BASED ON ASSESSMENT MODULE USING PBL IN PHYSICS

Arti Hadap & Vinita Khatri MPSTME, NMIMS, Deemed to be University, Mumbai, India
Email: arti.hadap@nmims.edu, vinita.khatri@nmims.edu

Abstract: In this paper qualitative analysis of Co-SoRTS based assessment module using Project Based Learning (PBL) in Physics for first year engineering students is presented. We propose an effective interaction and hands on experience with guided creative thinking via PBL which leads students towards research or product development ideas from their initial days itself. A detailed questionnaire was made to collect data for reflections of for students and teachers on PBL. Survey questionnaire helped in collection of data. Data is analysed using multivariate analysis and mixing qualitative-constructivist content analysis. Our Result analysis through questionnaire stimulation indicator, conclude that, maximum positive response is received for working in group 30.3 % and the researching ideas 38.7 % which will indicate an important role in enhancing the Co-SoRTS skills in the students.

Key words - Physics, Project based learning, Engineering students, Skills

Introduction

Skill enhancement and skill development are the challenging areas to focus for 21st century students. Communication, Social skills, Self-management, Research skills and Thinking skills (Co-SoRTS) are the set of abilities related to logical analysis and evaluation of arguments [1]. According to researchers, skill set like critical problem thinking & solving, adaptation of digital media and information technology, leadership in driving a team, inventions and productiveness, vocational learning through self-motivation, understanding of diversity in sociological thinking**,** computer literacy and knowledge of information technology for communication should be complemented with basic skill set of reading writing and arithmetic solving [2]. Students got benefits in developing multiple skills at different levels. For example, through PBL, elementary students learned to understand multiple perspectives and conflict resolution skills [3], special education students developed social skills such as patience and empathy [4], and low-ability students demonstrated initiative, management, teamwork and conscientiousness as they worked in groups [5]. However, positive effects were found to depend largely on the quality of the group process [6].

Accountability and Quality of higher education system can be measured by the percentage of developing individuals/students who are excellent, thoughtful, creative and well-rounded. To get such individuals/students it is very much required:

- to increase the accessibility and enrolment of students in higher education
- to enable students to study one or more specialized areas of interest at an in-depth level
- to reduce the boundaries of choosing specialization and establish a multidisciplinary environment
- to incentivize research or innovation perusal which is the back bone of a developing country (previously it was seniority based)
- to develop character, moralistic and intrinsic values, intellectual curiosity, scientific and creative thinking, service spirit, and the skills of the 21st century across a range of fields, including sciences, social sciences, the arts, humanities, languages, personal, technological and the vocational subjects.

Considering the key role of educator to develop and implement different pedagogies and apply available pedagogies in different way, in this paper, we propose a study and analysis of project-based learning (PBL) pedagogy. Review of PBL evidences, the practicing PBL has started long back, with a

very positive impact on learning in all streams [7-10]. Though PBL results to be effective in terms of developing creative thinking, enhancement in problem solving capabilities, and self-directed learning skills.

Conventionally, PBL is engaging students in real world problem solving and answering complex problems, by involving them on live projects over a long period of time, under the continuous guidance by the teachers [11-13]. Evaluation of their overall skills are done by demonstration of the created product or presentation for an actual spectator. As a result, students develop deep content as well as Co-SoRTS skills [14-17]. Project Based Learning releases a contagious, creative energy among students and teachers by regular one to one physical interaction.

Different pedagogies are practiced as a workable solution. In this paper, we propose a methodology development and qualitative analysis of PBL for Physics. The class room we selected to study, is of first year Physics subject and last year engineering students. Previously, as a conventional PBL, project implementation was always the integrated part of curriculum of engineering final year (last semester) students. Before pandemic, engineering students were facilitated with giving hands on experience on tools, machines, and one to one physical interaction with the mentors/ faculties and their group mates for completion the projects. But for first year students conventional teaching and evaluation in terms of mid-term exams, practical, term end exam were the only options. The technical product generating ideas and involvement in research with critical thinking was lacking for first year students. Even final year students were exposed to work on project [PBL] in their last year of engineering courses. Which could lead a monotonous teaching learning experience for engineering students before their final semesters. In this paper we propose an effective replacement of one-to-one interaction with the virtual interaction and hands on experience with guided creative thinking which leads students towards research or product development ideas from their first year itself. The quality of ideas and research articles generated has been compared as an analysis in virtual-class PBL and normal PBL. Evaluation of the pedagogy is done by taking the feedbacks of the students, research papers published by the students and idea of technical product developed by the students. Product development idea and involvement in the research will surely train the students for understanding research and product development since from their first year itself.

II. Methodology, Data collection and Analysis of PBL

During the first semester of the engineering, the students were asked to implement a PBL method as a part of their Physics course learning. Students never experienced PBL process in their previous studies so, first students are introduced with following steps for implementing PBL: - 1. Start with the formulation of promising and potential Question which can turn out to be a final product, 2. Design a Plan for the Project, 3. Create a Schedule for reviewing status of the project. Visualizing final out at the start of the activity will defiantly motivates the students to explore and learn. PBL need to be implemented as a group activity so, students are instructed to work as a team of four to five. One of the student members could be a mentor or leader for a team. After the discussion among the team, student mentor asked to report the final topic of the PBL activity. Finalizing PBL topic is assisted by the faculty mentors, but the origination of ideas and decisions were made by the students only. A question list was articulated by the mentor based on the project. It was intended to report and observe the sequential development of their work on the regular basis. Importantly, the evaluation standards must be chosen in way that, the PBL projects met all of the targeted points and to achieve grade-appropriate educational standards defined for the course.

The study used data collection through a survey where students reflected their views and experience on PBL, as well as their experience with the mentors. While concluding the semester, a focussed survey was conducted with the students (around 250 students, among which 140 responded), on the experience accumulation for pedagogical practicum: the PBL process. Survey consisted of twelve questions, in which few questions cover the Co-SoRTS skill set, and rest are the interview kind of

questions in which they can elaborate their views (responses provided at the end) without any limits and constraints. It was not possible to conduct one on one interview as the student-mentor ratio was very high. Participation in the survey was voluntary.

Students asked to fill the datasheet as a report too on a weekly basis. Data sheet contains the questions which are reflecting on the process they were experiencing. They are instructed to share the significant views about the process, negative and positive views about the project implementation, what they felt and what they thought about the learning process, as well as what they desired to embrace on to for imminent reference. To make the final conclusion about the PBL process by the students, question list is framed as a non-graded assignment. In assignment report they need to depict their reflections, in details, on learning out comes from the entire process, such as the significance, thoughts and feelings during the whole process, learnings from the procedure, difficulties and the lessons learnt, which might assist them in future. It is taken care that the final grades for the course are unaffected from the performance and participation in this assignment.

As mentioned above, our study model emphasizes our team to focus on the weekly discussions with the student groups about the work status, difficulties and also come up with the solutions to the problems been faced. Some interview questions are also put in the survey to understand the student status since the start of the semester, during the semester and at the conclusion of the semester. Interviews conducted on regular basis concludes the remarkable upwardly trending growth pattern in student's abilities to employ and effectively use project-based learning. The end semester general findings show a professional growth pattern as students became comfortable in creating a project-based learning environment are shown in table 1. We applied multivariate analysis, mixing qualitative-constructivist content analysis [18]. In addition, the consistency and level of quality of this study were confirmed using two methods: (a) triangulation of the research i.e. multiple instruments like survey, viva, personal interviews are used to examine the same research question (as explained above) and (b) meticulous review by the instructor. Brainstorming and discussion sessions were held, focusing on the questions and the relevant data found by each of the mentors. In cases of disagreement, the issue was chased until full agreement was reached.

Table 1- End semester general findings

Student	Beginning semester	Mid-semester	End-Semester
1.	Frustrating, time taking.	Time taking, sometimes annoying.	Still time taking but worth learning through PBL.
2.	Lack of resources.	Time consuming but finding the online resources	Increase in engagement and inquiry.
3.	Difficult to understand.	Collaboration and discussions helped to understand.	Growth in collaboration, communication and critical thinking.
4.	Difficult to connect with lived experiences.	Loved to learn using PBL.	Excitement in learning, fun and created products.

Further to obtain a perspective from the learners regarding the need and effectiveness of the PBL we used during the semester, a survey had been carried out. Survey provided student's perspectives of challenges and supports in the project-based learning process which at the same time supports our new National Education Policy too. The teacher's support was personal and caring as per students. They challenged students and provided responsive guidance and advice. The survey is analysed from the diploma students, engineering students from first year and final year as well. The details are as follows – out of around 300 students 180 have responded, and almost all among 180 students have responded positively for the learning through PBL. It is been observed from the survey that almost 85 % of the

students reported PBL as a major part of their learning throughout the semester. Along with importance of PBL, 80.3 % of the students reported extreme satisfaction in learning through PBL and some want to carry forward the work in the form of research (reported at the end of the discussion), though it is at an introductory level but students were introduced to research during the process, which will help them to build their CV strong in their initial year itself. Table below, shows the percentage of students who favoured PBL for their future growth and present learning along with their likes and dislikes in the whole process.

Table 2. The percentage of students with their likes and dislikes in the whole process

Question to students.	working in groups	creating the product	presenting ideas	researching ideas	presentation / exhibition
What did you like about working on this project?	30.3 %	12.7 %	9.2 %	38.7 %	9.2%
What did you dislike about working on this project?	12.7 %	22.5 %	15.7 %	14.1 %	35.2%

It is quite clear from the data above that maximum number of students like to work in groups and do the research while working through PBL. In all this process the role of mentor is very important and 81% students agree to the same.

Conclusion

Seeding of real-world problem-solving aptitude from first year of the course itself, with regular guidance by the mentor, can develop the new generation with research and product development mind-set. After analysing the obtained results and having discussion on the basis of the relevant theory, it can be concluded that learning using PBL the Co-SoRTS based assessment module further leads student's skills enhancement. Maximum positive response is received for working in group 30.3 % and the researching ideas 38.7 % which will indicate an important role in enhancing the Co-SoRTS skills in the students.

References

[1] M. G. Erikson and M. Erikson, "Learning outcomes and critical thinking–good intentions in conflict," Stud. High. Educ., vol. 44, no. 12, pp. 2293–2303, 2019, doi: 10.1080/03075079.2018.1486813.

[2] Chu, S. K. W., Tavares, N. J., Chu, D., Ho, S. Y., Chow, K., Siu, F. L. C., & Wong, M. (2012). Developing upper primary students' 21st century skills: inquiry learning through collaborative teaching and Web 2.0 technology. Hong Kong: Centre for Information Technology in Education, Faculty of Education, The University of Hong Kong.

[3] ChanLin, L.-J. (2008). Technology integration applied to project-based learning in science. Innovations in Education and Teaching International, 45, 55–65.

[4] Belland, B. R., Ertmer, P. A., & Simons, K. D. (2006). Perceptions of the value of problem-based learning among students with special needs and their teachers. The Interdisciplinary Journal of Problem-Based Learning, 1(2), 1–18.

[5] Horan, C., Lavaroni, C., & Beldon, P. (1996). Observation of the Tinker Tech Program students for critical thinking and social participation behaviors. Novato, CA: Buck Institute for Education.

[6] Achilles, C. M., & Hoover, S. P. (1996). Exploring problembased learning (PBL) in grades 6–12. Paper presented at the Annual Meeting of the Mid-South Educational Research Association, Tuscaloosa, AL.

[7] Jason Beringer, "Application of Problem Based Learning through Research Investigation", J. of Geography in Higher Edu., vol. 31, (3), 445–457, Sept. 2007.

[8] Elaine H.J.Yew, KarenGoh , " Problem-Based Learning: An Overview of its Process and Impact on Learning" , Health professional education, vol. 2 (2), pp 75-79 Dec.(2016). https://doi.org/10.1016/j.hpe.2016.01.004.

[9] Gabi Jerzembek and Simon Murph, "A narrative review of problem-based learning with school-aged children: implementation and outcomes", Edu. Rev., vol 65 (2), pp 206-218, 2013.

[10] YuzoTakahashi, "Problem-based Learning and Task-based Learning: A Practical Synthesis", The Kaohsiung J. of Med. Sci., vol. 24 (3), pp S31-S33, March 2008.

[11] Schmidt, H. G., "Problem-based learning: rationale and description", Med. Educ., vol. 17 (1), pp 11–16,Jan.1983. https://doi.org/10.1111/j.1365-2923.1983.tb01086.x.

[12] Cees P M van der Vleuten [1], Lambert W T Schuwirth, "Assessment in the context of problem-based learning", dv Health Sci. Educ. Theory.Pract. vo. 24 (5), pp 903-914, Dec 2019. doi: 10.1007/s10459-019-09909-1.

[13] Schwartz, P. (2001). Problem-based Learning (1st ed.). Routledge. https://doi.org/10.4324/9781315042541.

[14] Angela van Barneveld, Johannes Strobel, " Implementation of PBL in Engineering Education: Conceptualization and Management of Tensions" Proc. 2015 Canadian Engineering Education Association (CEEA15) Conf., 2015. https://doi.org/10.24908/pceea.v0i0.5790.

[15] Dods, R.F. "An action research study of the effectiveness of problem-based learning in promoting the acquisition and retention of knowledge", vol.20 (4), pp 423–37. 1997. doi.org/10.1177%2F016235329702000406.

[16] NorzainiAzman,Ling Kor Shin, "Problem-based Learning in English for a Second Language Classroom: Students' Perspectives", The int. J. of learning, vol.18 (6),pp 110-126 January 2012. doi.org/10.18848/1447-9494/CGP/v18i06/47648.

[17] M A Albanese , S Mitchell, "Problem-based learning: a review of literature on its outcomes and implementation issues", Acad .Med. , vol. 68 (1), pp 52-81, Jan. 1993. doi: 10.1097/00001888-199301000-00012.

[18] Shkedy, A. (2011). The meaning beyond words: Methodologies in qualitative research – from Theory to Practice. Tel-Aviv, Israel: Ramot.

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ANTIMAGIC LABELING OF CERTAIN FAMILIES OF DIGRAPHS USING HOOKED SKOLEM SEQUENCE

Ancy Dsouza Atharva College Of Engineering,Mumbai .
Kumudakshi Nitte(Deemed to be university),NMAM Institute of Technology,Nitte.
Divya Acharya Atharva College Of Engineering,Mumbai .

Abstract: The vertex sum at each given vertex u is equal to the total of all the edges directed into it minus the sum of all the edges directed out of it. This is known as an antimagic labeling of a directed graph G with v vertices and q edges. An antimagic digraph is a digraph that permits an antimagic labeling. In this paper, we analyze a few antimagic digraph features and use hooked Skolem sequences to demonstrate the anti magicness of specific digraph families.

.***Keywords:*** *Digraphs,antimagic,hooked Skolem sequence,graceful,vertex sum,edge sum,labeling.*

I. INTRODUCTION :

Subject to certain restrictions, a graph labeling is the assignment of integers to the vertices, edges, or both[1]. There are many different ways to label a graph. Harmonious labeling, magic labeling, antimagic labeling, and other types of graph labeling have all been researched thus far. There has been a significant lot of research on labeling graphs, but little on labeling digraphs. A labeling of a digraph D with m arcs is a one-one and onto function from the set of arcs of D to 1,...,m . The total of labels for all arcs entering u less than the sum of labels for all arcs coming out of u makes up the vertex-sum of a vertex u. If no two vertices in D have the same vertex-sum, a labeling of D is antimagic.

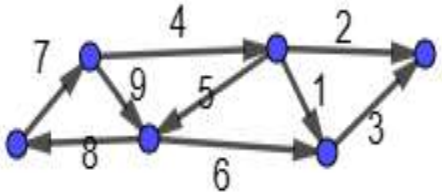

Fig1.1 Antimagic labeling

By giving each vertex v in a digraph D with p vertices and q arcs a unique integer value g(v) from 0 to q, the digraph is labeled. Each arc (u, v) is given a value g(u, v) by the vertex values, where g(u, v) = (g(v) g(u)) (mod q + 1). The labeling is referred to as a graceful labeling of digraph if the arc values are all distinct[2].

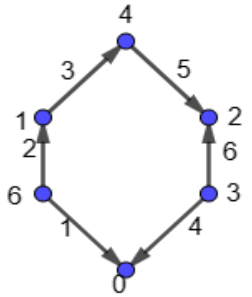

Fig1.2 Graceful labeling

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A hooked Skolem sequence of order n is a sequence $hS_n = (s_1, s_2, \ldots \ldots s_{2n+1})$ of 2n+1 integers containing each of the integers 1,2,....n exactly twice such that two occurrences of the integers j$\in$ $\{1,2\ldots\ldots n\}$ are separated by exactly $j-1$ integers and $S_{2n} = 0$[3]

$\vec{C}_k^r$ is the directed graph obtained from r copies of $\vec{C}_k$ in which any two consecutive directed cycles have a common edge

$\vec{C}$(n,n-3) is an orientation of the shell graph C(n,n-3) such that each shell is a unicycle of length 3[4].
Every connected 2d-regular graph has an antimagic orientation.

II.LITERATURE SURVEY

In literature it is observed that the existence of antimagic labelings of some families of digraphs is investigated using the concept of hooked Skolem sequences,existence of antimagic labelings of symmetric digraphs using Skolem sequences etc. Also the existence of graceful labeling is investigated using subset sum problems,(v,k,λ) difference set etc.. Antimagic labeling of digraphs and graceful labeling of digraphs are observed to be faces of the same coin as all the labeling techniques which hold for graceful digraphs also hold good for antimagic digraphs.. Every connected 2d-regular graph has an antimagic orientation.Hartsfield and Ringel proved that paths,2-regular graphs and complete graphs are antimagic.Antimagic labeling of digraphs can also be proved using using subset sum problems,(v,k,λ) difference set,skolem sequence.In this paper we are going to use hooked Skolem sequence to show the antimagic labeling of directed graph DC_n .Also we use subset sum problems to show that $\vec{C}_k^r$ and $\vec{C}$(n,n-3) is antimagic.

Let DC_n be a digraph with n vertices and 2n-3 edges.Let v_1, v_2,..... v_n be the vertices and e_1, e_2,..... $e_n$be the edges of DC_n. Let the hooked Skolem sequence be $(a_1, b_1), (a_2, b_2), \ldots (a_n, b_n)$, By assigning the ordered pairs as labels to each edges of DC_n we can get an antimagic labeling of DC_n.

For $DC_6, n = 6 \equiv 2mod4$ .The hooked Skolem sequence is given as (9,10),(1,3),(2,5),(4,8),(6,11),(7,13),(0,12).We can use this sequence to get an antimagic labeling of DC_6.

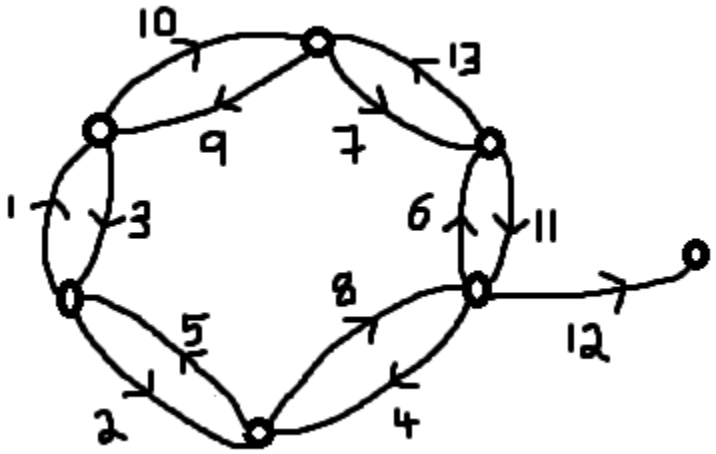

Fig 1.3 Antimagic labelling of DC_6

For $\vec{C}(8,5)$ the antimagic labeling is shown in the figure 1.4

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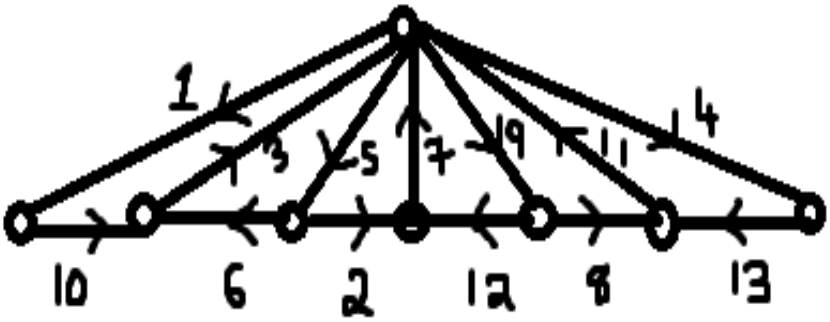

Fig 1.4 Antimagic labelling of $\vec{C}(8,5)$

CONCLUSION

In this paper we have stated that antimagic labeling for DC_n can be done using hooked Skolem sequences.Similarly antimagic labeling of $\vec{C}$(n,n-3) and $\vec{C}_k^r$ can be done using subset sum problems.It can be further proved that some other classes of digraph antimagic using this concept.

REFERENCES

[1] Joseph A.Galian,"*The Electronic Journal of Combinatorics*", Australian National University volume 1,2018.

[2]. Shivarajkumar,M.A.Sriraj,S.M.Hegde," Graceful labeling of digraphs-a survey", *AKCE International journal of graphs and combinatorics"*,Volume 18, Issue 3,2021.

[3]. Nabil Shalaby and Daniela Silvesan ,"The intersection spectrum of hooked Skolem sequences and applications",*Elsevier*.volume 167,20 april 2014.

[4]. Kumudakshi, *A study on labelings of directed graphs*,"National institute of technology,Karnataka,surathkal",2017, https://idr.nitk.ac.in/jspui/handle/123456789/14202.

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CLUSTER DECAY OF EVEN-ODD AND ODD-ODD SUPER HEAVY NUCLEI

Bhagyashree Gaikwad, Assistant Professor, HAS Department, Atharva College of Engineering, Malad west

***Abstract*—**Half-life of a cluster is a very important parameter to identify it in a nuclear reaction where it gets deposited and detected in the detection system. Half-life is also very important parameter to understand physical properties of nucleus. Here we use the energy eigenvalue as a complex eigenvalue to determine the decay width from which we can calculate the half-life. To calculate the half-life of a cluster we assume it to be a point particle. Here we develop the method to calculate the decay width and half-life. From this we show that even for the super heavy nuclei region the dominant decay process is the alpha decay process over the cluster decay process.

Keywords*—Cluster Decay, Super Heavy Nuclei,*

I .INTRODUCTION

The stability of Super- Heavy Nuclei can be greatly studied by the shell model. Super heavy elements do not have perfectly spherical nuclei. A spherical nucleus is considered to be most stable. Research studies proved that large nuclei are deformed causing the magic number to shift. [1] Since Super Heavy Nuclei are unstable these nuclei are artificially created to study its properties. The half-lives of different radioactive decays such as alpha decays, cluster decays and spontaneous fission are signs of formation of Super Heavy Nuclei. [2] The Super Heavy Nuclei decays through the two principle decay modes one is alpha decay and the other is spontaneous fission. There are various approaches for calculation of half-lives like coulomb and proximity shell model, Cluster models, semi classical approach of WKB approximations and also the viola-seaborg formula which is the phenomenological formula for alpha decay half-lives from experimental Q values. In the WKB approach the transition probability is calculated and to find the half-life and decay width the probability is multiplied by the assault frequency (a classical parameter). [3] Hence it is not a fully quantum mechanical approach. In the present work we will obtain the decay width from full quantum mechanical treatment. Before going to the procedure for finding the decay width we will first familiarize ourselves with the idea of a complex energy state. Such a state does not belong to the Hilbert space. We will develop the understanding of complex energy and such energy states in detail. By considering the state as a gamow state we will get decay width directly from which we will get the half-lives. Nowadays research on Super Heavy Nuclei is done extensively to investigate the existence of the upper bound of the periodic table.[4]Another curiosity is whether the magic number exists in Super Heavy Nuclei, or why do they fission out as soon as they are formed. The nuclear stability is determined by the interaction of nucleons inside the nucleus. Stability is decreased as we set for the large nuclear mass which is shown by the probability of spontaneous fission.

II. REVIEW

In recent research it has been seen that if we generalize the real energy eigenvalue to the complex energy eigenvalue it gives a rich amount of information about the system like if we consider the complex part of the energy it shows decay width of the decaying system. Let us see how it shows the decay width. Consider the decaying system. The outgoing particle has a free particle solution at a large distance; this wave function will spread out as time passes, thus the probability density at any point will tend to zero as time tends to infinity. Hence it is not a stationary state and breaks the time independence. But for continuum states like above, decaying states have a norm which is equal to infinite and therefore such states do not lie inside usual Hilbert space. To define this state one has to construct a space which is a superset of Hilbert space. The Resonance state or decay state is one of

such states. Such states are greatly describe by the Gamow states which can be shown by eigenvector $|E_n - i\Gamma/2\rangle$. Hermiticity of the Hamiltonian is broken due to the outgoing boundary condition therefore it has complex energy eigenvalue. Let us see how these states describe the decay state or resonance state. Consider time evolution of wave function

$$\Phi_n(r,t) = \Phi(r)e^{-i\varepsilon_n t/\hbar} \quad (1)$$

where, $\varepsilon_n = E_n - i\Gamma/2$, therefore

$$\Phi_n(r,t) = \Phi(r)e^{-iE_n t/\hbar}e^{-\Gamma t/\hbar} \quad (2)$$

Assume that Φ_n is properly normalized then no. of particles $N_n(t)$ in the state n contained in a one dimensional box of length a is

$$N_n(t) = \int_0^a |\Phi_n(x,t)|^2 dx \quad (3)$$

$$N_n(t) = e^{-\Gamma t/\hbar}\int_0^a |\Phi_n(x)|^2 dx \quad (4)$$

therefore,

$$N_n(t) = e^{-\Gamma t/\hbar}N_n(0) \quad (5)$$

Hence if we choose $\varepsilon = E - i\Gamma/2$, it represents a resonance. In our barrier penetration we don't have a bound state since the potential is either zero or repulsive. But potentials like given in fig.1 have both bound and resonance state. The real part shows the position and imaginary part shows half the width of resonance. From equation the mean lifetime of the system is the time T_n at which the number of particles in the box has diminished by e i.e. $N_n(T_n) = N_n(0)/e$. Therefore

$$N_n(T_n) = \frac{N_n(0)}{e} = e^{-\frac{\Gamma_n T_n}{\hbar}}N_n(0) \quad (6)$$

$$\frac{1}{e} = e^{-\frac{\Gamma_n T_n}{\hbar}} \quad (7)$$

$$\Gamma_n T_n = \hbar \quad (8)$$

The above relation is known as a gamow relation. In Fig.1 the spectrum of the system is represented. One can see that resonance has a width which is minus twice the imaginary part of the energy indicated by the red lines. From the gamow relation we see that width reflects the time in which the system stays in the resonance states. Wider the resonance i.e. Γ_n, smaller would be the time T_n at which the system is trapped inside the barrier. At zero energy the width is small since the barrier is high and the mean time at which the particle stays inside the barrier is large. At the top of the barrier resonance is wide hence the particle can easily escape, therefore mean time is short. If the height of the barrier tends to infinity all states have a zero width i.e. all states will be bound as we see in the infinite potential well. Therefore Gamow resonances are generalizations of bound states. Gamow resonance and bound states have a common property of obeying outgoing boundary conditions.

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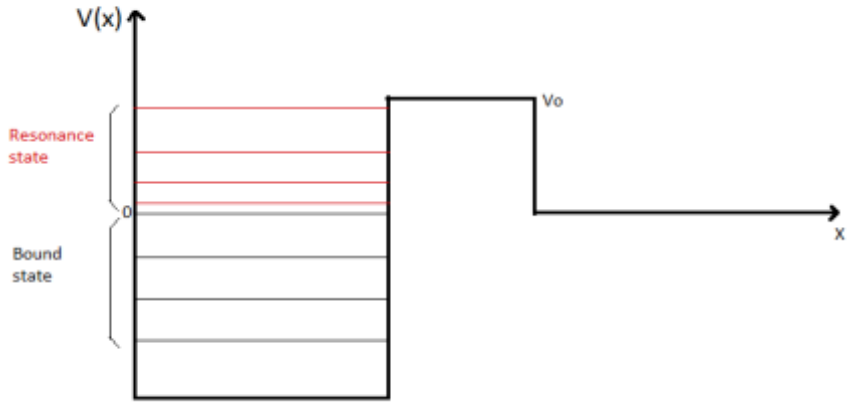

Fig1. Semi-infinite potential well.

Therefore we will call all states satisfying outgoing boundary conditions as Gamow states. These Gamow states are bound states as well Gamow resonances. In the complex K-plane we will call $K = \kappa + i\gamma$

And

$$\varepsilon = \frac{\hbar^2 K^2}{2m} = \frac{\hbar^2}{2m}(\kappa^2 - \gamma^2 + 2i\kappa\gamma) \quad (9)$$

With $\varepsilon = E - i\Gamma/2$

one gets

$$E = \frac{\hbar^2}{2m}(\kappa^2 - \gamma^2) \quad (10)$$

$$\Gamma = -\frac{2\hbar^2}{m}\kappa\gamma \quad (11)$$

The wave function behaves at large distance as

$u(K,r) \to Ne^{iKr} = Ne^{i\kappa r}e^{-\gamma r}$

(12)

and therefore it is outgoing (incoming) if $\kappa > 0$ ($\kappa < 0$).

There are four classes of poles as shown in fig.2. They are

1) Bound states, $\kappa = 0, \gamma > 0$,

$$E = -\frac{\hbar}{2m}\gamma^2 < 0, \Gamma = 0, u(K,r) \to e^{-\gamma r} \to 0 \text{ converges,}$$

2) Anti-bound states, $\kappa = 0, \gamma < 0$,

$$E = -\frac{\hbar}{2m}\gamma^2 < 0, \Gamma = 0, u(K,r) \to e^{|\gamma| r} \to \infty \text{ diverges,}$$

3) Decaying states, $\kappa < 0, \gamma > 0$,

$$E = \frac{\hbar}{2m}(\kappa^2 - \gamma^2) < 0, \Gamma = -\frac{2\hbar}{m}\kappa|\gamma| < 0, u(K,r) \to e^{i\kappa r}e^{|\gamma| r} \to \infty \text{ diverges,}$$

4) Capturing states, $\kappa < 0, \gamma < 0$,

$$E = \frac{\hbar}{2m}(\kappa^2 - \gamma^2) < 0, \Gamma = -\frac{2\hbar}{m}|\kappa||\gamma| < 0, u(K,r) \to e^{i\kappa r}e^{|\gamma| r} \to \infty \text{ diverges,}$$

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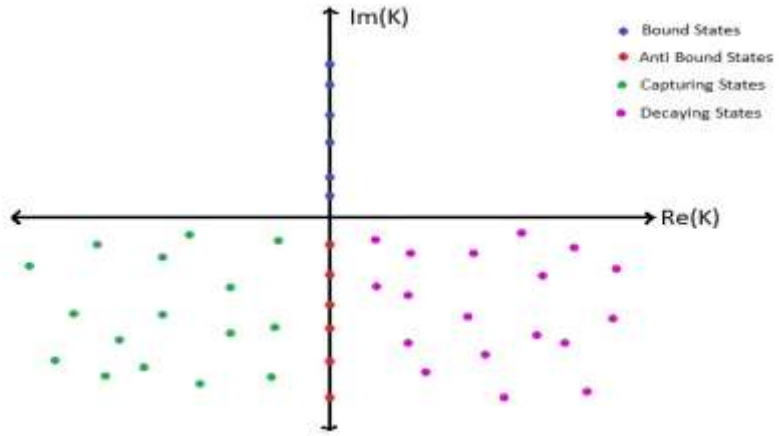

Fig 2. Complex plane representing Bound states, Anti Bound states, Capturing States and Decaying states.

Notice, for all class of states Γ is zero or negative. The above diverging wave function is normalized by an appropriate renormalization. The anti-bound states which are not real (virtual) states well about the formation of halo nuclei.

III. FORMALISM

Here cluster is considered to be point particle. [6] It is considered that a cluster moving inside the well tries to penetrate the barrier. The smallest clusters emitted are alpha particles so here we would first give a description for alpha decay which can then be applied to heavy cluster decay. We describe cluster as a point particle with well-defined mass and angular momentum moving in a gamow state under the interaction potential formed by interaction between cluster and daughter nucleus which we assumed are performed in complex state of parent nucleus and hence the size of this potential is considered to be equal to

$$r_0 A^{1/3} \quad (13)$$

Where, A is the mass of the parent nucleus Here we consider the cluster as a point particle because constructing a cluster wave function with internal structure is a very difficult task. With this assumption of a point particle our model turns out to be a simple effective model. We know super heavy elements usually do not have perfectly spherical nuclei but are deformed in their ground state. Now this deformation depends on how many particles does this nuclei have and how far they are from the shell closure. If the system is spin saturated it will always be spherically symmetric. But as we go away from the shell closure the system gets deformed since not all the orbitals are occupied. So for simplicity we consider even-even cluster emitters. Now even if the cluster is deformed it hides out in our assumption of a point particle. In the present model we consider that a cluster moving inside the well tries to penetrate the barrier and once it is through, the only interaction it has will be purely coulombic. Hence the outgoing wave function is coulomb wave function therefore the radial wave function corresponding to outgoing cluster can be given by.[5]

$$\Psi_{lj}{}^{out}(r) = N_{lj}[G_l(r) + iF_l(r)] \quad (14)$$

Where, F and G are regular and irregular coulomb functions respectively. The reason for defining wave function as r times function is to get dimension of N^2 as inverse length. Since in this case we are only considering 's' state which corresponds to $l = 0$ and $j = 0$ therefore radial wave function corresponding to outgoing cluster becomes

$$\text{r}\,\Psi_{00}{}^{out}(r) = N_{00}[G_0(r) + iF_0(r)] \quad (15)$$

Here N is a normalization constant and for simplicity let's drop the subscript 00.
Internal wave function for cluster is given by gamow wave function $\phi(r)$ .Since at large distance from the parent nucleus outgoing spherical wave functions become plane waves.

Therefore at limit $r \to \infty$,

$$\lim_{r\to\infty} |r\Psi^{out}(r)|^2 = N^2 \quad (16)$$

The normalization constant is extracted by a matching condition, where both internal and outgoing functions are equal to each other. Now this condition is found at boundary $r = R$ where the outgoing coulomb wave function $\Psi(r)$ is equal to the internal gamow wave function $\phi(r)$

$$R^2|\phi(R)|^2 = R^2|\Psi(R)|^2 \quad (17)$$

$$|N|^2[F^2(kR) + G^2(kR)] = R^2|\Psi(R)|^2 \quad (18)$$

$$|N|^2 = \frac{R^2|\Psi(R)|^2}{[F^2(kR)+G^2(kR)} \quad (19)$$

Here F and G are explicitly shown in terms of kR as coulomb wave function is a function of r and if we look at this function as a power series we cannot add length to length square. We need to make it dimensionless we need to multiply it with the quantity having dimension of inverse length that is k where k is a wave number of the outgoing particle. Now dimensionally matching the internal gamow and outgoing coulomb wave function the quantity N^2 physically turns out to decay probability per unit length at infinity. If we multiply this with v we will get the probability of decay per second. Here v is the velocity of the outgoing particle, and is given by

$$v = \frac{\hbar k}{\mu} \quad (20)$$

Where μ is reduced mass of binary system formed by cluster and daughter and $\hbar k$ momentum of outgoing particle. And

$$v|N|^2 = \frac{\hbar k}{\mu}\frac{R^2|\Psi(R)|^2}{[F^2(kR)+G^2(kR)} \quad (21)$$

Now the quantity decay probability per unit second is 1 over mean lifetime τ. now since we know

$$\tau_{1/2} = ln2\tau \quad (22)$$

We deduce decay half-life as

$$\frac{1}{t_{1/2}} = \frac{1}{ln2\tau} = \frac{1}{ln2}v|N|^2 = \frac{1}{ln2}\frac{\hbar k}{\mu}\frac{R^2|\Psi(R)|^2}{[F^2(kR)+G^2(kR)} \quad (23)$$

than we know that decay width Γ is related to half-life by gamow relation as follows

$$\Gamma = \frac{\hbar}{t_{1/2}} \quad (24)$$

Now by substituting the value for $t_{1/2}$, we get

$$\Gamma = \frac{1}{ln2}\frac{\hbar^2 k}{\mu}\frac{R^2|\Psi(R)|^2}{[F^2(kR)+G^2(kR)} \quad (25)$$

This is how we got the decay width and decay half-life by exact quantum mechanical treatment [5] As the above calculation done for decay in non-deformed even-even nuclei decay in deformed and odd nuclei is also important. So in General, the single particle or point cluster outgoing wave function is given as

$$r{\Psi_{lj}}^{out}(r) = N_{lj}[G_{lj}(r) + iF_{lj}(r)] \quad (26)$$

The probability per second that the particle passes through a area element $dS = r^2 d\theta d\varphi$ is given by $F_{lj} = |\Psi^{out}(r)|^2 2vdS$ where v is the velocity of the particle. Since

$$\lim_{r\to\infty} |r{\Psi_{lj}}^{out}|^2 = |N_{lj}|^2 \quad (27)$$

the probability of decay per second, i.e., the reciprocal of the half-life obtained by integrating F_{lj} about the angles and therefore the decay width is given as

$$\Gamma_{lj} = \frac{1}{ln2}\frac{\hbar^2 k}{\mu}\frac{R^2|\Psi_{lj}(R)|^2}{[{F_{lj}}^2(kR)+{G_{lj}}^2(kR)} \quad (28)$$

which is independent of R. The above expression gives the exact quantum mechanical value of the width.

For our present calculations we will calculate the partial decay width for angular momentum projected states. We will assume that the deformation of the parent nuclei and mother nuclei to be the same also we will assume that the mother nucleus is odd and the wave function for such nucleus is given as [5]

$$\Psi_m{}^{J_i M_i K_i} = \left(\frac{2J_i+1}{16\pi^2}\right)^{1/2} [D_{M_i K_i}{}^{J_I} \chi_{K_i} + (-1)^{J_i+M_i} D_{M_i -K_i}{}^{J_I} \chi_{\check{K}_i}] \quad (29)$$

where D are the Wigner matrices and χ_K is the intrinsic single particle or cluster (which is assumed to be a point particle) wave function which can be expanded in spherical component as

$$\chi_{K_i}(r) = \sum_{j \geq K_i} \alpha_{lj}(r)[Y_l(r)\chi_{1/2}]_{jK_i} \quad (30)$$

where l is determined by the parity of the state.We assume that the decay is possible with maximum probability when the nucleus is in the lowest energy state with $J_i = K_i$.The daughter wave function is given as

$$\Psi_d{}^{J_d M_d K_d} = \left(\frac{2J_d+1}{8\pi^2}\right)^{1/2} D_{M_d K_d}{}^{J_d} \quad (31)$$

The outgoing particle has a maximum energy when it leaves the daughter nucleus in the ground state on which the condition $J_d = K_d = M_d = 0$ can be imposed.Therefore from the conservation of angular momentum the outgoing particle have the same angular momentum as that of parent nucleus i.e. $j_p = J_i = K_i$. At a large distance R there is only coulombic interaction and nuclear interaction vanishes therefore the outgoing particle wave function is given as

$$R\chi_{K_i}{}^{out}(R) = \sum_{lj} N_{lj}[G_{lj}(R) + iF_{lj}(R)][Y_l(R)\chi_{1/2}]_{jK_i} \quad (32)$$

N_{lj} is determined by

$$|R\chi(R)|^2 = |R\chi^{out}(R)|^2 \quad (33)$$

at matching radius R. From the orthogonal condition of the different partial waves we find that the partial decay width of particular decay channel $l_p j_p$ is given by

$$\Gamma_{l_p j_p} = \frac{1}{ln2}\frac{\hbar^2 k}{\mu}\frac{R^2 \alpha_{l_p j_p}{}^2(R)}{[F_{l_p j_p}{}^2(kR)+G_{l_p j_p}{}^2(kR)} \quad (34)$$

The cluster is formed just outside the surface of the daughter nucleus. [7]

The formation probability of cluster is the absolute square of the wave function describing the cluster. Therefore

the formation probability of cluster is given as

$$P = \int r^2 dr|\phi(r)|^2 \quad (35)$$

where $\phi(r)$ is a Gamow wave function. We will show that the above formalism to be successful in calculating the half-lives of alpha particles as well as clusters.

V. CALCULATIONS

We used the computer code GAMOW to evaluate the outgoing cluster wave functions. Here we have assumed the interaction of standard wood saxon form which have three adjustable parameters. [8]

1) Depth (V_0)
2) Half density radius ($R_{1/2} = r_0 A^{1/3}$)
3) Diffusivity (a)

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For Depth V_0

In our model the cluster is considered to be a point particle moving in an energy state with energy equal to Q value. So here we fix Q value and adjust the depth. It is observed that it is good to search for the depth around -200 MeV. This value of the Depth is used in all the calculation. [8]

For r_0

It has been found that the value of r_0 has a dependence on the Q value. So we choose $\boldsymbol{r_0}$ = 1.31 fm for Q value about 70 Mev and $\boldsymbol{r_0}$ = 1.35 for Q value of about 70 Mev for simplicity. [8]

For a

Considering that the half lives depend on the width of the barrier it is found that diffusivity does not change the barrier width much. Thus on concluding that half-lives are not much dependent to '$\boldsymbol{a}$' we set the value of $\boldsymbol{a}$ = 0.54 fm. [8]

VI. RESULTS

Parent	Daughter	Cluster	Q (MeV)	$log_{10}T_{1/2}$	Formation Probability	Q_α (MeV)	$log_{10}T_{1/2}$ (α)	Foramtion Probability(α)
^{252}No	^{230}U	^{22}Ne	59.280	38.263420	4.62338×10^{-24}	8.550	-1.176994	9.75500×10^{-3}
^{253}No	^{231}U	^{22}Ne	58.580	39.421885	3.47173×10^{-24}	8.420	-0.772204	9.54652×10^{-3}
^{254}No	^{232}U	^{22}Ne	58.130	40.151607	2.91166×10^{-24}	8.230	-0.154401	9.25457×10^{-3}
^{255}No	^{233}U	^{22}Ne	57.920	40.453777	2.73227×10^{-24}	8.440	-0.870587	9.56535×10^{-3}
^{256}No	^{234}U	^{22}Ne	57.700	40.776850	2.55711×10^{-14}	8.589	-1.347932	9.77836×10^{-3}
^{257}No	^{235}U	^{22}Ne	57.360	41.323732	2.25311×10^{-24}	8.480	-1.033477	9.61621×10^{-3}

Table 1

Parent	Daughter	Cluster	Q (MeV)	$log_{10}T_{1/2}$	Formation Probability	Q_α (MeV)	$log_{10}T_{1/2}$ (α)	Foramtion Probability(α)
^{246}Fm	^{226}U	^{20}O	39.060	47.223410	6.64312×10^{-19}	8.380	-1.300278	0.104272×10^{-1}
^{248}Fm	^{228}U	^{20}O	38.880	47.555709	6.35644×10^{-19}	8.000	-0.058562	0.097921×10^{-1}
^{249}Fm	^{229}U	^{20}O	38.510	48.456228	5.49020×10^{-19}	7.710	0.964749	0.093416×10^{-1}
^{250}Fm	^{230}U	^{20}O	38.660	47.996410	5.97889×10^{-19}	7.560	1.510719	0.091110×10^{-1}
^{251}Fm	^{241}U	^{20}O	38.350	48.746927	5.29829×10^{-19}	7.430	1.996054	0.089168×10^{-1}
^{252}Fm	^{232}U	^{20}O	38.410	48.522229	5.53139×10^{-19}	7.160	3.068491	0.085332×10^{-1}
^{253}Fm	^{233}U	^{20}O	33.640	49.123456	6.19591×10^{-19}	2.210	2.845056	0.085929×10^{-1}
^{254}Fm	^{234}U	^{20}O	38.960	46.952906	7.24323×10^{-19}	7.310	2.422269	0.087271×10^{-1}
^{255}Fm	^{235}U	^{20}O	39.080	46.379207	1.22614×10^{-18}	7.240	2.689300	0.086217×10^{-1}
^{256}Fm	^{236}U	^{20}O	39.240	45.904276	1.33177×10^{-18}	7.030	3.549478	0.083304×10^{-1}
^{257}Fm	^{237}U	^{20}O	39.400	45.432274	1.45730×10^{-18}	6.870	4.229231	0.081130×10^{-1}

Table 2

Parent	Daughter	Cluster	Q (MeV)	$log_{10}T_{1/2}$	Formation Probability	Q_α (MeV)	$log_{10}T_{1/2}$ (α)	Foramtion Probability(α)
^{177}Tl	^{176}Hg	^{1}H	1.160	-1.670000	-	7.070	-1.945973	7.49481×10^{-4}

Table 3

VII. CONCLUSION

Table 1 shows formalism works great even for the cluster in which we had considered it as a point particle. It has been stated that in super heavy nuclei the dominant decay process is cluster decay over alpha decay. It is natural to assume that for heavy nuclei to stabilize heavy clusters should be emitted. But from our result Table 2 shows that alpha decay always dominates over cluster decay

even for the super heavy nuclei. From Table 2 we infer that the half-life of the cluster is much larger than the half-life of alpha with a much larger factor. From time scale if there is an alpha particle count we have to wait billions of years to get the single count of the cluster. Also we can see that the formation probability of a cluster is much less or negligible as compared to the formation probability of an alpha particle. Therefore we can say that alpha decay always dominates over cluster decay. We have also calculated nucleon decay which works fine for our case. The calculated half-life nearly matches with the experimental value which is $log_{10}T_{1/2} = -1.176$. For alpha decay of odd nuclei we have considered the available Angular momentum. Table 3 shows efforts made in calculation of half-life of odd-odd super heavy nuclei which further opens the application of this model in decay from odd parent nucleus with odd cluster. This theoretical Model has given us results over the region where Experimental techniques are yet not able to reach.

VIII. REFERENCES

[1] K. Bennaceur *et al* 2020 *J. Phys. G: Nucl. Part. Phys.* **47** 105101
[2] K P SANTHOSH. "Decay of heavy and superheavy nuclei", Pramana, 2014
[3] A. Bhagwat and Y. K. Gambhir, Phys. Rev. C 71, 017301 (2005)
[4] B. Buck, A. C. Merchant, and S. M. Perez, Phys. Rev. C 85, 054302 (2012), and references therein.
[5] E. Maglione, L. S. Ferreira, and R. J. Liotta, Phys. Rev. Lett. B 81, 538 (1998)
[6] J. K. Tuli, Nuclear Wallet Cards (2011), http://www. nndc.bnl.gov/wallet/
[7] A. Bhagwat and R. J. Liotta, "Cluster emission from super heavy nuclei". *Eur. Phys. J. A* **54**, 200 (2018)
[8] A. Bhagwat and R. J. Liotta Phys. Rev. C **92**, 044312 – Published 15 October 2015

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PREDICTIVE MODEL FOR DETECTING COPD

Poorna Rajesh Pimpale, Suchetadevi Gaikwad, Dhanashree Salvi, Renuka Nagpure Assistant Professor Information Technology Engineering, Atharva College of Engineering Mumbai, India

Abstract : Chronic Obstructive Pulmonary Disease is a disease of lungs that involves gradual decrease of normal functioning of lungs. This paper aims at specifying the work done to predict chronic obstructive pulmonary disease at an early stage. As lung disease has become a very prevalent problem all over the world where the patients don't even come to know that they have severe lung disease at an early stage as there are no proper disease specific symptoms in an early stage it is quite difficult to predict the disease. If the problem is not detected in time it may prove to be fatal as there might be inflammation in lungs due to which the
patient might suffer severe breathlessness. This paper aims to specify the methods and techniques used previously to determine chronic obstructive pulmonary disease in its early stage so that the patient's quality of life can be improved with the proper medication, healthy diet and exercise. This paper intends to study technological advancement that includes machine learning algorithms to analyze the disease. It was observed that many machine learning algorithms are being used such as Convolutional neural network, K-nearest neighbor, random forest, regression, support vector machine and many more. The experts have used deep learning based ResNet with convolutional neural networks to classify the infected features in High Resolution Computed Tomography scans of lungs.

***IndexTerms*:** COPD, Exacerbation, Artificial Intelligence, Proposed System

I. INTRODUCTION

In the human body we have many vital organs out of which Lungs are too important as it is the vital part of the respiratory system. The most important function of lungs is to absorb oxygen from the outer world or environment and transfer it into the blood stream so as to transfer the oxygenated blood throughout the body and transfer the deoxygenated blood out of the body. Chronic Obstructive Pulmonary Disease is the disease where the lungs gradually decrease their regular functioning. If a person is suffering from COPD, It becomes difficult for him to breathe. In COPD due to inflammation of lungs the airflow is obstructed leading to breathlessness that might prove to be quite fatal. Chronic Obstructive Pulmonary Disease includes Asthma, Bronchitis, Pneumonia, Emphysema[5]. COPD is a progressive disease which worsens over a period of time. COPD can be treated if detected in early stages. There are four stages of COPD. If the disease is detected in early stages then it becomes curable, else at the last stage or the End Stage of COPD the patient might have frequent exacerbations which could be fatal. At the last stage the patient might have a condition called chronic respiratory failure, where the patient is unable to breathe due to various reasons such as inflammation of lungs, deposition of mucus in air sacs and many more[15]. If the condition is not detected and diagnosis is not done on time it would be difficult to cure the patient.
Thus it becomes very important to predict the occurrence of COPD at an early stage so that the patient may preserve the functioning of the lung and quality of life is also improved.
ARTIFICIAL INTELLIGENCE
It is a branch of computer science which has become an essential part in the technical industry which believes in creating the intelligence in machines. Artificial Intelligence is the branch of science which is highly technical and specialized for core
problems of intelligence such as Knowledge base, Reasoning, Problem Solving Capability, Perception i.e the way system perceives the problem, Learning from the incidences, ability to change or manipulate and move objects.


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MOTIVATION

- Symptoms of Chronic obstructive pulmonary Disease are not detected in early stage
- At stage IV of Chronic Obstructive Pulmonary Disease it is difficult to cure the patient
- Spirometry is the test used to detect COPD which is too expensive.

OBJECTIVE

- Explore the state of art existing works on early detection of COPD can compare them in terms of accuracy, sensitivity, specificity and detection time
- To work on the features for COPD detection and do statistical correlation analysis to study the relation between features and COPD detection time over real data of patients[3].
- To find an appropriate predictive model to predict COPD based on multiple clinical parameters[4]. ● Test the effectiveness of proposed model for COPD detection among patients across different categories of age, sex , demographics etc
- To use data acquired from the fit bit used by patients and environment data from the various sensors put up in a particular area for early detection of COPD.

II. LITERATURE REVIEW

1.Title:Diagnosing asthma and chronic obstructive pulmonary disease with machine learning[15]
Published in year: Health Informatics Journal, SAGE, 2017

In this paper, author has considered the samples of about n=132 that identify the major factors that studies empirical pulmonology that contributes to diagnosis of the disease. It was observed that out of various machine learning algorithm Random Forest classifier proved to give 97.7 percent precision when it comes to detect the chronic obstructive pulmonary disease where the features or the attributes considered in this case were smoking, age of the patient, forced respiratory volume of the patient. It was also observed that the best precision for the asthama was achieved through Random Forest Classifier with the precision of 80.3 percent.

2.Title: Prediction of pulmonary pressure after Glenn shunts by Computed Tomography-based machine learning models Published in and year: Springer 2019[10]
In this paper, the author has trained the acquired dataset of about 100 samples with six machine learning algorithm such as Knearest neighbour, support vector machine, random forest, logical regression, Naïve Bayes and Linear Discriminant Analysis. Here the comparative analysis was done by the author for all the listed algorithms and its average performance was evaluated with respect to area under the curve, accuracy, sensitivity, and specificity.

3.Title:Machine Learning Characterization of COPD Subtypes Insights From the COPD Gene Study Published in and year: CHEST, 2019[9].
In this paper, the author has considered chest computed tomographic images and are trained through machine learning algorithms
to quantify COPD heterogeneity. Trajectory of lung growth is also depicted here.

4.Title: Comparison of Machine Learning Algorithms to Increase Prediction Accuracy of COPD Domain[8].
Published in and year: IEEE transactions, 2020
In this paper, the techniques used decision tree, naive Bayes and Bayesian network) based on ROC metric with 61 attributes were considered of affected patients. Theaccuracy achieved is only 76.8%

5.Title: Detection of Different stages of COPD Patients Using Machine Learning Techniques[3].

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Published in and year: IEEE transaction, 2021
In this paper, the author has recommended RFECV method which showed precision of about 90 percent with the data set.

6.Title: A Machine Learning Approach to the Interpretation of Cardiopulmonary Exercise Tests: Development and Validation[2].
Published in and year: Hindawai, April 2021.
In this paper, the author has used the dataset of 197 males and 37 females. The author has developed by using two novel approaches SVM and normalized percent of predicted normal for the interpretation process of CPET

III. EXISTING SYSTEM

Identifying patients who are at risk of acquiring this chronic disease is a challenge as there are many ambiguities when medicine and chronic disease comes into picture. There is a great impact on patients' lives when there is poor control and misdiagnosis occurs. As per World |Economic Forum, the global economic cost of chronic disease could reach up to 47$ trillion till 2030[9]. To overcome the challenges in the traditional healthcare system, Machine Learning algorithms are used to deal with uncertainty, accuracy, causal attributes, and their relationships. Exacerbation of Chronic Obstructive Pulmonary |Disease and its prediction is considered to be the challenge which can be met by using Machine Learning algorithms to predict the chances of occurrence of exacerbations at an early stage[3].
Existing system considers features from datasets acquired from blood reports, X-ray, Ultrasound, Computed Tomographic images. The dataset is trained using different machine learning algorithms like CNN,KNN,Random Forest, Naive Bayes, Regression etc. The results obtained from these algorithms are compared to predict Chronic Obstructive Pulmonary Disease[Fig.1]

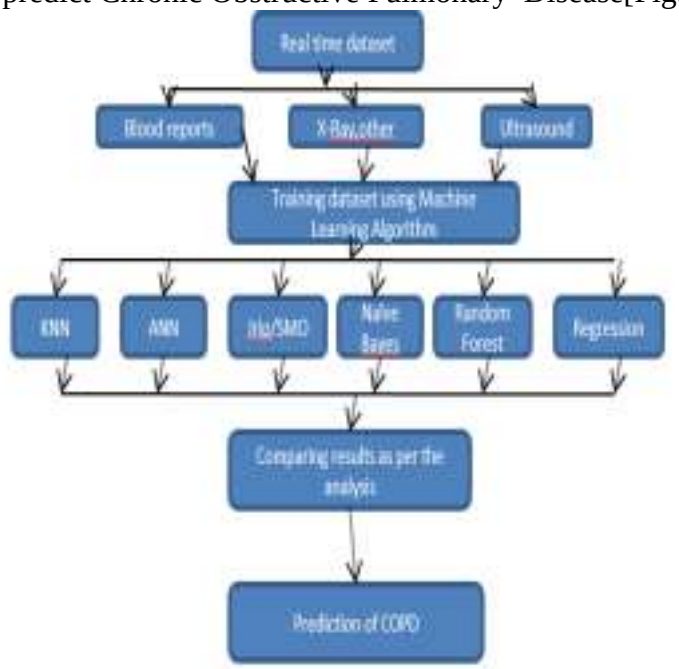

Figure.1. Existing System

IV. PROPOSED SYSTEM

Lot of research is already done in COPD, but

- Research papers seen so far have limited sample size and no real time samples.
- Limited papers on other input like CBC.

- Techniques used so far is only Random Forest, ANN,KNN,XGB,SVM,etc
- Alternative Techniques and different input types yet to be explored.

The proposed system aims to identify the chances of occurrence of chronic obstructive pulmonary disease at the early stages in order to improve the life of the patient by considering the real time datasets and training them against the competitive data analytics algorithm.
Explore efficient algorithms to correctly classify chronic obstructive pulmonary disease from standard/routine test reports to assist a doctor diagnose the disease faster/recommend additional testing.

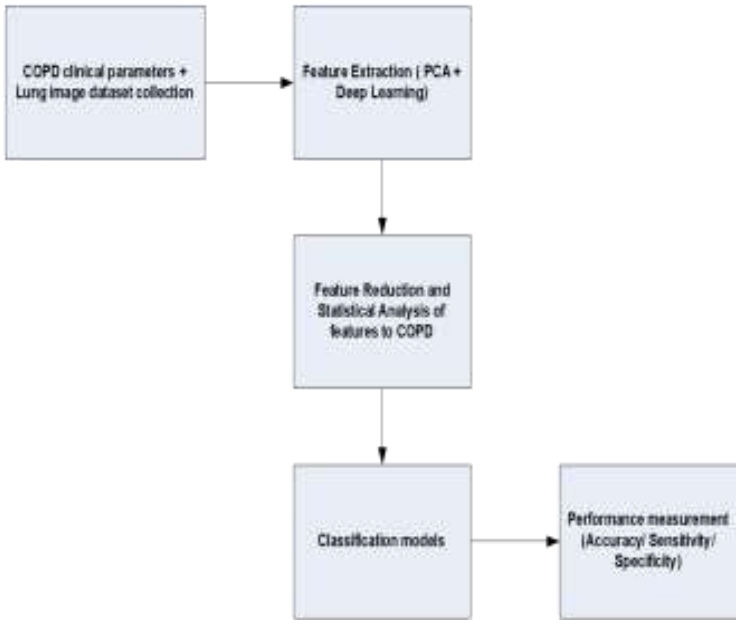

Figure.2. Proposed System

A.COPD Clinical Parameters[Fig.2]
In this module, data collection from hospitals or patients would be done. Data set required for analysis comprises of Physiological characters such as

- Diastolic Blood Pressure, Systolic Blood Pressure
- Age, Weight
- CBC report that comprises of all the blood components,
- SPO2 level
- Temperature

Data acquired from Fit Bit that comprises of

- heart rate,
- SPO2 level
- Temperature
- number steps taken in a day

HRCT(High resolution computed tomography) scans of lungs
X-Ray of Chest
Results of Spirometry Test
Answers to Questionnaire acquired from patients that includes questions related to their mood, temperament, emotional status, any symptoms
B.Feature Extraction (Deep Learning)[Fig.2]
To extract the feature from the data set acquired, ResNet50V2 can be used as it gives overall accuracy of about 98.49% which is observed from previous work.
Feature Pyramid Network can be used so as to classify the layers between the images obtained from HRCT[12] scans. Once obtained, dense neurons can be concatenated to obtain the final result.

C.Feature Reduction And Statistical Analysis Of Features[Fig.2]

After obtaining the required features, they must be reduced to the features that are quite essential to predict the occurrence of Chronic Obstructive Pulmonary Disease. Statistical Analysis of all the features that are reduced would be done here in order to find out what exactly is the result.

D.Classification Models[Fig.2]

There are various classification models such as Convoluted Neural Network, Support vector Machine, KNN, ANN and many more.

It is observed that the Convoluted Neural Network gives more accuracy and precision with respect to other classification models. Thus CNN can be used here as a classification model.

In most of the papers, CNN is used and it shows the maximum amount of accuracy. But the graph convolutional network method also proves to be best on non euclidean structure like graph[1]. The existing model of Graph convolutional network was applied on the dataset which is publicly available which had features like 320-dimensional feature vectors from computed topographical images of 300 patients suffering from COPD. In the proposed system the Graph Convolutional Network model can be used on real data set acquired from laboratories with desired features[1].

E.Performance Measurement[Fig.2]

In this module, after the application of classification and training the data set that is obtained, testing has to be done for the results that are obtained. Performance is measured with respect to Accuracy, Sensitivity and specificity of the results that are obtained. Performance measurement is quite important as here we determine how the modules have proved to be successful in prediction of occurrence of Chronic Obstructive Pulmonary Disease.

F.Feasibility Study

The major concern is to obtain the real time dataset. Existing dataset can be used to determine the performance. Convolutional Neural Network and Graph Convolutional Network models have to be applied on the real time dataset. Various laboratories are approached for the real time dataset and also hospitals that treat COPD patients are contacted to acquire the dataset. Local gyms are contacted to acquire the fitbit data.

IV. CONCLUSION

Thus, the proposed system will implement a system to identify whether a sample corresponds to a patient with chronic Obstructive Pulmonary Disease and the corresponding stage using a competitive data analytics algorithm with an industrially acceptable false positive rate and false negative rate. It would also explore efficient algorithms to correctly classify chronic obstructive pulmonary disease from standard/routine test reports to assist a doctor diagnose the disease faster/recommend additional testing.

References

[1]Early detection of COPD based on graph convolutional network and small and weakly labeled data , International Federation for Medical and Biological Engineering 2022

[2]A Machine Learning Approach to the Interpretation of Cardiopulmonary Exercise Tests: Development and Validation, Hindawai, April 2021.

[3]Detection of Different stages of COPD Patients Using Machine Learning Techniques, IEEE transaction, 2021 [4]Validation of a Deep Learning Algorithm for the Detection of Malignant Pulmonary Nodules in Chest Radiographs, *JAMA Netw Open.* 2020

[5]Deep Learning Enables Automatic Classification of Emphysema Pattern at CT, The Genetic Epidemiology of COPD (COPDGene) Investigator, 2020

[6]Deep neural network analyses of spirometry for structural phenotyping of chronic obstructive pulmonary disease, Sandeep Bodduluri,Purushotham V. Bangalore, Surya P. Bhatt JCI Insight. 2020

[7]Registration Based Lung Mechanical Analysis of Chronic Obstructive Pulmonary Disease

(COPD) Using A Supervised Machine Learning Framework, Springer, 2020
[8] In depth analysis of lung disease prediction using machine learning algorithms, International conference on machine learning, Image processing, network security and data sciences, Springer, 15 June2020.
[9] Comparison of Machine Learning Algorithms to Increase Prediction Accuracy of COPD Domain, IEEE transactions, 2020 [10]Prediction of pulmonary pressure after Glenn shunts by computed tomography–based machine learning models, Springer 2019
[11]An automatic system supporting clinical decision for chronic obstructive pulmonary disease, Springer, august 2019 [12]A Perlin Noise-Based Augmentation Strategy for Deep Learning with Small Data Samples of HRCT Images,Europe PMC, Dec 2018
[13]Joint learning for pulmonary nodule segmentation, attributes and malignancy prediction,2018 IEEE 15th International Symposium on Biomedical Imaging (ISBI 2018) April 4-7, 2018
[14]A prediction model for early death in non-small cell lung cancer patients following curative-intent chemo-radiotherapy, ACTA ONCOLOGICA, 2017
[15] Diagnosing asthma and chronic obstructive pulmonary disease with machine learning, Health Informatics Journal, SAGE, 2017

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PHYSICISTS AND COMPUTER ENGINEERS DO COMMUTE.

Shashi P Gupta, Assistant Professor of Physics, Humanities and applied science, Atharva College of Engineering, AET Campus, Marve Road Charkop Naka, Malad West, Mumbai 4000095.

***Abstract*—** when two operators, which help us to measure the physical quantities e.g. Momentum, Energy and Position etc. of a system, commute Physicists say that both quantities can be measured or observed at same time. So the title of my paper implies that both Computer engineers and Physicists can be observed working together to solve many real life problems. A physicist needs a computer engineer and vice versa. Unfortunately students of computer engineering seem to be a little unaware of the fact and they don't devote much time to learning physics[4,5,6], they seem to believe that they will be a computer programmer and they won't need much physics in future. There may be other reasons for the ignorance of this subject.
Student's approach to understanding physics can highly influence their motivation and ultimately development of great computer programs using different languages and platforms. Learning physics can help them to develop programming skills that will solve many day to day life problems. The ultimate work of a programmer /engineer is to solve our daily life problems and build a sustainable world. Here I discuss for computer engineers the importance of learning physics at an introductory level and how it will help to be a good programmer.

***Keywords*—** *Quantum Physics, Virtual Lab, Spectroscopic.*

I .INTRODUCTION

Students in their early engineering years are very much ignorant of learning basic science, be it physics, chemistry or mathematics[8,9]. The reason for Ignorance may differ from student to student. The reason can be the lack of interest of a student for these subjects. It also depends on how much time a student devotes to learn these subjects. Sometimes computer engineering students don't seem to pay much attention to these subjects because they feel that their career is to be a programmer but not a physicist.
Another unfavorable attitude toward learning physics is that the current syllabus doesn't tell them how learning physics can help them to be a good programmer. Since the work of the programmer is to solve the problems which are there in this universe where we live, and physics is the subject which helps us to understand the laws of this universe. Here I try to emphasize that a good programmer needs to be a good physicist and vice versa.

II. Programmer can simulate the macroscopic and microscopic world :

There are many daily life problems that need to be studied repeatedly in different conditions to solve them. Best way to do it is to make a simulator of the same environment or conditions. A programmer can build such a simulator using a different programming language with the best GUI. Programming such a simulator required the knowledge of both computers and basic science. Without the knowledge of Physics students won't be able to understand the basic problem and the theories which predict or explain them.

Example: In order to study the strength of material, a programmer with given conditions can build a simulator to check the strength of materials without wasting the energy and affecting the environment of our beloved earth. Also a simulator can be created to study the frictions of different types of material with the road hence to build an effective vehicle tyre, battery or any accessories of industry without even fabricating these in the real, in fabrication for such different types of accessories will surely affect our environment and man power. There are many simulators which help us to do so.

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These are the basic motivations to learn programming and the basics of science. Without knowledge of basic science students can't understand the basics of friction, band gap of material or fission or fusion which are the ongoing research interest of current time and material properties and its fabrication process which indeed need knowledge of Physics, mathematics and chemistry.
Similarly to understand physics we need a large group of programmers who can help us to build great simulators using their programming skills. There are many simulators already available which have been coded by great computer engineers with very nice GUI. I am listing a few of them below which can help the engineering students to motivate them to learn programming and to enjoy the learning process of physics

A. Virtual Physics labs :

PHET and Amrita university lab - these two platforms are there which helped many students and faculty in covid period to learn and enjoy physics. We can perform a number of physics experiments using these two Virtual labs, thanks to computer engineers who were interested in physics.

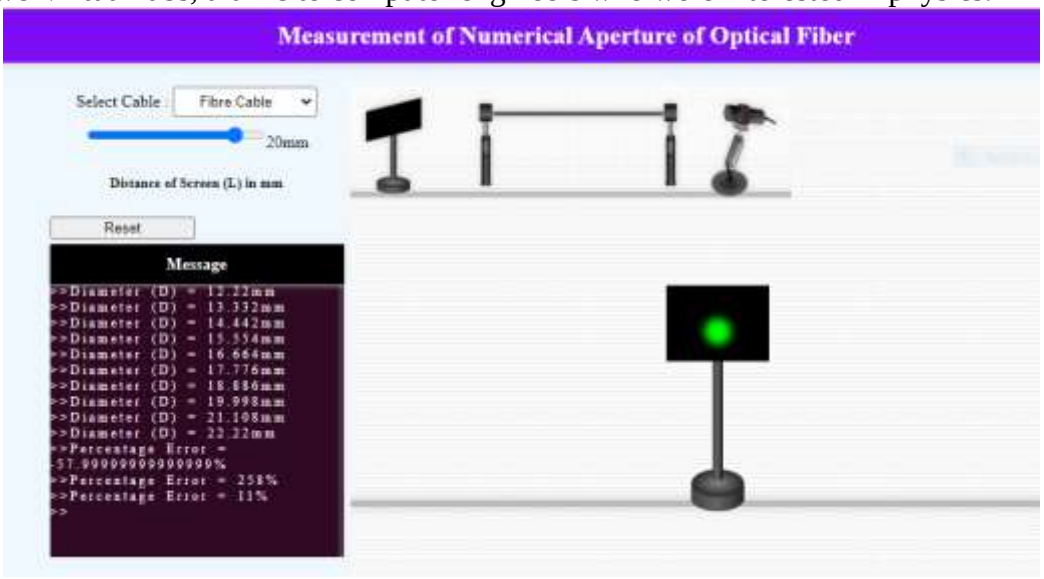

Fig : Measurement of Numerical aperture using Simulator .

The above simulator [1] helps students to understand the basics of optical fibre.
Here we used this simulator to find the numerical aperture of optical fiber.
This describes the range of angles within which light hence information that is incident on the fiber will be transmitted along it.
In Vlab and Phet we can perform many Physics experiments, like Experiments from Modern Physics, Classical Physics and many more.

Tracker[2] -: Tracker is a simulator which uses videos of real life and tools in it helps to get results.It is built in Java framework. It helps to study and understand Physics and many experiments.The development of the Open Source Physics Java framework and the free Tracker video analysis program can make spectral intensity measurements easy, cheaper and interactive. Students use a line profile, a tool in Tracker, to generate intensity of spectra and also give graphs of it of recorded video of spectra. A downloadable video spectroscopy library allows quantitative video spectroscopy to be used into introductory labs with local video camcorders.

The Open Source Physics framework is a set of Java software packages that can be used for curriculum development, physics education research and computational physics. It is designed to be used in introductory college physics practicals and lectures. Tracker and the video spectroscopy

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library are available for download[2] .

This poster describes video spectroscopy experiments. Where were measured and analyzed the following spectra:
1. Thermal incandescence
2. Color filters
3. Gas lamps

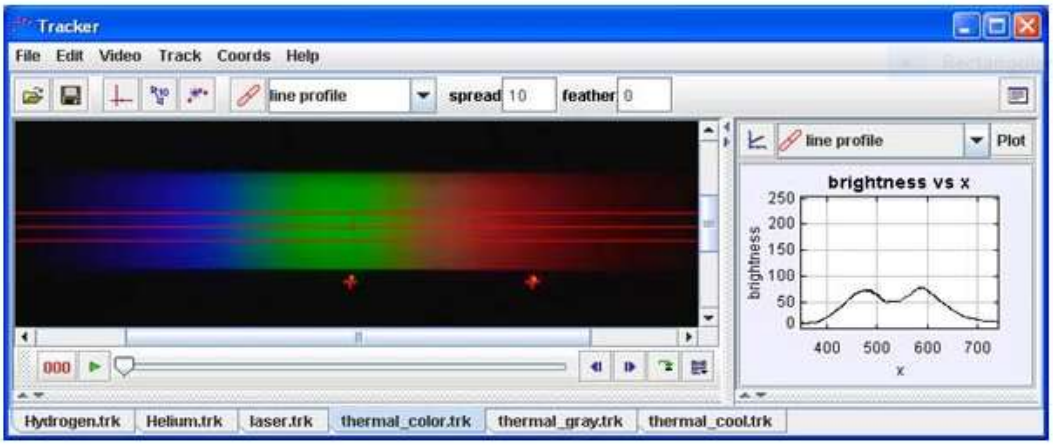

Figure 1

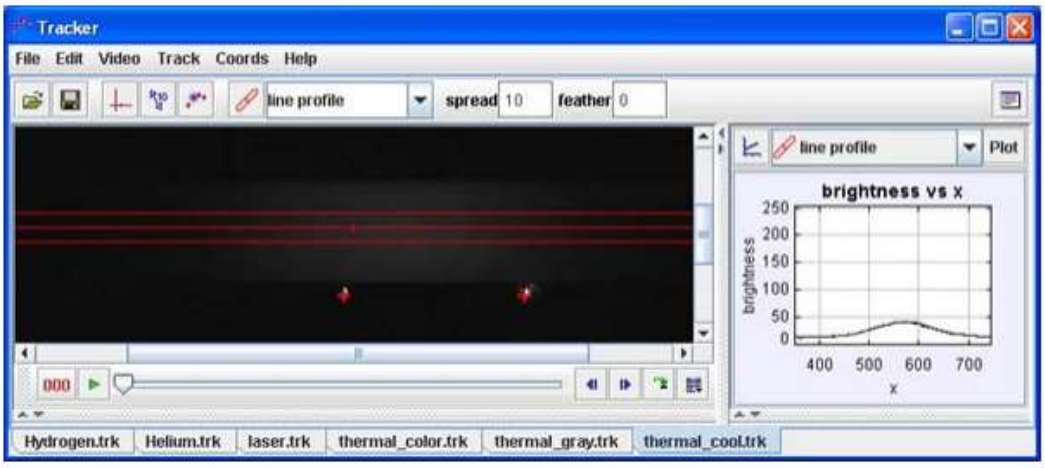

Figure 2 Thermal Spectra: Color, Grayscale, Cool

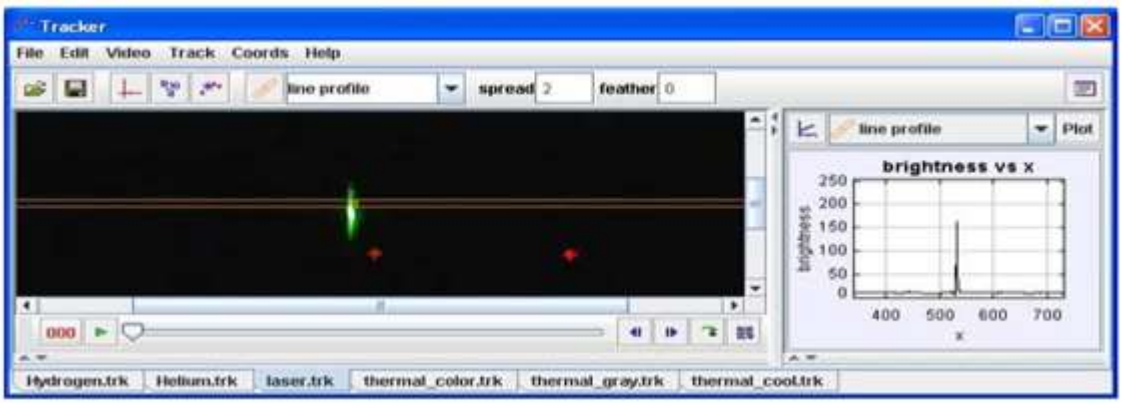

Figure 3 Line Profile of laser beam.

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Exoplanet-spotting with tracker

We can detect exoplanets by detecting small, periodic drops in the intensity of light as the exoplanet passes by. We can build a star and planet prototype using a light bulb and globe and a Spherical ball which is hanging from a certain height, which may act as a Pendulum, a conical pendulum. To get a large period of the orbit we can use a long string. The light intensity of our star can be measured using datalogger attached with the light sensor. When an exoplanet passes through the star, the light intensity decreases, this we can detect using line profile menu of the tracker to detect the presence of the exoplanet. We can easily draw the distance vs intensity graph (Shown below Figure 4) and may predict exoplanet position.

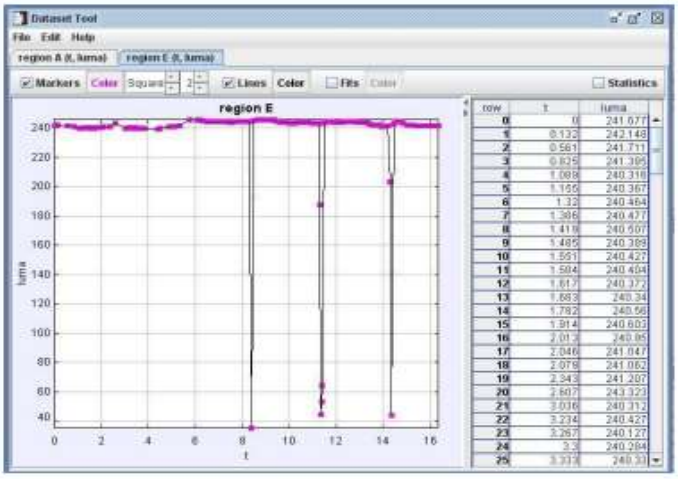

Figure 4 The distance vs intensity graph.

Quantum espresso:

It is one of the best creations of both Physicist and Computer engineering . This particular software is currently the best available option to physicists to study many properties of materials based on the theory.

We can study many Physical properties of materials directly from the basic physical quantities such e.g mass, charge , coulomb force of an electrons , based on quantum Physics.

We can study electronic properties charge density , energy dispersion, band structure, frequency of oscillations of atoms in crystals , Phonon angular frequencies , Phonon-electron interaction which play very important role to understand the electrical conductivity, superconductivity and temperature dependent of energy band of atoms or molecules.

Here we have calculated the band gap energy of MGO molecules. Using Quantum espresso scientists are able to predict the promising and current value of band gap energy which is 7.4 eV which earlier other simulators was predicting 3.4 eV Figure 5 .

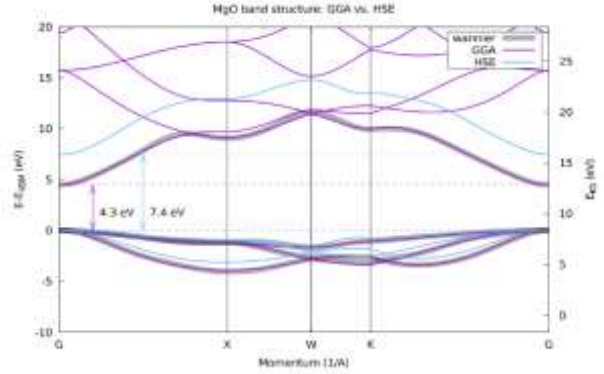

Figure 5 Band gap energy MGO molecules .

Conclusion: This paper clearly shows that a computer programmer can help their career and may

work on many emerging fields and contribute to various science projects. Computer engineers are a very important asset to a physicist. By researching little about Quantum espresso, anyone can understand the importance of computer programmers who understand physics in great detail.
Quantum espresso is solving and predicting many results which were unknown to material scientists. I can say that a computer engineer who programmed Quantum espresso must have studied physics, especially quantum Physics. Getting the solution of the Schrodinger equation for many body systems is now a cup of tea by using quantum espresso.
Students of Computer engineering should pay more attention in studying Physics in their first year of college so they will have the foundation of Physics on which they can learn more advanced physics for their future projects and may create many simulators or software that will have impact in the field of STEM.

References

1 https://bop-iitk.vlabs.ac.in/exp/numerical-aperture-measurement/theory.html
2 www.cabrillo.edu/~dbrown/tracker
4. De Mul F, i Batalle C, De Bruijn I and Rinzema K 2003 How to encourage university students to solve physics problems requiring mathematical skills: the 'adventurous problem solving' approach Eur. J. Phys. 25 51
5. Prosser M and Trigwell K 1999 Understanding Learning and Teaching: The Experience in Higher Education (London: McGraw-Hill Education UK)
6. Ramsden P 1992 Learning to Teach in Higher Education (London: Routledge)
7.Hammer D 1994 Students' beliefs about conceptual knowledge in introductory physics Int. J. Sci. Ed. 16 385; Schommer M 1990 Effects of beliefs about the nature of knowledge on comprehension J. Ed. Psych. 82 406
8 Mason A and Singh C 2010 Do advanced students learn from their mistakes without explicit intervention? Am. J. Phys. 78 760; Brown B, Mason, A and Singh, C 2016 Improving performance in quantum mechanics with explicit incentives to correct mistakes, Phys Rev PER, 12, 010121.
9. Larkin J and Reif F 1979 Understanding and teaching problem solving in physics Eur. J. Sci. Educ. 1 191

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NONVERBAL COMMUNICATION AND ITS IMPORTANCE AT WORKPLACE

Shobha D'mello, Rajendra Mahajan, Dr.Balaji Shinde, Assistant Professor, Atharva College of Engineering Malad, Mumbai

Abstract: *Throughout the day we spend time with our colleagues at the workplace. We used to communicate with each other and transfer our thoughts, feelings, emotions and experiences. After analyzing the schedule of the whole day it has been observed that we use language to communicate but most of the time without spoken words we convey messages effectively just with the help of some cues, expressions and symbols. It proves that humans can communicate with language or without language. When we communicate with language it is called verbal communication and when we communicate with any other medium other than language that appeals to our senses and information is transferred between two individuals we can call it nonverbal communication. People give importance to verbal communication at the workplace but most of the time they neglect the importance of nonverbal communication. Nonverbal communication is an important aspect of the 21st century as it lays emphasis on behavior of an individual at his place of work. Interpreting and analyzing information are keys in understanding messages but most of the time interpreting nonverbal cues is a big challenge. This paper will focus on various aspects of nonverbal communication which are playing a vital role at the workplace.*

Keywords-Nonverbal communication, body language,cues, behavior

"The global village is shaping its own language. The global market, the corporate world, science and technology are all using this handy lingua–franca, which is not the language of Shakespeare or Churchill, nor that of R. K. Narayan …‖ (Arun Sadhu, The Times of India, January 17, 2007)

Introduction-

Effective communication empowers individuals to convey their messages and emotions constructively that leads to bolster relationships between co-workers. Most of the people just focus on the verbal aspect of communication to achieve effectiveness and relinquish nonverbal aspects. In fact nonverbal communication plays a vital role in the engagement of stakeholders in an organization. It is an inseparable part of day to day communication in a business scenario. The 21st century brings technological advancement but the human factor is still needed to complete the task. While working together proper understanding and consideration is required which is lacking at many places due to wrong interpretation of verbal and non-verbal behavior. The scope of nonverbal communication is very vast as it includes many factors which deal with a living human being. Each Individual in a corporate world comes across with different people who have their own perception, thoughts, beliefs and ideologies. Proper understanding of non verbal aspects of communication like body language, gestures, postures, eye contact and vocalics creates a positive and healthy atmosphere at the workplace.

Importance of nonverbal communication-

In a corporate environment verbal communication is always accompanied by nonverbal cues. Non verbal aspects play an important role when one talks with colleagues, boss, or any stakeholder. They are salient features of communication which affect communication process in formal situations like presentations, meetings, group discussions and even in social settings like official get togethers, parties,

lunches or dinners. It has been observed that the success of most of the organizations depends on the ability of people to decode and understand non verbal aspects of communication. Lack of proper understanding of nonverbal cues creates communication gaps between stakeholders. Not only leaders but all the people who are involved in different activities should go through the training of non verbal communication to reduce these gaps. If these gaps are not eliminated they become hindrance in the smooth process of communication. Different communication situations require different understandings as employees interact with each other face to face, through telephonic conversation, through emails and mobile chats. In each situation employees need to decode and understand different cues for better communication. The proper understanding of nonverbal cues is essential which can be learned over a period of time.

Every corporate organization has some set of values and culture. The accuracy of analyzing and interpreting nonverbal cues enables us to understand information, message, attitude, emotions, and feelings of a person in a better way. The better understanding enhances good bonding, healthy work environment, team spirit, high morale and effective engagements at the workplace. In the business world 'how you say' is more crucial than 'what you say'. While interpreting the message one should not only consider the words but also body language, expressions, eye contact and tone of a person. Various methods of nonverbal communication come into play in the workplace at different situations like project presentations, interviews, meetings, group discussions and activities within and outside campus.

Forms of Non-Verbal Communication:

Non-verbal communication refers to all perceptions and interpretations made by our senses. Nonverbal communication can often be divided into two categories: The difference between conscious and subconscious nonverbal communication

1. Conscious non-verbal communication:

The sender transmits a message with a specific intention, and the receivers are aware of the sender's intended meaning. As an illustration, when welcoming a guest, Indians fold their hands and interlock the palms of both hands. It represents a gracious greeting for the visitor. It is a form of conscious nonverbal communication in which the broad intent of the act is understood by both the sender and the recipient. Graphics, photos, maps, diagrams, and other visual aids can be efficiently used to convey conscious nonverbal information.

2. Subconscious Non-Verbal Communication: Subconscious non-verbal communication involves sending unconscious messages to the recipient. Even though the recipients of such communications are not consciously aware of it, they still have impressions after viewing or hearing anything. An ambulance siren, for instance, can signal a casualty or a medical emergency. Unknowingly, people are given information about power and status after seeing a police officer's outfit or a doctor's apron. In summary, unconscious non-verbal communication involves the unconscious or unconscious delivery of messages.

Methods of nonverbal communication

Communication is the most simple yet complex process , because the way a person uses nonverbal cues plays a pivotal role in having meaning to the message to be conveyed, if there is some kind of misinterpretation it may lead to a miscommunication. When a message is communicated it takes two persons to comprehend the message .Sometimes communication is a futile attempt. Verbal communication is impossible when a reply is meant only for the receiver and not the general audience; it helps to give a desired feedback without disturbing the whole group of the audience. Communication is

possible without using words, communicating without the use of words is known as nonverbal communication. Nonverbal communication acts as a bridge between the sender, the receiver and the environment.

The following are some of the main contributing variables of nonverbal communication at workplace:-

Kinesics:
Kinesics, or more technically non-verbal demeanor connected to motion, of any portion of the body or whole, is the interpretation of body languages such as facial countenances and gesticulations.

The transmission and interpretation of sentiments, attitudes, and moods through both unconscious and conscious body language occurs by:

1) bodily position, movement, physical state, relationship to other people, things, and environment,
2) face quirks and eye-movement
3) The spoken words can be entirely different from this transmission and interpretation.

Every physiological gesture has a certain significance. For illustration, a wry smirk expresses scepticism, a rubbing of the nose denotes perplexity, and shrugging shoulders denotes disappointment.

When someone is eager to hear something, they sit with their feet under the chair, their feet pressed to the ground, and lean forward on the desk. Someone who is focused maintains eye contact and nods frequently. When a message is conveyed orally and nonverbally through body language, it has greater meaning.

Proxemics:
The scientific word for the part of body language that refers to personal space is proxemics. The study of measurable distance between people during interaction is known as proxemics.
Unintentional responses to sensory fluctuations or shifts, such as minute variations in voice pitch and sound, result in body separation and posture. According to the following delineations, social distance as well as intimate and personal distance between individuals are consistently connected with physical distance.

In both personal and professional life, space is crucial. Space is a symbol of power, especially in formal contexts. Officers in higher positions frequently receive superiorly furnished quarters in comparison to their inferiors. Authorities are given a distinct seat during meetings, whereas subordinates are given a seat that is relatively smaller. In order to establish connection with the audience, space is used as a technique. Effective presenters make excellent use of their available space to deliver messages. Conversely, a person may be threatened in a private setting, as is the case in a testing environment. Space separation conveys intimacy in addition to power or status.

1. Intimate Space: As the name implies, intimate space is very close to one's body. Intimate space is defined as the range 0-18". In that area, the majority of our bodily parts move. Only close friends, family, or chosen persons are allowed in there because it is so near to the speaker's body. Others are not allowed in that area. However, they may be permitted in specific situations, such as to congratulate,

comfort, or express sympathy. Speakers utilize low tones or whispers since they are so close together. It is frequently used to talk about extremely confidential issues.
2. Personal Space: The range of personal space is 18" to 4'. It extends outside the close-knit group. Only friends and coworkers are permitted entry. Typically, regular speech volume is employed. However, a small group of people could also use this area to address some crucial problems.
3. Social Space: The distance between the speaker and the social space is between 4 and 12 feet. It is appropriate for formal or official communication. In this area, business meetings are held the majority of the time. The speaker utilizes a formal tone with a loud or standard speech volume in this area because it is typically utilized for interacting with clients or visitors. Personal issues, emotions, and feelings can be discussed in the first two areas, but in the social space, primarily formal or official issues are discussed.
4. Public Space: The speaker's distance from the public is greater than 12 feet. In formal settings, communication in this area is typically one-way. The speaker must adopt an objective stance while speaking loudly and in a formal tone. To communicate clearly in this area, a public address system is always an excellent idea. It is frequently employed while speaking to enormous crowds of people.

Oculesics (Eye contact): It examines how eye contact affects nonverbal communication. We communicate a lot of nonverbal cues to other people through our eyes. The exchange of meaning between communicators without the use of words is known as nonverbal communication, and oculusics is one type of it. It can consist of the surrounding environment, the communicators' physical features or traits, and their actions.

Making eye contact is crucial for fully comprehending the message. It aids the speaker in successfully connecting with the listeners. It conveys the speaker's and receiver's sincere interest, curiosity, involvement, and sentiments. If they keep eye contact, both the speaker and the listener feel important and valued. Eye contact improves communication when giving speeches, attending meetings, interviews, and conversations with superiors and coworkers.

Chronemics : We frequently state that time is a valuable resource or that time is money. In both personal and professional life, it signifies the worth and significance of time. Time management is regarded to be one of the most important factors in a successful business because it can have either positive or bad effects. A prompt response conveys interest, readiness, and excitement, while a delayed response conveys lack of interest or care. All communications must be completed on time or else their significance is lost. The amount of time spent with the person also demonstrates his value and priority. The value of time differs amongst cultures.Chronemics (Time) refers to a person's situational awareness of their actions at work. The employee has a duty to be present at the appropriate location and time because everything is noted by the appropriate authorities. For instance, if a meeting is set for 10:00 am, the employees must arrive early; this demonstrates their commitment to the firm.

Haptics : Haptics refers to the study of touch. Superiors need to understand the importance of using touch while communicating with subordinates as well as must be alert and know how touch can be misleading. When we work with others when we use touch to communicate, it should be minimized as much as possible as tolerance of each subordinate differs from person to person. Haptic or tactile communication is the term used to describe communication that takes place through touch. The most effective non-verbal communication method is touch. Your aim, attitude, feelings, status, perception, need, etc. can all be expressed through touch. In casual settings, holding hands or giving someone a

loving hug is a simple way to express your love and care. On the other hand, in a professional setting, a forceful handshake can convey your attention or opinions. A shaky handshake exudes insecurity and diminishes credibility. Even a simple "well done" from the manager to an employee can convey their appreciation.

Although touching is typically done voluntarily, it can also happen accidentally or unintentionally. Touch, on the other hand, can be used to comfort, guide, and communicate sympathy.

Vocalics/Paralinguists : It means a person's way of presenting themselves plays a vital role in the communication process. It doesn't matter if communication is verbal or nonverbal it matters, that the nonverbal behavior of an individual in a given circumstance such as proper use of volume, pitch, speed, and pauses to convey the message in a meaningful way.

It is one of the branches of the study of variations in volume,pitch, speed, and pauses to convey the meaning of the terms used in communication. Interestingly, when the speaker is making a presentation and is looking for a response, he will pause. However, when no response is desired, he will talk faster with minimal pause.

The non-verbal components of communication that are utilized to change meaning and express emotion are referred to as chronetic. Pitch, volume, and, in rare cases, duration are all examples of paralanguage that can be used deliberately or unconsciously.The definition may occasionally be limited to vocally produced sounds. The field of research is called paralinguistics.The term "paralanguage" describes the type of speech used to communicate a message, including volume, pitch, pace, and non-fluencies like "ah," "um," or "uh." It facilitates communication of the speaker's attitude. There may occasionally be a discrepancy between what a person says and what his actions suggest. In such circumstances, the person's actions can be seen as a more accurate representation of his sentiments and beliefs.

Physical Appearance: A person's appearance always affects how others see them. Words will never have the same impact as well coiffed hair, ironed clothes, and a cheerful smile. It is widely held that a person's physical characteristics indicate the level of success they will have throughout their lives.

A person's appearance reflects the reputation of the company. A person is required to maintain a decent wearing style and a well-groomed appearance while dealing with stakeholders directly. It means that the hair can be neatly styled and clipped, the clothes can be dated but yet attractive, and appropriate shoes can be worn to complete the look. Being well-groomed makes a person a valuable asset to the company. As was previously mentioned, a single person serves as a miniature representation of the business as a whole.

Olfactics:
Who has a pleasant scent? How appealing do you seem to others? Numerous industries that produce items like scented candles, aromatherapy oils, mouthwashes and deodorants, household disinfectants, and perfumes and colognes have grown out of the desire to use and appeal to the sense of smell over the years.

The memory of both pleasant and unpleasant experiences is evoked by smell. For instance, when horrible things happen, our sense of smell becomes more acute, as if going onto high alert to warn us of impending danger. Of course, pleasant smells like those from freshly made cookies or blooming flowers are also associated with happy recollections.

Color:

The colors we wear and the colors we surround ourselves with have an impact on our physical and mental well-being.For instance, studies show that prolonged exposure to pure red excites the neurological system and increases blood pressure, heart rate, and breathing rate. Dark blue, on the other hand, has a relaxing impact and causes blood pressure, respiration, and heart rate to decrease when the individual is equally exposed to it. Color may either make us move more rapidly or more slowly, help us relax or make us irritated. People who frequently wear red are more animated, outgoing, and impatient than those who don't.

Silence

Communicating through silence, we can communicate through silence. Writers loudly pay brilliant tributes to the importance of silence. The best example is Thomas Carlyle's "speech is great, but silence is greater" or the old saying "speech is silver, but silence is gold" ie. silence speaks louder than words". Silence can express agreement, disagreement, indifference, appreciation, or withdrawal...

Examples of communication through silence

Examples of communication through silence are as follows:

- Silence can be a very effective form of communication in many situations.
- If the employer asks for a salary increase and the boss is silent, this means that the increase has been refused.
- If a boss asks a certain employee "were you out yesterday" and the employee remains silent, it means that he answered yes.
- If your friend is angry with you, he may be silent, and a worried or sad person may not want to say anything. His behavior and facial expression are enough to convey his thoughts and feelings.

It is not necessarily required to speak to one another. Silence can be used to convey a message. It's because our silence can likewise have many connotations depending on the circumstance. Silence can communicate our conformity, oddity, disinterest, respect, disdain, and other things. It can be used to ignore someone or cut off contact with them. On the other side, a speaker can draw the audience's attention with a little pause before speaking. Silence during the presentation can indicate that the audience is in agreement to move forward, while silence after asking a closed question (seeking agreement or disagreement) can also imply disapproval.

Visual and Auditory Signs and Signals: The word ‘Sign’ is derived from the Latin word ‘signum’ which means a mark. Signs and signals are both symbols with a specific meaning. Signals are dynamic and contain a component of change or movement, while signs are fixed and static symbols.

Visual and aural modes can also be used for nonverbal communication. Visual and auditory refer to things that can be seen and heard, respectively. Visual communication uses images like graphs, maps, charts, signs, and symbols. On the other hand, aural communication utilizes bells, tunes, whistles, and sounds.

Gender and Nonverbal Communication

We pick up the appropriate use of nonverbal cues from others in the same way that we acquire language from them. Since men and women prefer different nonverbal interaction styles that frequently reflect different gendered patterns, it is likely that our nonverbal interaction style influences how we identify as a particular gender. According to researcher Judith Hall, "man" and "female" are roles, each with a certain set of expected behaviors.

Men and women frequently utilize nonverbal communication in ways that mirror societal norms as a result. Men, for instance, are expected to display assertive behaviors that show their dominance and authority, whilst women are expected to behave more receptively and reactively. Therefore, it should not come as a surprise that men speak more and interrupt women more often than vice versa.

Conclusion

Understanding how non-verbal cues are used to convey messages is crucial in the workplace. You run the risk of missing a crucial message if you simply pay attention to linguistic clues that are being used to communicate. It is important to keep in mind that while our words provide clear meaning, our nonverbal cues reveal our emotions and attitudes. We communicate our actual emotions through nonverbal clues. Acquiring the ability to decipher non-verbal cues enables you to understand the precise message being expressed by the other person. Controlling your body motions might also assist you in avoiding sending unintended messages.More weight is given to how the message is conveyed than what is actually spoken. Positive first impressions are made when you greet your team with a smile on your face.

A terrible impression could be made, though, if you welcome your team members in a commanding manner or make fun of someone in public. Non-verbal cues are a very important and effective form of communication, but they are so frequently neglected. In order to successfully communicate ideas in a meaningful and successful way, all professionals should understand how to use nonverbal cues appropriately. Knowing the appropriate usage and use of technology is crucial for every manager or team leader.

Nonverbal cues include the behaviors or characteristics of human beings, as well as the utilization of things, sounds, moments in time, and places that inspire others to find meaning. Nonverbal communication also serves metacommunicative purposes since it enhances the character and meaning of verbal messages. Nonverbal cues can supplement, contradict, accentuate, control, or completely replace verbal cues. They are therefore a crucial component of the whole communication package.Additionally, nonverbal behavior has communicative value, is ambiguous, mostly relational in character, and offers indicators of dishonesty.

References:

1. Balan,K.R. and Rayudu C.S. (1996) Effective Communication, Beacon New Delhi.
2. Eyre, E.C. (1985) Effective Communication Made Simple, Rupa and Co.Calcutta

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INCREASING OVERALL EQUIPMENT EFFECTIVENESS BY IMPLEMENTATION OF TPM TO REDUCING LOSSES

Priyanka Sulakhe Assistant Professor, Department of Humanities and Sciences, Atharva college of engineering & Technology, Malad (W)
Chaitanya Kolte, Assistant Professor Department of Humanities and Sciences, Atharva college of engineering & Technology, Malad (W)

***Abstract*—** The most prevalent and well-liked techniques are those that measure the overall effectiveness of the device. Total productive maintenance is a frequent strategy utilized. In this project, we'll use TPM to compute OEE and work through issues specific to a chosen industry. We gather machine shop data from the various industries, and after that, we determine the maximum OEE. The ideal OEE value is around 96%.

***Keywords*—** Total productive maintenance, Implementation, OEE

I .INTRODUCTION

Putting into practice comprehensive productive maintenance to raise OEE A medium-sized business called Niraj Enterprises in Malad West has been chosen for this purpose. It is a market leader in producing the pin, roller, and pulley parts required in packing machines. Management needs to gather all relevant information so that it can respond quickly to supervisors' concerns about issues including poor machine maintenance, inadequate tool quality, and inherited flaws. The management has a significant impact on the education and training of all untrained employees. Therefore, they offer unskilled workers training programmers before appointing them to desired positions. It is necessary to employ statistical techniques to determine when training has finished. Here are a few key points made clear.

i. CAPABILITY: It is actual input minus the reference input.
ii. CONVINCINGNESS: Over reference output is actual output.
iii. YIELD: The real output triumphs over the real input. (Amount of finished goods produced per worker)
iv. TOTAL QUALITY MANAGEMENT**:** The manufacturing sector primarily employs 5 principles.

- Generate superior work.
- Pay attention to the customer
- The strategic approach to improvement.
- Constantly becoming better
- Promote respect for one another
- Team effort

POROPOSED METHODOLOGY

Measurements data is collected according to shown below points:

a. Amount of items
b. Faulty item
c. Production time anticipated
d. Unplanned downtime

EXPRESSIONS USED TO CALCULATE OEE:
An essential technique utilized in industries is determining overall equipment efficacy.
Methods as follows:

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i. For a month monitor OEE (including availability, performance and quality) for the target equipment. Ensure that the results are organized by shift.

ii. Evaluate each shifts performance, keeping track of each employee's top performance for availability, performance and quality across all shifts.
To determine the "Best of the Best" OEE score, multiply the best individual performances collectively.

The stretch goal for availability, performance, and quality is represented by the "Best of the Best" OEE score, which is generated from the best results actually attained throughout the month.

Expression used for calculation:

- Accessibility = $\frac{Planned\ production\ time - Unscheduled\ downtime}{Planned\ downtime}$
- Performance= $\frac{Ideal\ cycle\ time\ x\ parts\ produced}{Available\ time}$
- Quality= $\frac{Total\ units\ started - Defective\ units}{Total\ units\ started}$

OEE = (Accessibility x Performance x Quality)

OEE is a measurement of machine potential that is applies when an industry needs to boost productivity. For the purpose of determining the maximum OEE, TQM tools are implemented. The collecting of data is vital for the manufacturing process turn into usable knowledge for productivity enhancement. Machine tools that turn raw materials into finished goods in order to boost OEE are used when better productivity is anticipated. Machine availability with the least amount of downtime is a component of reliability, which calls for failure data analysis and root cause investigation. A TQM tool is a technique that measures product quality and price improvement while also automatically increasing productivity.

CALCULATION

In a Machine Roller Equipment Efficiency as a Whole calculating a machine's pins

Accessibility of Roller = $\frac{49200-3600}{43250} x\ 100$= **92.6%**

Where,
Planned production time= shift Length- Breaks= 43550-3600= 39650 min
Performance of Roller = $\frac{7.3 \times 90}{720}$ x 100= **91%**
Where,
Ideal cycle time = (6x60x12) min per (600) piece = 4320 min per 600 piece= 7.2min/piece Parts produced= 90 piece
Accessible time= 12x60= 720 min
Quality of Roller = $\frac{545}{600}$x 100 = **91%**
Where,
Total number of pieces= 600
Non defective Pieces = Total units started − Defective units = 600- 60=540 pieces OEE=0.92 x 0.91 x 0.91
OEE=76.18 %

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OEE FOR A MACHINE'S ROLLER AFTER TPM IMPLEMENTATION CALCULATION:

Accessibility of Roller = $\frac{43550-3600}{43550} x$ 100= **92.67%**

Where,

Planned production time= (shift Length- Breaks) = (43200-3600) = 39600 min

Performance of Roller = $\frac{6.9}{720} x$ 100 x 100= **96.25%**

Where,

Ideal cycle time = (6x60x12) min per (630) piece = 4320 min per 630 piece= 6.8min/piece Parts manufactured = 100 piece

Accessible time = (12x60) = 720 min

Quality of Roller = $\frac{606}{630}$x 100 = **96.25%**

So,

Total number of pieces = 630

Non defective Pieces = Total units started − Defective units = 630- 30=600 pieces OEE=0.9267 x 0.9625 x 0.9625

OEE=85.85 %

The roller is the product, and the CNC is the machine with the lowest cost, according to the math. OEE (74.25%). This machine is referred to as a TPM model machine since TPM will be used to increase its OEE. After TPM deployment, OEE is computed for the Model machine, and the results reveal an increase in OEE from 76.18% to 85.85%.

RESULTS AND DISCUSSION

The outcomes of the TPM model machine implementation were based on the methods used in the previous chapter. After TPM implementation, OEE for the model machine is also recalculated. Now, the OEE of the roller obtained prior to and following the deployment of TPM is contrasted with the one prior to and following implementation with graphical results being shown.

Table1. Comparison of OEE before and after TPM implementation

Sr.no.	OEE Factor	Before Implementation	After Implementation
1.	Accessibility	92.6	92.6
2.	Performance	91.00	96.25
3.	Quality	91.00	96.25
4.	Overall OEE	76.18	85.85

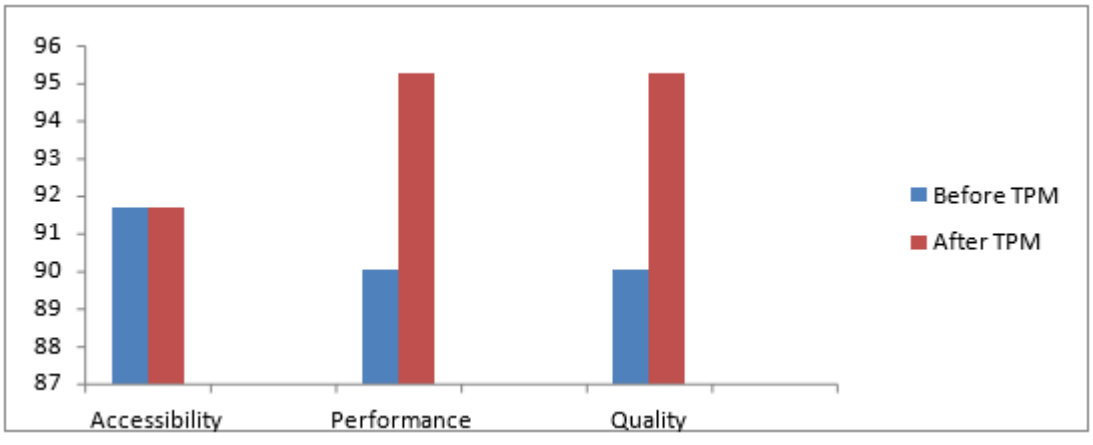

Figure .1. Comparisons of Accessibility, Performance & Quality

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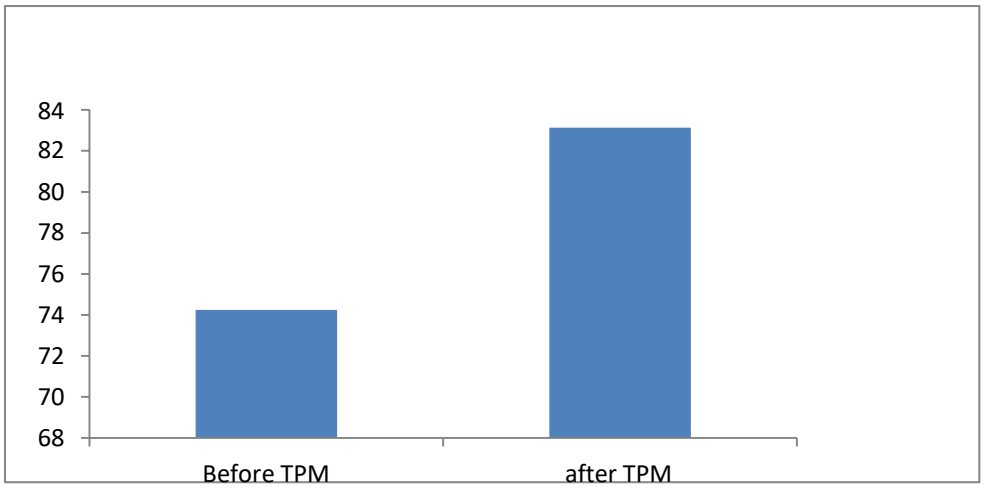

Figure 2. Comparison of overall OEE

It is obvious from the above result that OEE has been adjusted. The model machine that shows improvements in OEE of Roller product at the same scheduled production time while decreasing the quantity of rejected pieces and increasing the quantity of created products following TPM adoption.

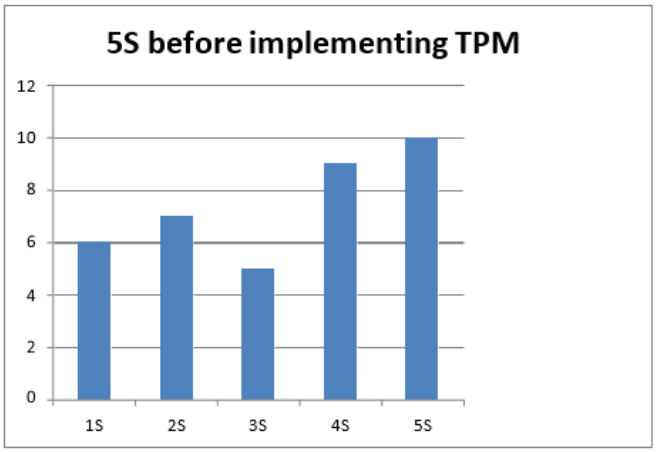

Figure 3: 5S audit following TPM adoption

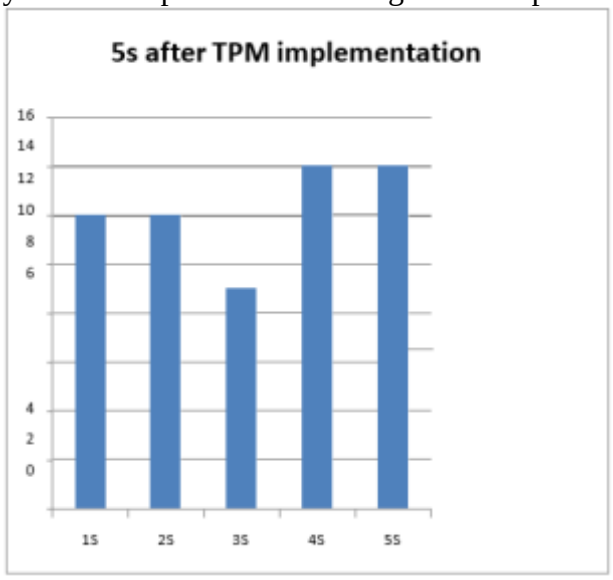

Figure 4. 5S audit after TPM implementation

From the aforementioned findings, it is evident that the 5S audit sheet and graphical scoring representation decrease losses and raise OEE both before and after the deployment of TPM

CONCLUSION

Adoption of TPM improves OEE and reduces losses. OEE is a crucial component for increasing productivity in the sector. OEE is a crucial component for increasing productivity in the sector. This study examines a medium-sized manufacturing industry to assess equipment effectiveness and machine maintenance. To improve the important machine, the numerous issues such as production delays, setup losses, machine losses, idleness, failures, and performance losses are assessed. Step-by-step TPM implementation is then carried out.

REFERENCES

[1] Prabhu M. Vivek, et.al, 2014, "Optimization of Overall Equipment Effectiveness in a manufacturing System".

[2] Ron A.J. de, et.al, 2005, "OEE and equipment effectiveness: an evaluation".

[3] DuttaSubhankur, et.al, 2016, "A Review on the experimental study of Overall Equipment Effectiveness of various machines and its improvement strategies through TPM implementation".
[4] Vijayakumar S.R., et.al, 2014, "Improvement of overall equipment effectiveness (OEE) in injection moulding process industry".
[5] Singh Ranteshwar., et.al, 2012, "Total Productive Maintenance (TPM) Implementation in a Machine Shop: A Case Study".
[6] Raut Swapnil, et.al, 2017, "Implementation of TPM to Enhance OEE in A Medium Scale Industry".
[7]M.S.Rahman, el.al, 2016, "Implementation of total productive maintenance for capacity enhancement by improving overall equipment effectiveness of slotting and honing machine".
[8] SwapnilThorat, el.al, 2018,"Implementation of total productive maintenance (TPM) to enhance overall equipment efficiency in jute industry a case study".
[9]RajkumarSahu, el.al, 2016, "Implementation of TPM through frame model to improve OEE of pet food processing plant".
[10] Gedefaye Achamu1, el.al, 2018, **"**TPM and RCM Implementation in Textile Company for Improvement Of overall Equipment Effectiveness".
[11] Nithin Raj and Sanukrishna S, "Overall Equipment Effectiveness Improvement by Implementation of TPM-A study", International Journal of Advanced Research, Vol.2, No.12, 2014, pp.461-468.
[12] Chowdury M. L. Rahman and M. A. HoqueRaj, "Evaluation of Total Productive Maintenance Implementation in a Selected Semi-Automated Manufacturing Industry", International journal of Of Modern Engineering Research, Vol.4, No.8, 2014, pp.19-31
[13] Pradeep Kumar, Raviraj Shetty and Lewlyn L.R. Rodrigues, "Overall Equipment Efficiency and Productivity of a News Paper Printing Machine of a Daily News Paper Company - A Case Study", International Journal of Engineering Practical Research, Vol.3, No.1, 2014, pp.20-27.
[14] Ashwin B. Virupakshar and Anil Badiger, "Enhancing productivity through TPM concepts: A case study", International Journal of advances in Production and Mechanical engineering, Vol.2, No.2, 2016, pp.23-26.

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AUTOMATIC BLOOD PARAMETER DETECTION USING MATLAB

Nilesh Shimpi, Snehal Bhelkar, Neha Pagaria, Niranjan Samudre Assistant professor, Atharva College of Engineering, Malad

Abstract:-Blood and its components are main indicator tool in determining many pathological conditions. The deficiency of red blood cells, which constitutes 99% of blood cells and specialized as an oxygen carrier, causes various blood disorders. The diagnosis of blood cells manually is tedious and time consuming that could be simplified utilizing automatic analysis. We aim to automate the process by means of making a system that will detect RBC and WBC count along with detecting the level of hemoglobin and cancer cell detection.

We aim to use processing along with machine learning to create this system that will provide RBC as well as WBC count of the user and will provide an accurate hemoglobin level for the sample provided by the user. We will use multiple image processing techniques and machine learning technique to achieve this desired result. With the advent of image processing, neural network microscopic photographs can be processed for the parameters required. The input of the system will be an image of the blood sample that will be acquired using microscopic camera and will be stored in database. Various algorithm are being applied on the image to count different parameters from it and accordingly the output will be displayed on the screen. In simple words, this system will prove to be cost effective and will not be time consuming as it will be using the best algorithms to automate the system.

Keywords: Machine learning, Artificial Intelligence, Hemoglobin Detection.

I. INTRODUCTION

Blood is the most crucial part of all medical research and diagnosis of diseases. Its an important indicator of a health of a human being and essential life giving entity for our survival. In Pathological laboratories producing precise result for every test mainly in the area of RED BLOOD CELL (RBC) count are a major issue. The RBC and WBC count is very useful for diagnosis of various diseases such as anemia, leukemia, tissue damage, etc. .Methods generally used in the hospital laboratories counts the blood cells manually- time consuming and inaccurate results.

Image processing is a powerful method to identify each single cell in blood samples. For this method, some pre-processing and some post –processing techniques have been implemented on the image of blood sample in order to provide a much cleaner and clearer image [1]. We aim to use image processing along with machine learning to create a system that will provide RBC as well as WBC count of the user as well as give an accurate hemoglobin level and platelet detections for the sample provided by the user.

We have used advanced image processing technique with a new set of contour detection algorithm to achieve this desired result and here we have also used the advent of image processing.

Following are the objectives of the given research:

i. To propose a method for segmenting RBC region automatically.
ii. To differentiate the normal RBC and abnormal RBC from blood images.
iii. To assess the developed system qualitatively and quantitatively.
iv. Segmentation and classification method is used to develop an automated RBCs counting system
v. To test segmentation and performance of the system accurately and reliability towards the RBCs count process.
vi. To classify WBC using control detection.
vii. To detect the hemoglobin level using hemoglobin estimation method.

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II. PROPOSED SYSTEM

In MATLAB, Image processing tool are used for detection and calculation of blood parameters. For this method, few pre-processing and post –processing techniques are included. In Pre-Processing technique it consists of image acquisition, image segmentation, etc.

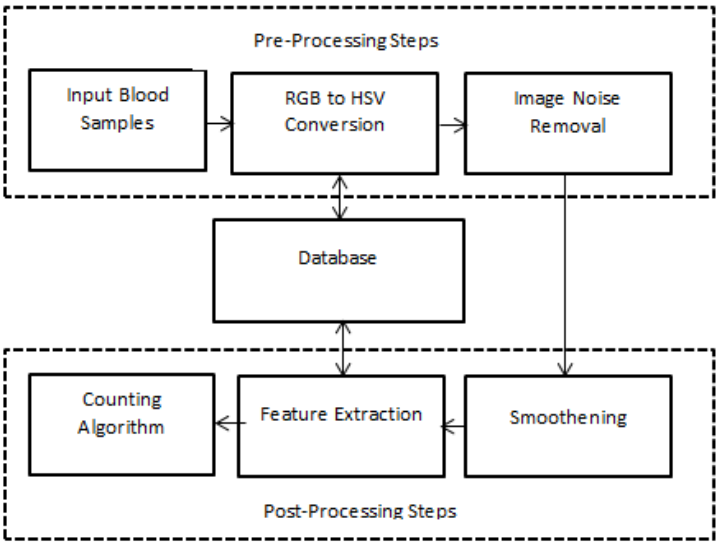

Fig. 1 Block Diagram

The post-processing steps include different mathematical operation for detection and counting algorithms as follows:

The steps used for RBC and WBC Detection is as follows:

Step1- Input Image Blood samples: -

In this step we have captured the blood sample image from database. This blood samples contained lots of irrelevant noise so we cannot apply algorithm directly, so some preprocessing steps need to apply.

Step2-Image Enhancement:-

Image taken from the database in RGB color format .So we need to convert it RGB (Red, Green, Blue) to HSV (hue, saturation, value) image. – HSV model describes color similarly in a way how human eye prefer the image also describing image in terms of RGB make object discrimination complicated.

Step3- Masking

In this step, we have to apply 3x3 mask on the HSV image. Masking is a process in which extraction of blood parts from the background .The mask can be moved from left to right and top to bottom on image and perform the convolution operation. So required object extracted from the background [3].

Step-4 Image Noise Removal-Gaussian Blur

In this step we take input from step 3 which will be a masked image which contains some noise in it. Hence we will be using Gaussian smoothing to remove noise present in it. Gaussian smoothing is the process of blurring the image by using a Gaussian function or kernels [2]. Here we are using 5*5 kernels. A kernel is an array (square) of pixels(a small image).Hence to blur the image we convolve the image with a low pass filter. It actually removes the noise or high frequency component from the image and gives blurred image when this filter is used.

Step-5 Segmentation

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In this step we have used different segmentation technique based on similarity and dissimilarity. It is a technique in which grey scale image converted into binary image, using multi thresholding separate background from foreground.[3]

Step-6 Counter Detection

In counter detection technique is useful for analyzing the shape and detecting the object from image. Hear 3 X 3 masks are used to detect the points which are then connected to form the boundary of the image.

Algorithm to detect hemoglobin level:

For hemoglobin estimation, we first generate pixel intensity distribution histogram for the blood spot sample image. The highest peak in the histogram has corresponding hemoglobin value that is calculated and presented on UI [4]. Here pixel of image are analyzed considering red color intensity and histogram is plotted

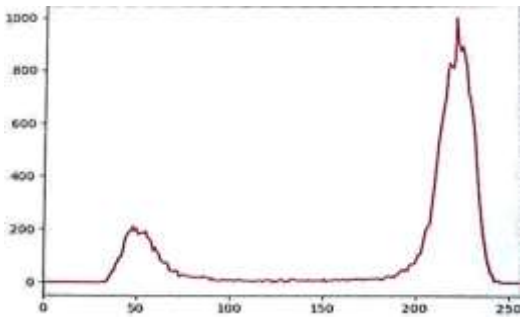

Fig. 2 Histogram of Hemoglobin

Steps for Platelet Detection:

Platelet detection is done using Blob Algorithm [5]. Blob detection detects specific geometry shape such as area, shape, color, etc. Filtering process applied to the shape detected by Blob detection. The basic idea is given as

1) Take an image and do some pre-processing steps and remove the noise from it.
2) Non recursive-
i) If pixel's value is zero
ii) If pixel is out of boundary then also its value is zero.
3) Recursive-If pixel is on
i) Turn of current pixel
ii) Return 1 plus the sum of its entire surrounding pixel

RESULT ANALYSIS

Result of RBC and WBC detection can seen below where input microscopic image is converted to an output image where the detected RBC and WBC in black and violet color.

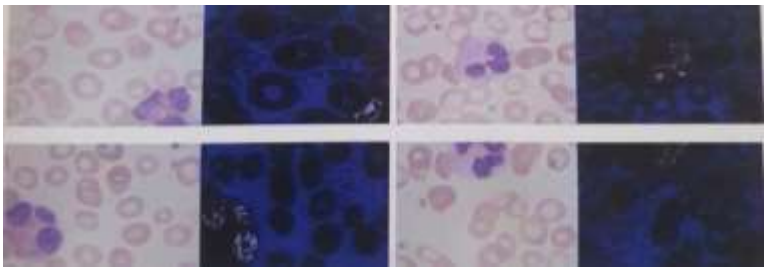

Fig.3 Output of RBC/WBC detection

Two Outputs of platelet detection can be seen below where blue circle is shown over the platelet detected. The platelets are small cell compared to RBC and WBC.

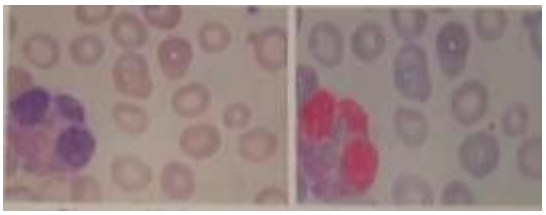

Fig.4 a) Output of Platelet detection

Fig.4 b) Output of Platelet detection

The output of Hemoglobin detection shown as below where a red pixel intensity by which hemoglobin levels are calculated using Hb color scale.

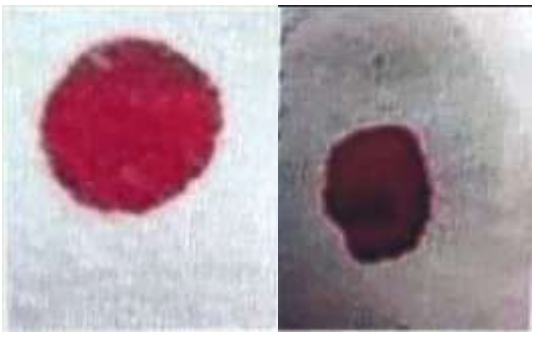

Fig. 5 a) Output of Hemoglobin Detection

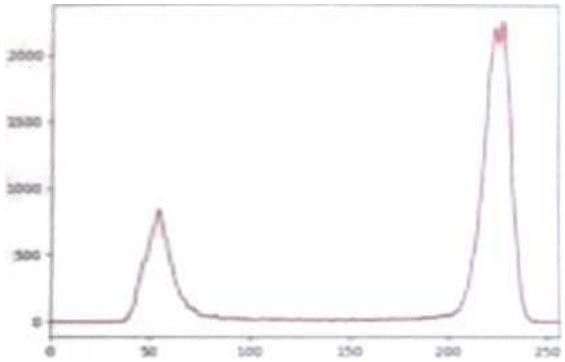

Fig.5 b) Histogram for Hemoglobin

CONCLUSION

Our proposed system consists of GUI. Use of the system will also remove the human errors occurring during manual testing of blood .Hence it is helpful for better diagnosis of diseases.

REFERENCES

1. H. C. Andrews, A. G. Tescher and R. P. Kruger, "Image processing by digital computer", *IEEE Spectrum*, vol. 9, no. 7, pp. 20-32, 1972.
2. W. K. Pratt, Digital Image Processing, New York:John Wiley & Sons, Inc., 1978.
3. Kong Dali, Cui Yang. Research Status and Development Direction of Digital Image Processing Technology. Shandong Institute of Water Conservancy, 2012(04):11-14.
4. Ding Ke. Research and Development Direction of Digital Image Processing Technology. Economic Research Guide, 2013(18): 246-270.
5. Elham Yousef Kalafi,Wooi Boon Tan and Christopher Town,etc. Automated identification of Monogeneans using digital image processing and K-nearest neighbor approaches. BMC Bioinformatics, 2016, Vol.17 (19).

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REVIEW: ADSORPTION OF TOXIC METAL IONS BY EMPLOYING COIR PITH'

Dipa Patel, Dr.P.N. Nemade, Dr. Bhushan Sonawane, Dr. Priyanka Badani Dept. Of Applied Sciences Atharva College of Engineering Mumbai,India

***Abstract*—** Many water supplies are currently contaminated by sources like home and agricultural waste as well as industrial processes. Many adsorbents are used widely for removal of metal ions because of its convenient use. This paper reviews the methods of preparing adsorbent coir pith and its applications as capable component for removal of metal from waste water. It analyses the work of researchers in this field to adsorb metal using coir pith. The study of effectiveness of coir pith is inspected.

Keywords*—adsorption, coconut, coir pith , heavy metal, pH.*

I. INTRODUCTION

Toxic heavy metals are becoming an ecological threat with its increasing presence in pharmaceutical, chemical, textile industries, agricultural pesticides, fertilizers, and other industrial waste. The toxic metals include Nickel, Zinc, Lead, Copper, Arsenic, and Mercury. Heavy metal may result into neurotoxicity, liberates free radical, which in turn boost up damage of lipids, proteins and DNA. Chromium is carcinogenic in nature, causes cancer of lungs, digestive tract and even hemorrhage, diarrhea. Excess exposure of Copper may lead to respiratory problems, kidney and liver failure, headache, vomiting. Nickel is again carcinogen in nature leading to kidney and lung problems, gastrointestinal concern, skin inflammation and pulmonary fibrosis. Mercury is even neurotoxin, influences the central nervous system. Surplus exposure to zinc leads to stomach cramps, skin irritation, anaemia, etc. Exposure to these chemicals may lead to several medical issues to human, so extradition of these metal ions from water is very important. Regulation of laws is becoming rigorous in developed countries for heavy metal ions limit. Since the metallic impurities are non- biodegradable, its removal is necessary. Many techniques are available for treating these metal ions from waste like chemical coagulation, ion exchange, reverse osmosis, biochemical oxidation, and adsorption. Research adsorption method by using adsorbents like graphene, activated carbon, saw dust, carbon nanotubes, tree leaves and barks, silica, coir pith, resilient weed and other agricultural waste like wheat husk, rice husk corn, sugarcane husk, orange peel, banana peel, pinewood is gaining importance. Graphene is a two-dimensional carbon based nanomaterial, having adsorption capacity greater than other magnetic adsorbents like $FeFe_2O_3$, $MnFe_2O_4$. Activated carbon is also a better adsorbent because of its perfectly developed porous design and good surface area, which is the most required criteria for adsorption. Carbon nanotubes also acquire extensive surface area, exceptional mechanical, electrical, adsorption properties, and superior mesopores. Among the many biosorbents used, coir pith obtained from ripened coconut husk is a large area of research interest. Concern has grown regarding wastewater pollution's effects on the ecosystem. The contamination has been cleansed using a number of standard wastewater treatment treatments, including chemical coagulation, adsorption, and activated sludge, but there are still certain drawbacks, particularly the high running costs**..** Coir pith is alsoused for adsorption of toxic dyes. Nonetheless, cost effectiveness is a necessary tool for choice of an adsorbent for heavy metal eradication from wastewater. Commercial activated carbon is estimated to cost around Rs. 500/kg, but bioadsorbents cost between Rs. 4.4 and 36.89/kg, which is significantly less than the price of commercial adsorbents. [8-12]

II. COIR PITH

Coir pith was considered a waste product years before and discarded provoking large environmental issues. Coconut is used extensively in many parts of India and it is even common fruit in many other

Asian countries. 1.6 ton ofcoconut coir pith is procured from husk of 10000 coconuts. Coir pith is a light fluffy material. The dark, porous, lighter-weight particle that is released when the fibre is torn from the husk is known as coconut coir dust. The coir dust is about 70% of the weight of the coconut husk (Tejano, 1985). Coir dust is abundant in lignins and tannins. The adsorption capability of coir pith is due to the existence of hydroxyl and carboxyl groups [8]. Raw coir pith comprises 8.7% ash content, 25.2% lignin, 35.0% cellulose, 7.5% pentosans, 1.8% lipids and resins, and 11.9% moisture

content,10.6% other materials[7]. In consideration of its low cost, the statistic number of research by investigators isincreasing considerably.

Fig1 : Coir pith from coconut fruit

Characteristic	Content
Specific Surface Area (m^2/g)	167
Micro pore Area (%)	89.3
Micro pore Volume (%)	75
Moisture Content	6.35 ± 1.12
pH	5.68 ± 0.01
Ash (%)	47.11 ± 9.07
Porosity (%)	93.11
Organic matter (%)	52.89 ± 9.07
Total Carbon (%)	29.38 ± 5.04
Total Nitrogen (%)	0.44 ± 0.03
C/N ratio	66.13 11.3

Table 1: Characteristic of coir pith [6]

III. PREPARATION OF ADSORBENT

Coir pith obtained from coconut is washed well to discard clay, mud or any other waste attached. Later on it is dried and reduced to 2 mm grain size. Carbonization takes place in conventional electric furnace. On heating at 400° C and adding $ZnCl_2$, char is prepared. The mixture is dried and impregnated char is treated at 650° C [10].This is the general method of preparing coir pith, which can be varied.

The groundwork of coconut coir pith can also be done by washing many times with water, then sun dried for period of 3 days. The dehydrated matter is pulverized into powder using crusher to procure fragments of 100 μm size. The powder was dipped in 1 L of 4N H_2SO_4 for a day. The coir pith which is now activated is drained and washed with distilled water to achieve neutral pH. The acid treatment helps to eradicate mineral elements and to accelerate hydrophilic nature of adsorbent surface [13].

Preparation of coir can be executed likewise by immersing, cleaned and withered coconut coir in 10% potassium hydroxide solution and then washing with distilled water to discard free potassium hydroxide. Heating at 900°C for half an hour in environment of nitrogen is carried out. Washing of

carbon is done in distilled water, followed by 10% hydrochloric acid. Finally washing is given with distilled water to remove traces of free acid and dried. Crushing is done to obtain fine particle of 212-500 μm [5].

IV. APPLICATION OF COIR PITH FORADSORPTION OF METAL

Kitirote Wantala *et al.* performed research on adsorption of Zn (II) and Pb (II) using modified coir pith as adsorbent.The average adsorption capacity time for Zn was found to be120 min and Pb was 10 min. pH 5 was the optimum pH for adsorption. The results also correlate with Freundlich and Langmuir adsorption isotherm. The results obtained were 29.33 mg Zn(II)/g adsorbent and 36.50 mg Pb(II)/g adsorbent[1].

Amarasinghe had used artificial wastewater of $Cd(NO3)2\ 3H2O$ and $PbNO3$ in distilled water and maintaining pH as 5.5 .Batch adsorption test were operated for known metal ion concentration.31 % to 98% was the elevation in the elimination of lead ion just as the concentration of adsorbent was raised from 0.5"10.0 g/L. In contrast to lead, cadmium absorption was slightly lower. The amount of coir pith needed to remove 98% of the cadmium was 10.0 mg/L solution, which was less than Pb's adsorption capacity. For low ion concentrations, the proportion of surface operating sites to overall metal ions in the solution was steep, which indicates all metal ions must have come in contact with the adsorbent and been eliminated from the solution. The study's findings demonstrate that the highest adsorption was seen at pH 5.Adsorption in the initial period of 10 min was highest procuring 90% results. [2]

K. Kadirvelu *et al.* used coir to make activated carbon to adsorb metallic ions, specifically Cadmium from wastewater, which on experimental analysis gave good results. For the adsorption of Cadmium from waste solution, an activated carbon, which was prepared from agricultural solid waste, was used. Criterion like agitation time, adsorbent measure, pH and metal ion concentration were examined. The results for Langmuir adsorption isotherm were 93.4 mg Cd/g at pH 5 (30°C) and particle size was 250-500 μm. The percent extraction rose with pH from 2 to 4 andwas stable till pH 10. Hence, coir pith a waste from coir processing industry is found to be cost effective product for metal ion treatment from water [3].

Anirudhan *et al.* carried out adsorption of heavy metal ions like Pb, Hg, Cu by activated carbon obtained from coconut waste was carried out through batch adsorption process. Pb and Cu adsorbed best at pH 6 and Hg at pH 7. The adsorption capacities of activated carbon declined in the order, Pb > Hg > Cu. The experiment disclosed a good adsorption capacity for Pb(II) and Cu(II) at pH 6.0 and for Hg(II) at pH 7.0 [4].

M.Chaudhari *et al.* carried out batch adsorption test of lead nitrate with 0.1g of activated carbon. Adsorption was low at low acidic pH and increases up to 39.6 % for pH 5 and increased marginally till pH 6.The author had performed the experiment with coconut coir activated carbon (CCAC) and commercial activated carbon(CAC) ,and found CCAC had surface, micro pore area and micro pore volume and pore diameter greater than that of CAC. This in-turn increases the adsorption capacity of CCAC[5].

Adsorption experiment study of Co(II), Cr(III) and Ni(II) was carried out by Parab *et al.* in both single and multi- component systems . 12.82, 11.56 and 15.95 mg/g for cobalt, chromium and nickel, respectively were the adsorption capacity results by using coir. The most favourable pH values for maximal metal ion sorption were detected as 4.3 for cobalt, 3.3 for chromium and 5.3 for nickel.[11]

Namasivayam and Sureshkumar looked into whether coconut coir pith could be used as a biosorbent to remove Cr(VI) after being modified with a cationic surfactant called hexadecyl trimethyl ammonium bromide. The optimum pH for Cr(VI) adsorption was 2.0. During elimination, there was a small intensity reduction of Cr (VI) to Cr(III). The biosorbent's adsorption range was discovered to be 76.3 mg/g[7].

Kulkarni and co-workers (2013), executed his experiment on domestic waste water treatment. The aim of his experiment was to reduce COD and organic matter present in sewage water by application of adsorption technique .The adsorbent he had choose was coir from coconut fruit . The same adsorbent was used in batch and column process and gained clear positive result and removed 75-81% COD [10].

The maximum Cr (VI) biosorption was accomplished at pH 2, which is similar to the work of M.H. Gonzalez and his colleagues who were able to adsorb more than 95% of the possible analyte present in the solution. Cr waste sulphochromic solutions from soil fertility laboratory was used for the analysis. It was observed that adsorption of chromium increased with decrease in pH. The data was tested with various adsorption isotherms. The observation of Gonzalez was that 17% of Cr was eliminated by dried coir of coconut and 72% was removed by hydrated coconut coir. The adsorption time took for removal o*f* ions was 10 min [12].

The results of Sheel Ratan *et al.* of extradition of Nickel from water was 22.8117 % (2 g/L of adsorbate) and elevated to 75.8781 g/L (5 g/L of adsorbate). Batch adsorption test of lead nitrate with 0.2 g of adsorbent 100 ml of nickel solution was carried out and contact time, concentration of lead, pH favorability was observed. Lower pH favors adsorption hence, here the pH range studied was 2-10. Increased adsorption capacity was found at 6, and with increase in pH, the capacity was found to be decreasing. Thecontact time was taken as 2 hours. The results were plotted on Langmuir and Freundlich adsorption isotherm.[13]

EVALUATION

From the pH study variation, it was noticed that low pH favoured adsorption of metal ions .The results are in conformity with Freundlich adsorption isotherm. The interpretation from the research papers is found for the factors like pH, removal time. The ideal pH range for chromium adsorption was found as 1-2, range 4-7 for cadmium, 4.5-6 range for copper, for nickel it was found to be 4-6. The average adsorption time was found to be 120- 900 min, 5-120 min for cadmium, 120 min-12 hours forcopper [6].

V. FUTURE PERSPECTIVES

In this survey paper, the bioadsorbent used for eradicating of metal ions like chromium, nickel, cadmium, lead, mercury and copper is extremely economical adsorbent and is capable of and is a constructive replacement for commercially available adsorbents. The eviction efficiency isupgraded by modifying pH, concentration level and surface area. Still the research executed is less, so the future viewpoint will be definitely to surge the wide research pertinent in the field to remove metal ions from water in a broader sense. Eviction of heavy metal ions from wastewater will be a conclusive challenge, as it will demand huge amount of bioadsorbents.

VI. CONCLUSION

In today's world owing to the expeditiously developing technologies, toxic industrial by-products and practices ,are leading to the devastating situations of environment pollution and disrupting biological processes ,thus menacing public health. Because it offers design flexibility, high-quality treated effluent, is reversible, and may replenish the adsorbent, the adsorption approach is emerging as a potentially preferable choice for the eviction of heavy metals. Usage of biosorbents in the recent past for eviction of various pollutants from wastewater, adsorption of toxic dyes and metals is widely studied. However, application of coir pith by recycling the waste will scale down the environmental pollution, which can be caused by dumping of unwanted coir from coconut fruit after its main use. In spite of all the research activities performed still there is need for better research for preparation of high adsorable coir pith, producing high performance coir pith which can be applicable for bulk experimentation and the disposal of coir pith after use. This review paper puts a light on use of coir pith for the adsorption of metal ions from water on the ground of articleswritten.

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REFERENCES

[1] Kitirote Wantala,Metal adsorbent prepared from coir pith as agricultural waste: Adsorption of Zn(II) and Pb(II) from aqueos solution,Material Science and technology7,101-108,2013. B.M.W.P.K. Amarasinghe,Lead and Cadmium Removal from Aqueous Medium Using Coir Pith as Adsorbent: Batch and Fixed bed Column Studies, Journal of Tropical Forestry and Environment Vol. 01,36-47,2011.

[2] K.Kadirvelu.,Activated carbon from coconut coir pith as metal adsorbent, :Adsorption of Cd(II) from aqueous solution, Advances in Environmental research 7(2),(2003)

[3] T.S. Anirudhan,Adsorptive removal of heavy metal ions from industrial effluents using activated carbon derived from waste coconut buttons,Journal of Environmental Sciences,Vol23,1989-1998(2011).

[4] M. Chaudhuri,Coconut coir activated carbon: an adsorbent for removal of lead from aqueous solution ,WIT Transactions on Ecology and The Environment, Ravage of the Planet III,95(2011)

[5] Muksit Ahamed Chowdhury, Review of Renewable Biosorbent from Coir Pith Waste for Textile Effluent Treatment, International Journal of Textile Science , 5, 132-140,2016.

[6] Namasivayam C. and Kavitha D, Adsorptive removal of 2- chlorophenol by low-cost coir pith carbon, Journal of Hazardous Materials, 257-274. 2003. MSME, Coir Pith Wealth From Waste A Reference.

[7] Renu, Heavy metal removal from wastewater using various adsorbents: a review,Journal of waste reuse and desalination,387- 419,2017.

[8] SB Bhagawat,Literature review,2016.

[9] Parab H, Determination of kinetic and equilibrium parameters of the batch adsorption of Co(II), Cr(III) and Ni(II) onto coir pith,Process Biochemistry,41,609-615.

[10] M. H. Gonzalez, Coconut coir as biosorbent for Cr(VI) removal from laboratory wastewater.,Journal of Hazardous materials,159,252- 256,2008.

[11] Sheel Ratan,The removal of Nickel from waste water by modified coconut coir pith,Chemical Sciences Journal,7:3,2016.

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ANONYMOUS CRIME TIPPING USING BLOCKCHAIN

Rajesh Gaikwad Guide
Shlok Upadhyay, Satyam Vishwakarma, Isha Yadav, DurveshKhanvilkar
Department of Computer Engineering, Shree L.R. Tiwari College of Engineering, Thane, Maharashtra,

Abstract **-** In the present world, the crime rate is always increasing across the globe along with the advancements in the technology to tackle them. However, even after these technological advancements, most people are hesitant to report about a crime incident that they have witnessed because of the fear of getting into various troubles. Our research aims to make people aware about their social responsibility to tell about any crime incident they have witnessed, without fearing any external threat. We are using Blockchain that can simplify crime documentation as well as be cost effective decentralized storage. Hence, along with the server cost reduction, the actual information is also kept safely. In addition to this, we are also exercising a technique to give trust score to the tips to recognize its genuineness based on the tipper,the location and the crime. The web-application apart from being user-friendly, it is also very essential to Crime investigation officers who work on the very basis of this witness information. This web app can help in gaining essential clues as well as having prior knowledge of some extremely dangerous crimes such as terror attacks and bomb blasts which could pose serious national threats.

Index Terms **–** anonymous, blockchain, crime, culprits, fake, genuine, india, tips, web-application, whistleblowers, witness.

I. INTRODUCTION

Today, the entire world is filled with different kinds of temptations. There have always been both right as well as wrong simultaneously. The law enforcement authorities utilizes a variety of methods to find any substantiate evidence of the crime in order to punish the criminals. One of these methods that seems to be the most valid one is anonymous reporting. There are various countries such as India, United States of America, Chine, Singapore and Australia that have developed crime reporting system on the base network to create a more accessible environment for reporting. The major problem that causes the gap between the law enforcement and the substantiate evidence is the possibility of revenge from the criminals. On the very basis of this revenge from the criminals it becomes difficult to encourage people to report about any witnessed crime [3].

Based on the above discussed problem, it becomes important to safeguard the substantiate witness from this revenge of the criminals. This makes anonymity as the most important security demand in any crime reporting mechanism. But we must also consider the fact that anonymous tips might result in huge number of fake tips to waste the time of the authorities and cause trouble to innocent people on purpose. Therefore, we present the idea of a decentralized anonymous crime tipping web-application on the blockchain. The reason blockchain-based network is proposed is that its transparent and open, and can has certain required properties like tamper-free and decentralized. Also, using the blockchain network gives a certain trust in the sense that any intervention can't work [5].

We attempt to bring the concept of utilizing an official ID of the tipper without exposing his/her ID to the authorities only for the sake of elimination of fake tips as well as tips given by bots. The concept of trust

score that we utilize can help in identifying fake tips to more extent. We have tried to cover most of the limitations of the present system and opted for their solutions in the most efficient manner possible [2], [5].

II. PROBLEM

According to the reports, the crime rate in India went from 383.3 per lakh population in 2019 to 487.8 per lakh population in 2020. As per a new study in 2021, in the metro cities of India only up to 8% of the various crime victims registered a First Information Report (FIR) to the police. The remaining 92% victims aren't mentioned on any official records possible. This leads to a major question that why is the majority of the victims or even witnesses not reporting about these crimes?

There are numerous challenges faced by the law enforcement officials in order to investigate and solve the crimes. Out of the variety of different factors that limits the effectiveness and performance of the law enforcement officials, a substantiate witness' ability to give reliable information about actions and identity of criminal is the most important one. Working and solving a crime becomes quiet a tedious task for the law enforcement officials without this basic information about the crime from the witness [1], [2]. Most of the people show hesitancy to give information about any crime they have witnessed due to numerous reasons that includes:

- There is absence of trust with regard to the law enforcement officials. People think twice before giving information about any crime as their own circumstances will be investigated as well.
- People take into account that dealing with law enforcement officials is quite difficult and also the officials will be frequently in contact with the witness and think of it as too much of a hassle.
- There may also be a chance that the criminals may somehow acquire the details of the witness and could threaten the witness' family or cause any harm to them.
- Some of the witnesses may also choose to not disclose a crime incident simply because they face trauma even thinking about it [3], [4].

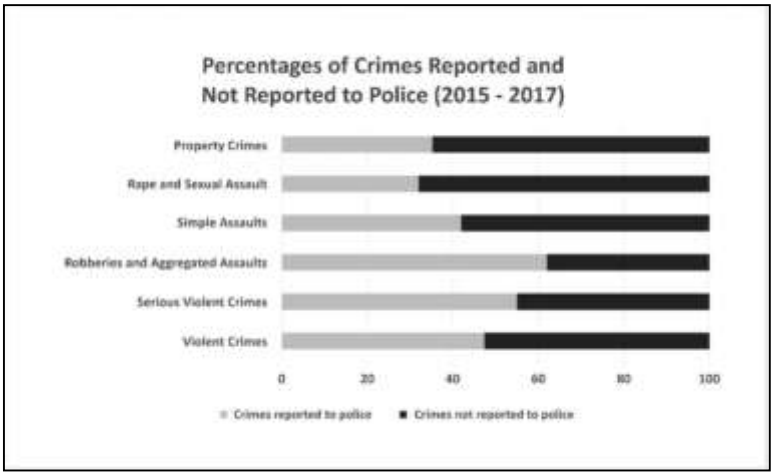

Fig 1. Statistics from 2015 to 2017, showing percentages of crimes reported and not-reported to police

There are also people who don't know if they're supposed to report a crime incident that has either occurred or is about to. There is a lack of knowledge about how, when and who can give information about any crime to the law enforcement officials. In all the cases, we can see that it is more of a social responsibility to report any crime incident rather than just randomly talking to someone about it. There are various ways such as Phone Calls, Letters, Mails, SMS, etc. through which one can report

any crime incident they have witnessed, but the witness should present clear and actual facts in order to establish the genuineness of the

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crime reported. However, despite of the advancements in technology, there still lacks a single-maintained system that connects the people and the law enforcement officials as well as verify the relevance of the crime reported based on concise facts. This seems like a big gap between substantiate witnesses and justice in the world [1].

III. SOLUTION & METHODOLOGY

The solution for this problem that we are developing is a decentralized web-application that enables the user to submit tip-offs about any crime in a completely anonymous manner which will help the law enforcement officials to gain intel on these criminals. We want to provide all the people an equal opportunity to give information about any crime incident they have witnessed without revealing their actual identity. This information is then given a trust score based on the location and type of crime. The information is then forwarded to the law enforcement officials with the trust score who can use this intel and investigate the crime incident, all this while keeping the substantiate witness completely safe and anonymous. This will greatly help in crime solving as well as allow effective documentation of the crime incident [1], [4].

The flow for the proposed system is as follows:

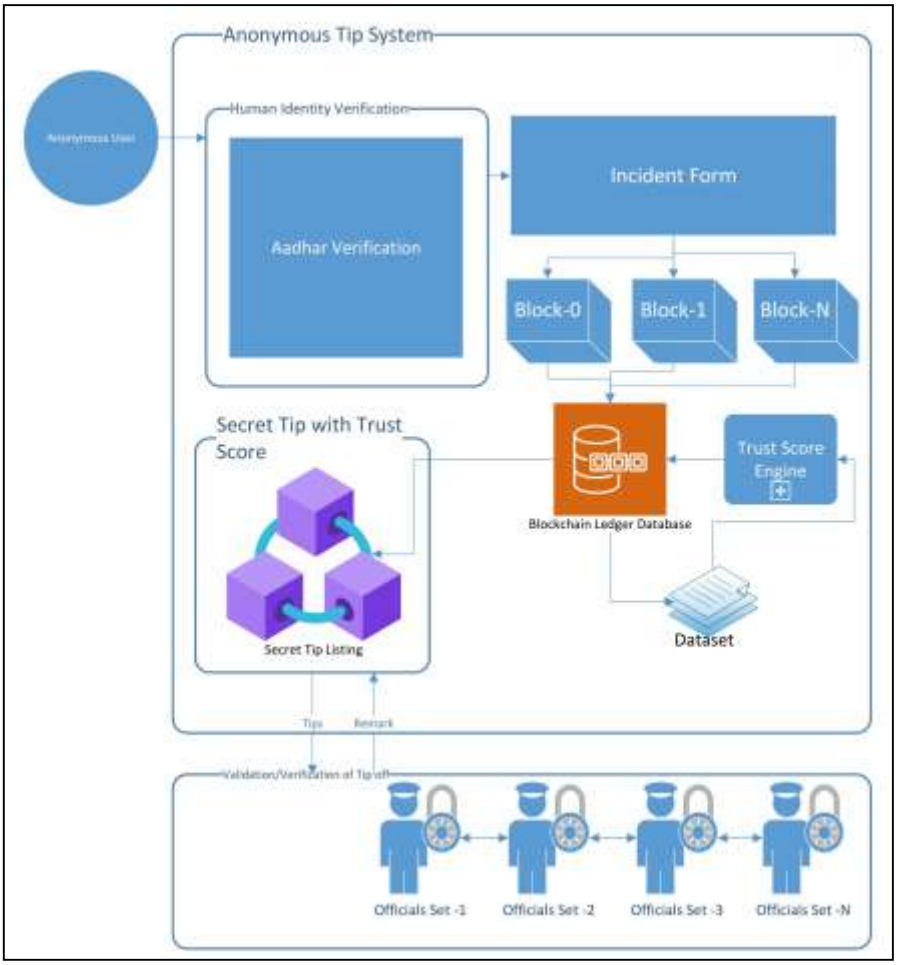

Fig 2. Block Diagram for Proposed System

- The user signs up using the Aadhar verification system, where the Aadhar number is provided by the user and then an OTP is sent to the registered mobile number that the user needs to submit. After this, user logs in using a metamask wallet.
- Once logged-in, the user can submit a tip and provide all the relevant information such as type of crime, location, detailed description of the things witnessed as well as any photograph or video if any regarding the tip.
- Once the tip is submitted, a trust score is generated for the tip based on the user's past tips credibility as well as whether there are other tips for the same location and type of crime in past or present.
- After the trust score has been generated for the tip, the tip details are received by one of the randomly selected official. Then this official can decide based on the trust score whether to investigate or not.
- If the official decides to investigate, then the tip is forwarded to the police station of the location of crime mentioned in the tip. The police can then investigate it and send the investigation report back to the official.
- The official can then check all the details of the tip and investigation and can either approve the investigation report or request for more investigation to be done if any loop holes are found in the investigation.
- Once the investigation report of a tip is finally approved, it is finally stored on the blockchain as a transaction and the user who has submitted the correct tip, has his credibility increased.
- If the tip submitted by the user is investigated and results to be a fake tip, then that user is blocked on the web app for a period of 1 year as a punishment for wasting the resources and time of the police.

Technologies to be used for the development of the proposed system:

- We will be using HTML5, CSS3, JavaScript and React JS to build the front-end of the proposed web-application.
- We will be using Parity to build the Private Ethereum Blockchain Network.
- We will be using MongoDB as our Inter-Planetary File System (IPFS) to store and retrieve information.
- We will be using Solidity to create our Smart Contracts for the proposed system.
- We will be using Self Sovereign Identity (SSI) for the digital identity verification of the law enforcement officials.

IV. CONCLUSION

Our research clearly shows the importance of giving a fair mean to the people for crime tipping while maintaining complete anonymity of the substantiate witness. We often underestimate the importance of a substantiate witness to give crucial information about a crime incident. While a victim of a crime should report it, information provided by a substantiate witness can prove to be a game changer while solving a crime. We have also figured out a way that can help in distinguishing genuine tip-offs from the fake ones considering not all the tips-offs will be legitimate. This could further help the law enforcement officials as the fake tip-offs will be identified early and genuine tip-offs can hold valuable information that can help in solving a crime. We believe that justice is only possible if we give a fair opportunity to all the people that are substantiate witnesses of a crime incident to give valuable information without fearing any threat to them or their families. By utilizing the earlier mentioned technologies, it is possible to develop a decentralized web-application where user can provide tip-offs about crime completely anonymously. This research explains in detail on the techniques and exact high design model that can achieve it. With this

research we hope to cover all the factors that should be considered in crime tipping and we hope to servethe nation with our innovation.

REFERENCES

[1] Raksha S, Samhitha, Raipalle Shreyaa, & Pranav M S. (2022). Survey on Blockchain-based Anonymous Tip-off System. International Journal of Innovative Science and Research Technology, 7(4), 909–913.

[2] Zou, Shihong & Xi, Jinwen & Wang, Siyuan & Lu, Yueming & Xu, Guosheng. (2019). ReportCoin: A Novel Blockchain-Based Incentive Anonymous Reporting System. IEEE Access. PP. 1-1. 10.1109/ACCESS.2019.2915956.

[3] Wang, Huaqun & He, Debiao & Liu, Zhe & Guo, Rui. (2019). Blockchain-Based Anonymous Reporting Scheme With Anonymous Rewarding. IEEE Transactions on Engineering Management. PP. 1-11. 10.1109/TEM.2019.2909529.

[4] Sharma Ashwani & Sharma Bhuvanesh & Bhardawaj Avdesh. “Design of a Novel Online Crime Reporting System.” in International Conference on Engineering Technology and Science (ICETS’16), 2016.

[5] https://www.sih.gov.in/sih2022PS?technology_bucket=Mg==&category=U29mdHdhcmU=&organization=QWxs&organization_type=QWxs

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ACTIVE SUSPENSION USING PID CONTROL WITH MATLAB

Aditya Bende, Antra Panchal, Mayuresh Vedhekar, RiteshVishwekarma, Prof Pragya Jain
Department of Electrical Engineering, Atharva College of Engineering

Abstract
This research paper proposes a PID controlled electromagnetic actuator design for active suspension system. In this method the ride profile is an unknown disturbance and we only measure the vertical displacement of the vehicle body caused by irregular ride profile. The simulation result show that proposed control can achieve better suspension performance and requires less information, also achieves better traction after encountering irregularities on the road.

Introduction

A suspension system consists of springs and dampers which connects the wheels and chassis and is responsible to absorb road bumps. The goal of suspension system is to increase the ride comfort, handling and stability.

Passive suspension compromises in all three criteria where as active suspension provides a common ground between the above three criteria by adding energy back to the system. An electromagnetic actuator incorporated in the suspension system adds energy into the vehicle body thus reducing its vertical acceleration and displacement. It is controlled by algorithm and sensor to provide real time adjustment. The sensor is responsible to measure vertical displacement and acceleration.

Since the 1990s the approach for best cost and performance has resulted in development of electronically controlled suspension which gives continuous and adjustable damping. It has resulted in massive development in servo/solenoid dampers made with co-operation of automobile companies (Ford, Volvo and GM) with control dampers suppliers like Sachs, Tenneco. Recent dampers are from Tenneco utilize magneto-rheological fluid which is non-Newtonian fluid that changes its properties in the presence of a magnetic or electric field. The dampers that utilize these fluids are called MR dampers and are more reliable than electromagnetic ones as they do not have any moving parts. In case of any irregularities on the road the fluid molecules under magnetic field forms a chain like structure absorbing all the forces caused by the bumps of the road.

Simulation

Modeling of Active Suspension of with Quarter Model of a Car

We use unknown and uneven road profile to compare both the suspension systems. The response of the control strategy used in active suspension is determined using Simulink toolbox which is then compared with passive suspension response. The quarter model of car shown below, is used for active suspension system with the marked elements.

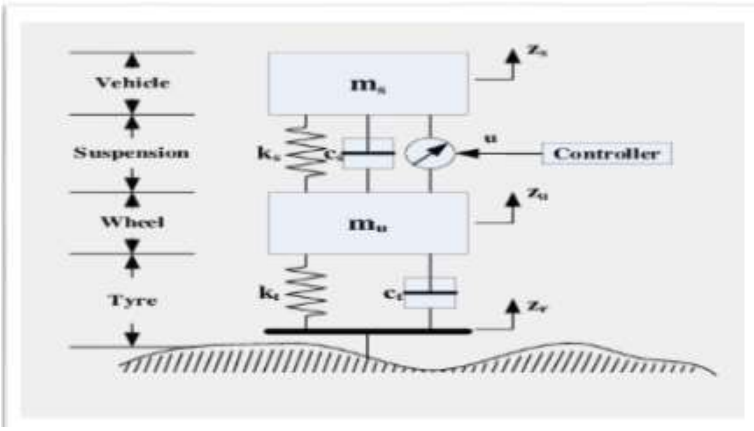

Figure1: Active Suspension System of a Quarter Model of Car

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Figure 1 demonstrates following quantities: -

- Ms: Sprung Mass (Car Chassis)
- Mu: Unsprung mass (Wheel Mass)
- Ks: Spring Stiffness
- Kt: Tire Stiffness
- Cs: Damper Force
- Ct: Tire Force
- U: Actuator Force
- Zs: Body Displacement
- Zu: Wheel Displacement
- Zr: Road Profile Displacement

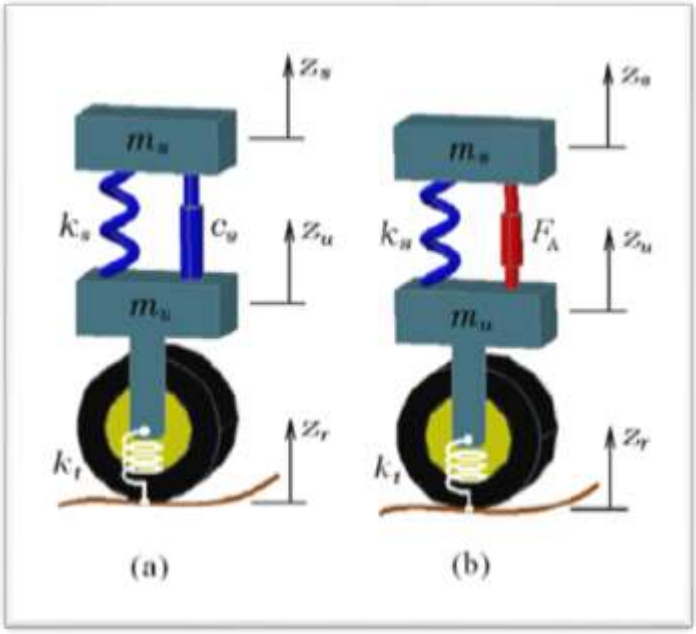

Figure 2: a) Passive Suspension b) Active Suspension

Mathematical model of active suspension

The damper is replaced by the actuator, results in suspension system with the spring. Thus, according to figure 2(b): -

$$Ms.\ddot{Z}s + Ks(\mathrm{Zs} - \mathrm{Zu}) = Fa$$

$$\mathrm{Mu}.\ddot{Z}u - \mathrm{Ks}(\mathrm{Zs} - \mathrm{Zu}) + \mathrm{Kt}(\mathrm{Zu} - \mathrm{Zr}) = -\mathrm{Fa}$$

Mathematical model of passive suspension

According to figure 2(a): -

$$Ms.\ddot{Z}s + Cs(\dot{Z}s - \dot{Z}u) + Ks(\mathrm{Zs} - \mathrm{Zu}) = 0$$

$$Mu.\ddot{Z}u - Cs(\dot{Z}s - \dot{Z}u) - Ks(\mathrm{Zs} - \mathrm{Zu}) + Kt(\mathrm{Zu} - \mathrm{Zr}) = 0$$

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Mathematical Model of Active and Passive suspension using Simulink Toolbox

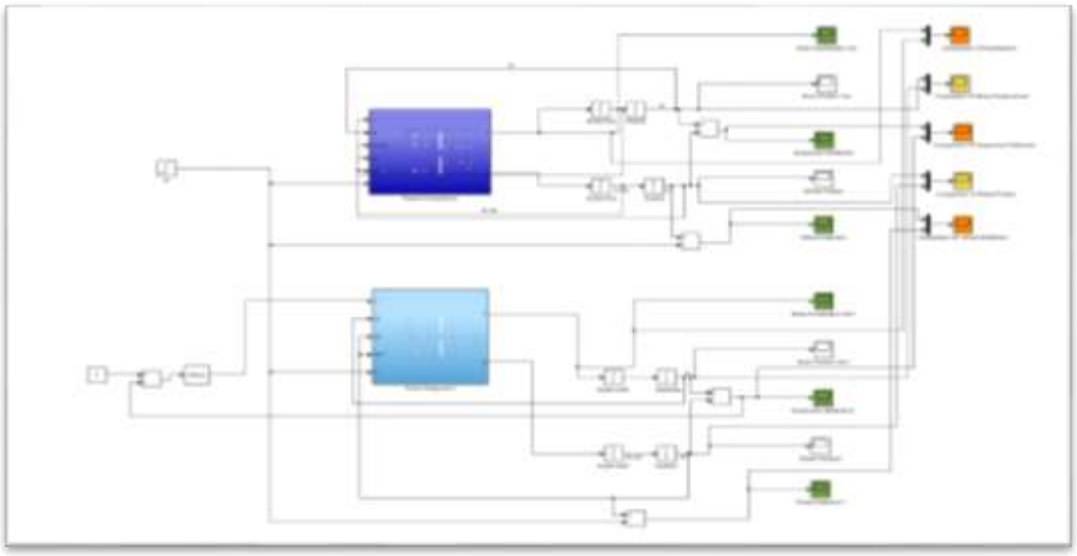

Figure 3: Comparison of Passive and Active Suspension

In Figure 3 Simulink model is made using mathematical model of passive and active suspension system. Purple subsystem in figure denotes passive suspension model and blue subsystem denotes active suspension model.

Following below are the constant values taken: -

Constant Values	Value
Ms: Sprung Mass	282 kg
Mu: Unsprung Mass	45 kg
Ks: Spring Stiffness	17900 N/m
Cs: Damper Force	1000 Ns/m
Kt: Tire Stiffness	1657900 N/m
Zr: Road Profile Displacement	1
Proportional(P)	1
Integral(I)	100
Derivative(D)	5000

Table 1. Vehicle suspension system parameters for a quarter-car model

Simulation Results are Shown below. When compared to its passive equivalent(yellow), the active vehicle suspension system(blue) exhibits a high level of vibration attenuation.

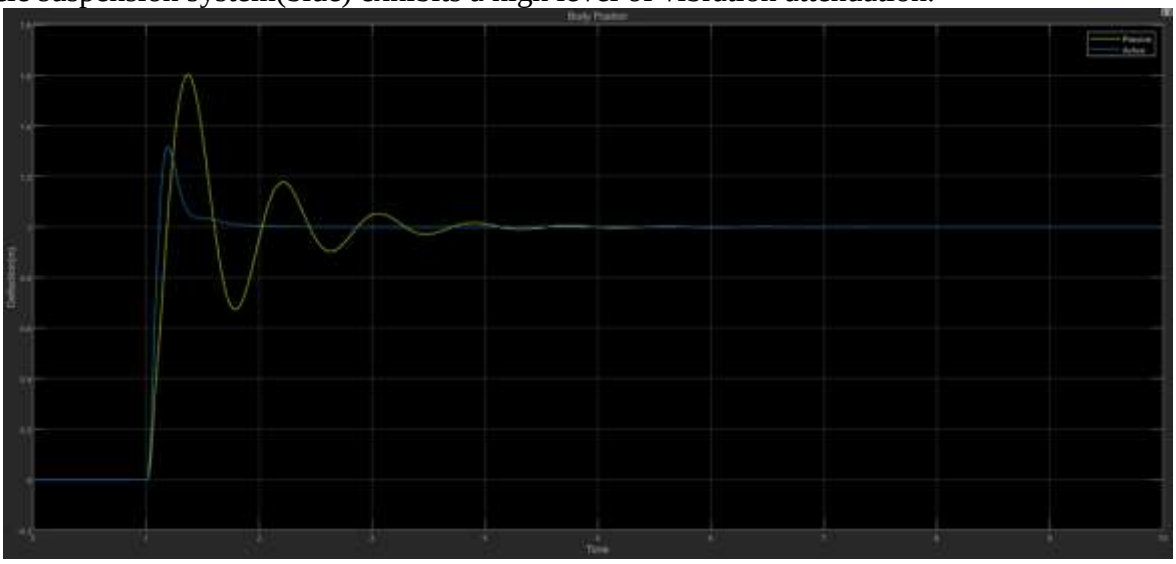

Figure 4: Comparison of Body Position versus Time

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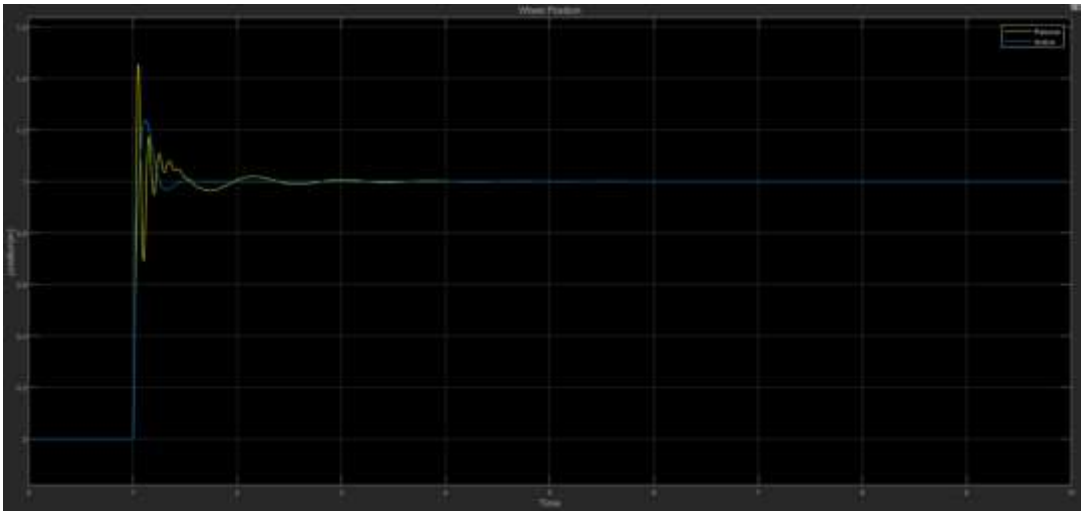

Figure 5: Comparison of Wheel Position versus Time

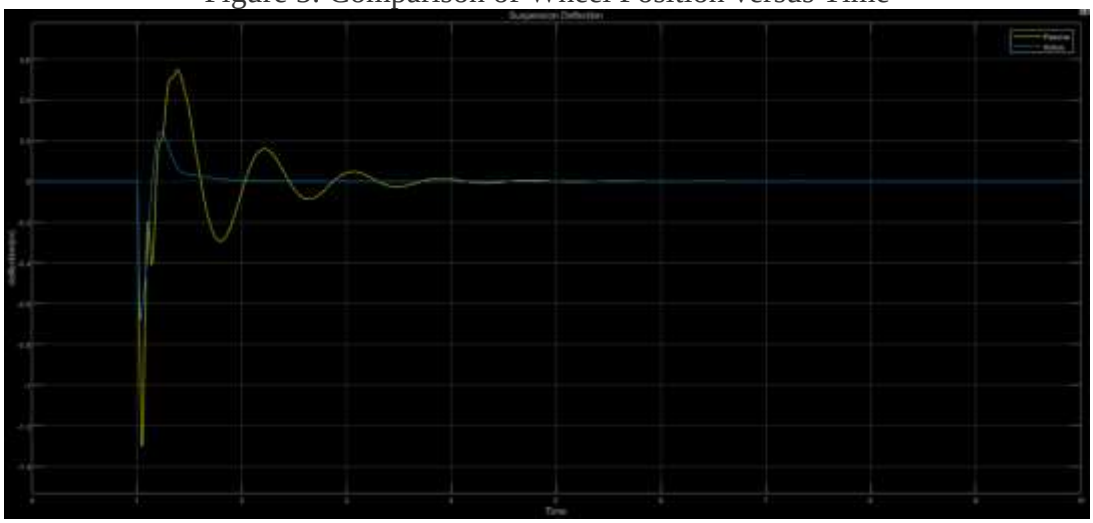

Figure 6: Comparison of Suspension Deflection versus Time

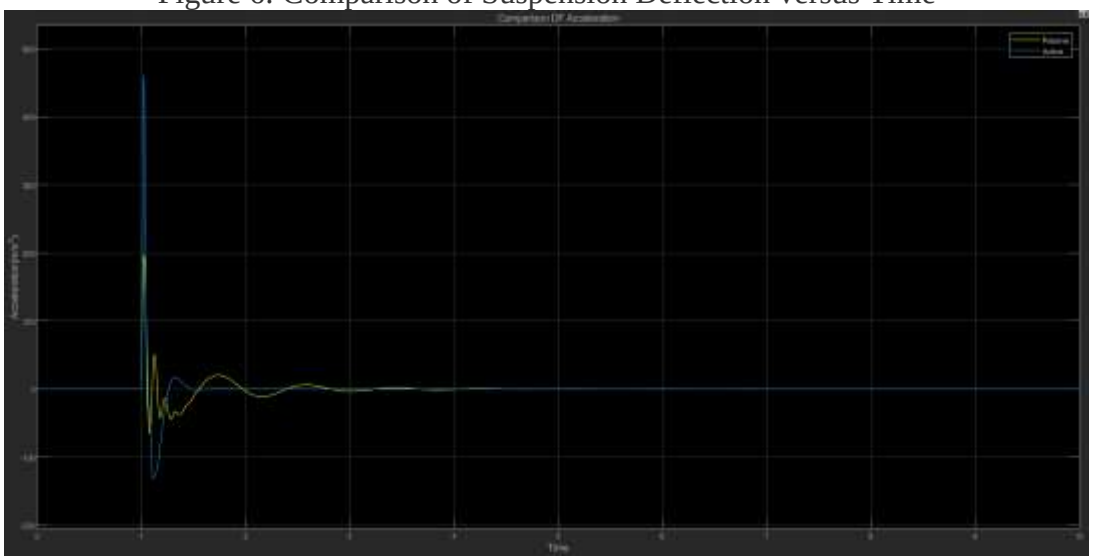

Figure 7: Comparison of Acceleration versus Time

Simulation Results

In the above figures road disturbances are assumed as the input for the system. Parameters the are taken into observation are body position, wheel position, suspension deflection and comparison of acceleration.

No	Parameters	Passive	Active	Reduction
1	Body Position	1.6m	1.3m	18.75%

2	Wheel Position	1.47m	1.21m	17.68%
3	Suspension Deflection	0.58m	0.21m	63.793%
4	Acceleration	$199m/s^2$	$460m/s^2$	-131.15%

Table 2: Comparison table between active and passive suspension

Table 2 shows reduction in body wheel and suspension travel when compared to a step input for Zr=0.1. When compared to acceleration the reason active suspension has higher acceleration value is because it has better opportunity for traction as bumps are absorbed by the suspension.

Conclusion

The suspension system proposed only responds to the position of the car body and tire and is independent of road profile, this factor is the main advantage of the system. The simulation findings demonstrate that it takes less time than passive suspension to stabilise the vertical position of the quarter of the car. The choice to utilise an active suspension system should be based on the trade-offs involved as it leads to higher costs, more complexity and leads to more maintenance requirements.

References

1) AMA Soliman MMS Kaldas, "Semi-active suspension systems from research to mass-market – A review Journal OF Low Frequency Noise, Vibration and Active Control 2021, Vol. 40" Journal of Low Frequency Noise, Vibration and Active Control 2021, Vol. 40(2) 1005–1023.
2) Jing Na, Yingbo Huang, Qianqian Pei, Xing Wu, Guanbin Gao and Guang Li," Active Suspension Control of Full-car Systems without Function Approximation." 10.1109/TMECH.2019.2962602, IEEE/ASME.
3) Rahul G Shete ,Akshay S Tawar, Kaustubh A Gunjal ,Shraddha R Kulkarni ,Saurabh M Gunjal ,Aniket R Bunde ,Sharad A Jadhav ,Siddhant D Sananse," Digital Image Processing Assisted Active Air Suspension in Automotive Vehicle."Univerisity of Canberra 2020 978-1-7281-5970-6.
4) Mostafa Ghoniem ,Taher Awad ,Ossama Mokhiamar," Control of a new low-cost semi-active vehicle suspension system using artificial neural networks" Alexandria Engineering Journal ,2020 59, 4013–4025.
5) Abd El-Nasser S. Ahmed, Ahmed S. Ali, Nouby M. Ghazaly ,G. T. Abd el- Jaber," PID CONTROLLER OF ACTIVE SUSPENSION SYSTEM FOR A QUARTER CAR MODEL" International Journal of Advances in Engineering & Technology, Dec., 2015. 22311963.
6) Jiangtao Zheng Xiju Zong Songxiang Ma," Comfort Control of Active Suspension Based on State Feedback." School of Electrical Engineering, University of Jinan, Jinan, China ISSN 2689-6621.
7) Esteban Chávez Conde ,Francisco Beltrán Carbajal ,Antonio Valderrábano González Ramón Chávez Bracamontes," Generalized PI Control of Active Vehicle Suspension Systems with MATLAB" Universidad del Papaloapan, Campus Loma Bonita 2Universidad Autónoma Metropolitana, Plantel Azcapotzalco, Departamento de Energía 3Universidad Politécnica de la Zona Metropolitana de Guadalajara 4Instituto Tecnológico de Cd. Guzmán México DOI: 10.5772/23746

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DISPLACEMENT-AMPLIFYING COMPLAINT MECHANISM FOR SENSOR APPLICATIONS FOR VIBRATION MEASUREMENT IN INDUCTION MOTOR

CHAITANYA KOLTE, ASSISTANT PROFESSOR DEPARTMENT OF HUMANITY AND SCIENCES ATHARVA COLLEGE OF ENGINEERING MALAD(WEST)
PRIYANKA SULAKHE, ASSISTANT PROFESSOR DEPARTMENT OF HUMANITY AND SCIENCES ATHARVA COLLEGE OF ENGINEERING MALAD(WEST)

Abstract
The topic of the paper is displacement-amplifying compliant mechanisms (DaCMs), which employ a single elastic continuum and the input force applied at one location to produce amplified output displacement at a different point. In order to accurately represent the static and dynamic behavior of DaCMs, we created a spring-mass-lever model. Using a combined Figure of Merit, we used this model to evaluate the topologies of DaCMs for sensor applications using a number of criteria. When none of the DaCM topologies in the database can fully satisfy the needs of a new sensor, we use topology optimization to create a new DaCM. In order to include them in the optimality criteria approach, which is utilized to solve the topology optimization problem, these nonlinear constraints have to be linearized. Two applications of DaCMs, namely, a bulk-micromachined high-resolution accelerometer and a minute mechanical force sensor are pursued in this work.
1. ***Keywords:*** *Induction machines, harmonics, hysteresis, saturation, mechanical vibrations.*

1. INTRODUCTION

The focus of the paper is on compliant mechanisms, which amplify displacement at one point of an elastic continuum by using the force applied at another. Thus, the single-piece elastic body that makes up a compliant mechanism behaves rather stiffly like a lever. This work takes into account two uses for a Displacement-amplifying Compliant Mechanism (DaCM), namely a high-resolution micro-machined accelerometer and a tiny mechanical force sensor. The thesis includes thorough computational and analytical modelling, methodical design, including topology optimization, and testing of two devices.

2. Structural Analysis Of DaCM by Solidworks Structural Analysis.

Figure 1: Structural Analysis of M1 Structure

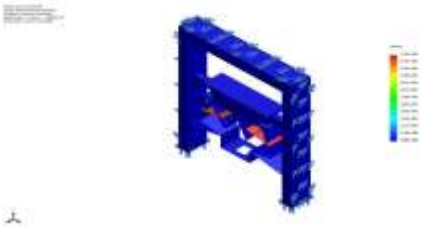

Figure 2: Structural Analysis of M1 Structure

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Figure 3: Structural Analysis of M1 Structure

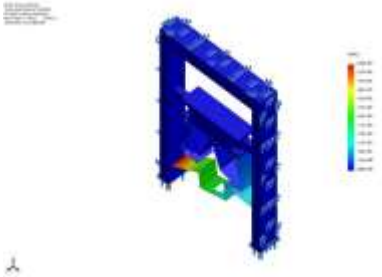

Figure 4 : Structural Analysis of M1 Structure

3. Results Obtained by Frequency Analysis

Frequer Numb	Rad/s	Her	Secon
1	0.153	740	41.04
2	0.732	760	8.578
3	53.74	775	0.116
4	54.43	770	0.115
5	116.2	771	0.0540

Mode Number	Frequency(Hertz	X directi	Y directi	Z directio
1	740	1.2178e	0.0023	**1.7202e-0**
2	760	0.0013	1.0524e-	**0.001019**
3	775	5.5946e	1.6374e-	**7.2929e-0**
4	770	8.0157e	2.313e-	**1.0461e-0**
5	771	0.0011	0.0013	**2.266e-00**

Table : Results Obtained by Frequency Analysis

4. Conclusions

Understanding displacement-amplifying compliant mechanisms (DaCMs) and looking into its applicability for sensor applications are the project's main goals. In order to do this, a lumped spring-mass-lever model for the DaCM has been presented, which represents both its static behavior and the dominant-dynamic mode. These models have been used to categorize and assess different requirements that are crucial for sensor applications. A number of realizations were made, most notably the significance of net

amplification for sensor applications as opposed to inherent amplification. To create a catalog of DaCM topologies, several mechanisms from the literature were taken into account.

Appendix

EFFECT OF FABRICATION LIMITATIONS ON THE RESOLUTION OF AN ACCELEROMETER

.**References**

2. Hybrid Time-Frequency Domain Analysis for Inverter-Fed Induction Motor Fault Detection, Proc. IEEE Int. Conf. Industrial electronics (ISIE), Jan. 2011, Chua, TW, Tan, W.W., Wang, Z.X., and Chang, C.S.

3. Induction motor fault diagnosis using current analysis in the time domain was described by Ece, D.G., and Gerek, O.N. in Proc., 17th IEEE Int. Conf., Signal Processing and Communications, 2009, pp. 488–491.

4. (2009) "Gaussian orthogonal ensemble spacing statistics and the statistical overlap factor applied to dynamic systems", Journal of Sound and Vibration, Volume 324, Pages 1039–1066. Nicole J. Kessissoglou and Geoff I. Lucas.

5. Design optimization for dynamic response of a mechanical vibration system with uncertain parameters using a convex model, Journal of Sound and Vibration 318, 406-415, Xiao-Ming Zhang and Han Ding, 2008.

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FABRICATION AND RESPONSE REPLICATION OF UNSTRUCTURED AND PRESTRUCTURED MR ELASTOMER AND ELASTOMER USING STEEL NET

Bharat Bhagwat Waghode, Research Scholar, Oriental University, Indore, MP, India
Netra Pal Singh, Professor, Oriental University, Indore, MP, India
Jitendra Narkhede, Assistant Professor, D.Y. Patil Institute of Technology, Pimpri, Maharashtra,
Corresponding author. Email: bharatwaghode@atharvacoe.ac.in

***Abstract*—** The magneto-rheological (MR) elastomeric material has developed addicted to a powerful and cutting-edge smart substance which adjusted and quickly acted upon in relations of mechanical belongings using or deprived of the usage of a magnetic flux. They are made of elastomeric materials with Fe elements incorporated into the medium. Based on the application of a magnetic field during the fabrication process, isotropic and anisotropic MR elastomers are divided into various groups. An elastomer's matrix contains magnetizable particles that are distributed in a highly controlled and kind-organized manner. After observing the structural and behavioral alterations of MREs, another fabrication was made by layering a steel net between elastomeric mediums to replicate the behavior of MREs. Their performance was shown via a Fast Fourier Transform (FFT) analysis. Due to their exceptional mechanical properties, they can be used in a range of applications, including seismic devices, vibration absorbers, and isolators.

***Keywords*—** smart material, magneto-rheological elastomer, carbonyl particles

I . INTRODUCTION

The developing trend of a superior and lax regime has boosted demand for both new technologies and materials, drawing a lot of attention to sophisticated smart and bright functional features. According to Kamila et al., environmentally sensitive possessions are those that are like-minded to ecological elements comprising magnetic flux, mechanical stresses, high temperature, and light (2013). Magneto rheological (MR) resources have become the most significant smart resource due to their enormous economic potential. They are characterized as resources for applied smart materials that exhibit rheological then visco-elastic characteristics like yield plus shear stress as well as damping characteristics in the presence of an external magnetic field. On the other hand, due to the formation of its beautifully polarized particles, MREs can now be divided into two separate sets: isotropic (unstructured) and anisotropic (prestructured). In an isotropic MRE, the polarized elements are uniformly distributed, resulting in physical recitals that are trustworthy in every direction. According to Danas et al. (2012) and Kumbhar et al. (2013), the magnetic elements in an anisotropic MRE are stretched sideways with the input magnetic flux track (2012, 2013). These resources were selected for this investigation. Due to their practical use in vibration absorbing devices and their inherent characteristics under external magnetic flux, Zhou et al. (2014) and Ge et al (2013).

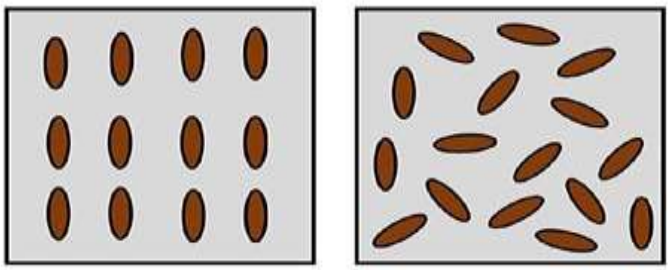

Fig. 1: *Isotropic and anisotropic MRE's*

Preparation of unstructured and prestructured MREs with 350% iron elements by mass of elastomer medium have been done in this revision Kumbhar *et al.* (2012, 2013) and Zhou *et al.* (2014) and Hegde *et al.* (2014). Another preparation was conceded out by setting steel mesh in between the

elastomeric marix after sighted the structural and behavior alterations of MREs. And, using Fast Fourier Transforms(FFT) examination, observed at models for transmissibility and proportion of vibration concentration Kumbhar *et al.*(2012, 2013). To view the interior morphology of isotropic and anisotropic material materials, SEM examination is required, Ge *et al.*(2013) and Zhou *et al.*(2014) and Khimi *et al.*(2015).

II. FABRICATION OF ISOTROPIC / ANISOTROPIC MR ELASTOMER AND ELASTOMER WITH STEEL NET

An advantageous prestructured magnetic elastomer is an anisotropic magnetic elastomer (MRE). For the period of the curing practice, an exterior magnetic flux is applied to the mixture of magnetic particles and elastomer matrix. One of the most useful unstructured magnetic elastomers accessible is the isotropic MR elastomer. The combination was not subjected to any additional external magnetic flux while it was being cured. According to Kumbhar et al., MRE is an elastomer matrix containing ferromagnetic particles that cures with or without magnetic flux (2012, 2013).. In MRE, which comes in type A (liquid reagent) and type B, iron particles were used with an elastomer matrix that was blended with silicon oil at a ratio of 350 percent by weight (curing reagent). According to Tang et al., the PDMS elastomer was selected due to its straightforward curing process and broad temperature range (2015). Permanent magnets were used to apply a magnetic field during the curing of anisotropic MREs. The cure period was 48 hours for both samples. There are a total of three samples, two of which are MREs that are isotropic and anisotropic. The other, meanwhile, is made of elastomer and steel mesh. 350g of CIP were used to create samples 1 and 2. The type of magnetic flux determines whether there is magnetic flow or not. According to Li et al. (2013), Hiruddin et al. (2014), and Kang et al. (2015), MRE samples 1 and 2 were isotropic (unstructured) and anisotropic (prestructured), respectively (2020).

Table 1: Contented by wt. used for Sample 1 and 2

Model Type	Part-A	Part-B	Si-Oil	CIP	Drying Time
Unstructured & Prestructured MRE	50	5	50	350	48

(Both samples are of same contents, Sample 1 and 2)

Model 3 has been organized by elastomer by means of steel mesh having weightiness of 20gm introducing in elastomeric medium of weightiness 55gm (50 +5) by 10gm of Si oil.

Table 2: Contented by wt. used for Sample 3

Model Type	Part-A	Part-B	Si-Oil	CIP	Drying Time
Elastomer by means of Steel Mesh	50	5	10	Steel Net=20	48

(In Sample 3, Steel mesh is to be introduced in abode of CIP)

Figure 2 depicts a actual image of isotropic(unstructured) and anisotropic(prestructured) MRE combined by 350gm of CIP. Fig.3 characterizes a true representation of an elastomer with a steel net.

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Fig. 2: *Unstructured (Sample 1) and Prestructured (Sample 2) And Elastomer with Steel net (Sample 3)*

III. RESPONSE ANALYSIS OF MRE's

To ascertain the efficacy of organized MRE samples in terms of transmissibility and percentage of vibration absorption, it was crucial to conduct the investigative investigation, which was briefly mentioned in the study article given. The testing design is depicted in Figure 6. Two accelerometer sensors, a system, an activation table, and a relevant channel FFT make up the test framework. The accelerometers picked up the frequency and amplitude of the vibrations, which the FFT analyzer then captured. Both accelerometer sensors recorded the amplitude force. Both unstructured and prestructured MRE samples were utilized in the experiment, which was run under a variety of conditions. Different loads, notably 0N, 10N, 20N, and 30N, were utilized based on the size of the MRE samples.

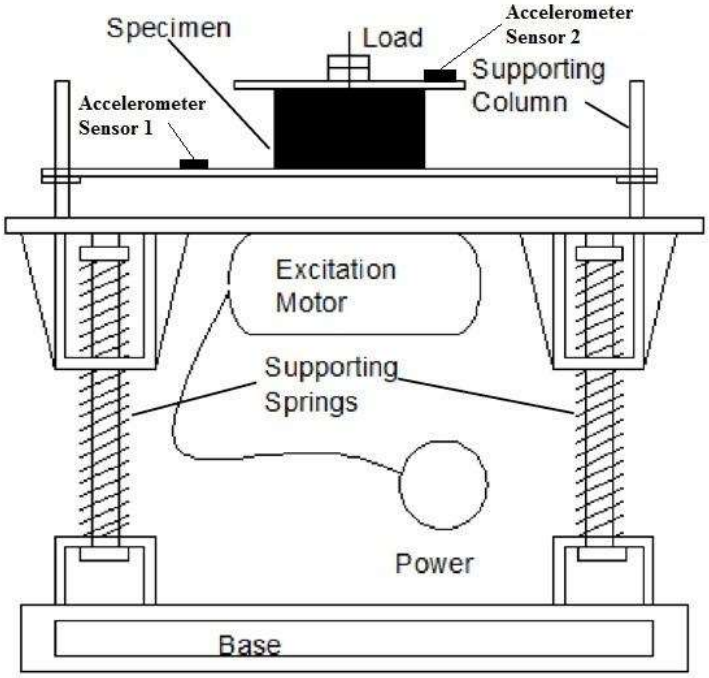

Fig. 3: *Design of Experimental Setup*

Under such load circumstances, the amplitude and frequency of each MRE were examined.

A) Sample 1

Table 3: Outcome table for Model 1

Location	Amplitude	Transmissibility	Vibrat.Absorb %
	Below No Load		
Superior Amp.	7.38	0.793	20.703
Inferior Amp.	9.31		
	Below 10N		

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Superior Amp. Inferior Amp.	7.27 9.19	0.791	20.892
	Below 20N		
Superior Amp. Inferior Amp.	6.74 8.57	0.786	21.354
	Below 30N		
Superior Amp. Inferior Amp.	6.58 8.42	0.781	21.853
All interpretation are figured by FFT analyser at 48.3 Hz			

Model 1 using zero load then 10N load condition

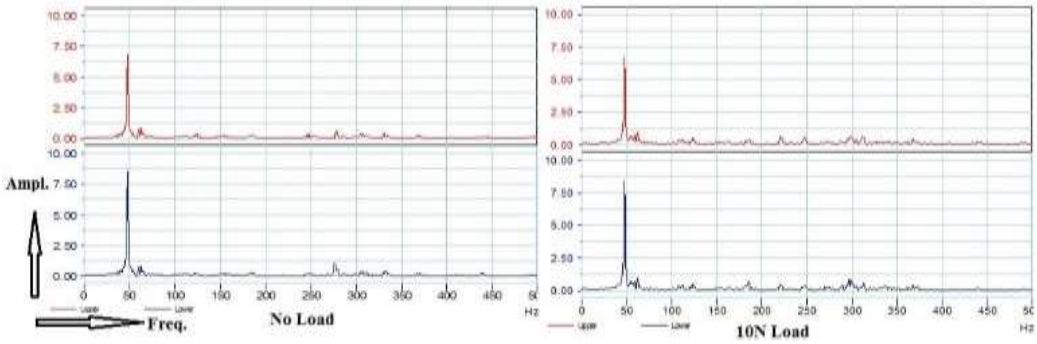

Fig. 4: *FFT diagram for Model 1 with zero load and 10N*

Model 1 using 20N load then 30N loads condition

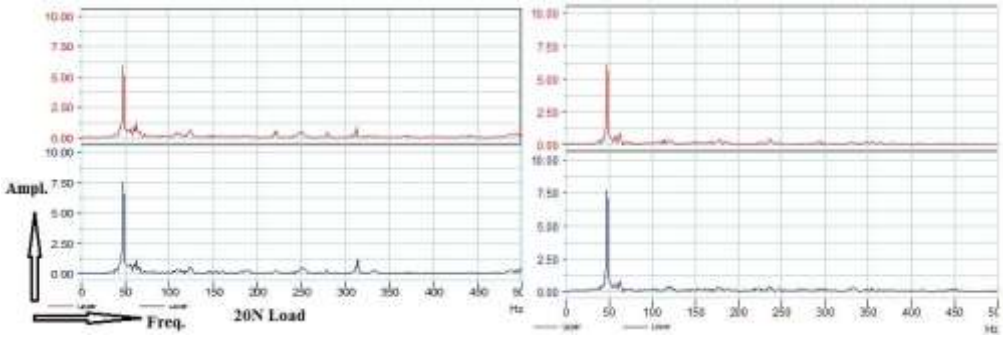

Fig. 5: *FFT diagram for Model 1 with 20N and 30N*

In all loading scenarios, both accelerometer sensors detect the vibration amplitude of both locations at natural frequency 48.3Hz, as seen in the FFT diagram for model 1. From the measured amplitude, the transmissibility proportion and vibration absorption proportions must be calculated. The best outcome in terms of concern objectives is Sample 1's 21.853 percent vibrational absorption and 0.781 transmissibility proportion at 30N load.

B) Sample 2

Both accelerometer sensors pick up the dynamic response of both places at resonance frequencies 48.3Hz under all loading conditions, as the FFT graph for sample 2 demonstrates. The observed amplitude must be used to calculate the transmissibility ratio and percent of vibration absorption. The best outcome in terms of the primary objectives is demonstrated by Sample 2 at no load, which exhibits 21.915 percentile vibration absorption and 0.781 transmissibility ratio.

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Table 4: Outcome table for Sample 2

Location	Amplitude	Transmissibility	Vibrat.Abs.%
	Below No load		
Superior Amp.	6.77	0.781	21.915
Inferior Amp.	8.67		
	Below 10N		
Superior Amp.	6.39	0.783	21.691
Inferior Amp.	8.16		
	Below 20N		
Superior Amp.	5.71	0.784	21.566
Inferior Amp.	7.28		
	Below 30N		
Superior Amp.	5.68	0.791	20.113
Inferior Amp.	7.11		
All interpretation are calculated by FFT analyser at 48.3 Hz			

Model 2 using zero load then 10N load condition

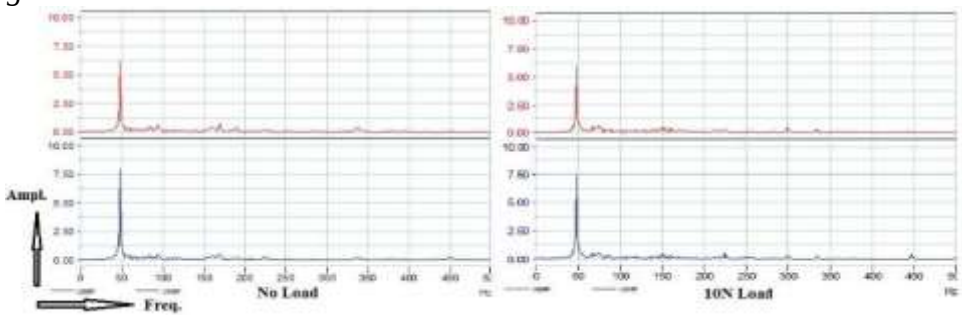

Fig. 6: *FFT diagram for Model 2 with zero load and 10N*

Model 2 using 20N load and 30N load condition

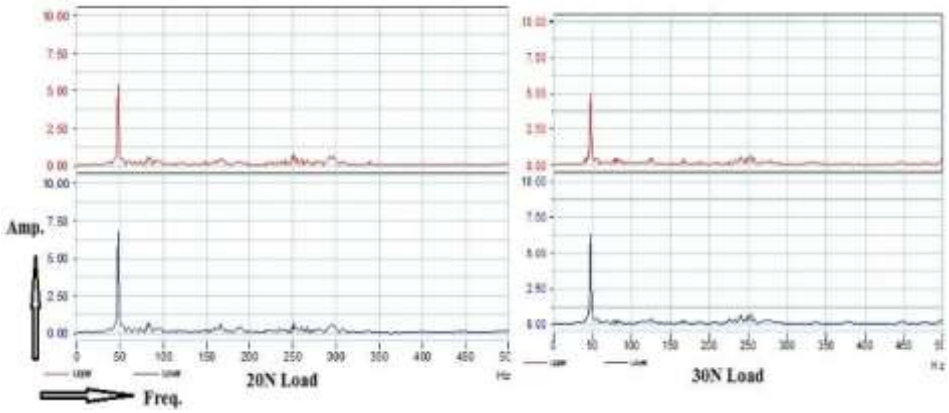

Fig. 7: *FFT diagram for Model 2 with 20N and 30N*

Unstructured and prestructured MRE examples with 350gm of CIPs by weight were assessed for their vibration amplitudes, transmissibility, and vibration absorption percentage. Both samples performed satisfactorily for the parameters examined. A reduced rate of absorption along a material's length is considered transmissible. A low transmissibility ratio and a high absorption rate are necessary for a beneficial outcome. Prestructured MRE outperformed unstructured MRE in terms of MR performance.

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C) Sample 3

Table 5: Result table for Sample 3

Location	Amplitude	Transmissibility	Vibrat.Abs.%
	Below No load		
Superior Amp.	7.19	0.772	22.77
Inferior Amp.	9.31		
	Below 10N		
Superior Amp.	7.08	0.77	22.96
Inferior Amp.	9.19		
	Below 20N		
Superior Amp.	6.59	0.769	23.104
Inferior Amp.	8.57		
	Below 30N		
Superior Amp.	6.46	0.769	23.278
Inferior Amp.	8.42		
All interpretation are calculated by FFT analyser at 48.3 Hz			

Model 3 using zero load then 10N load condition

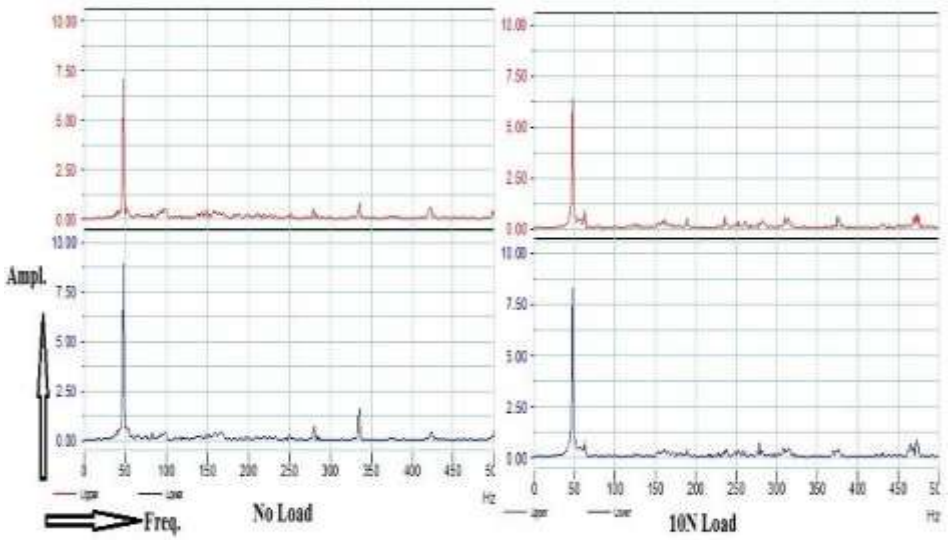

Fig. 8: *FFT diagram for Model 3 with zero load then 10N*

Model 3 using 20N then 30 N load condition

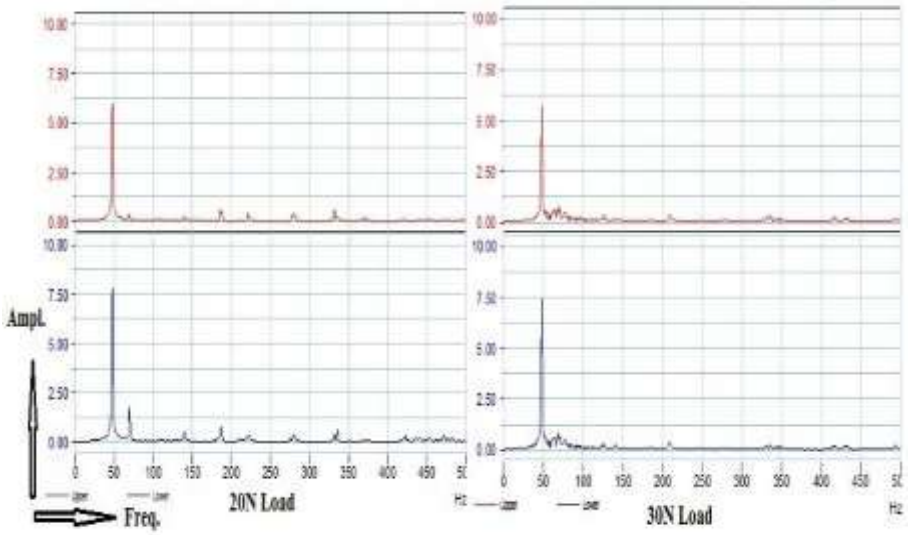

Fig. 9: *FFT diagram for Model 3 using 20N and 30N*

In all loading scenarios, both accelerometer devices detect the dynamic response of both places at natural frequency 48.3Hz, as seen in the FFT diagram for example 3. From the measured amplitude,

the transmissibility proportion and vibration absorption fractions must be strong-minded. The best performance in terms of concern objectives is shown by Sample 3 at 30N load, which exhibits 23.278 percent vibration absorption and 0.769 transmissibility ratio. Sample 3 shows excellent results in terms of transmissibility and vibration absorption percentages if compared to the first two MRE samples.

CONCLUSION

In this study, we explored the production, groups, components, and usage of smart MREs. The transmissibility and vibration absorbance percentages are also used to explain the vibration qualities of MREs and elastomers with steel net. In terms of MR performance, prestructured MRE fared better than unstructured MRE. For isotropic MRE samples, after the MRE was verified in the absence of a magnetic field at zero load, 10N, 20N, and 30N loads individually whittled down the lower amplitude of vibration at the same frequency. Transmissibility also decreased as the load enlarged, and the percentage of vibration absorption rose. Additionally, the transmissibility of 10N,20N, then 30N loads rises independently while the amount of vibration immersion decreases as the load increases, precisely as the MR damper was demonstrated with magnetic flux at zero load. Lower absorption along a material's length is referred to as transmissibility. A low transmissibility ratio and a high absorption rate are necessary for a desirable outcome. Sample 3 shows good results in terms of transmissibility and vibration absorbance percentages when comparing to the first two MRE samples. Conclusion: When a low level of seclusion is requisite, an elastomer containing steel net must be chosen for the solicitation since sample 3 is simpler to make than samples 1 and 2.

REFERENCES

[1] Susmita Kamila, “Introduction, Classification and Applications of Smart Materials: An Overview”, *American Journal of Applied Sciences* 10 (8): 876-880, 2013

[2] S. R. Kumbhar, Subhasis Maji and Bimlesh Kumar, “Fabrication and Response Analysis of Magnetorheological Elastomer”, *Material Science Research India*, Vol. 9(1), 111-116, 2012

[3] S. R. Kumbhar, Subhasis Maji, Bimlesh Kumar “Development and Characterization of Isotropic Magnetorheological Elastomer”, *Universal Journal of Mechanical Engineering* 1(1): 18-21, 2013

[4] K. Danas, S. V. Kankanala, N. Triantafyllidis, “Experiments and modeling of iron- particle-filled magnetorheological elastomers”, *Journal of the Mechanics and Physics of Solids* 60, 120–138, 2012

[5] Yanfen Zhou, Stephen Jerrams, Anthony Betts, Lin Chen “Fatigue life prediction of magnetorheological elastomers subjected to dynamic equibiaxial cyclic loading” *Materials Chemistry and Physics*, vol. 146 , 487-492, 2014

[6] Lin Ge, Xinglong Gong, Yanceng Fan and Shouhu Xuan, “Preparation and mechanical properties of the magnetorheological elastomer based on natural rubber/rosin glycerin hybrid matrix”, *Smart Materials and Structures* 22, 115029 (8pp), 2013

[7] Sriharsha Hegde, K.V. Gangadharan, **“**Testing of RTV-Silicone based thick magneto-rheological elastomers under harmonic loading conditions” *International Journal of Scientific & Engineering Research*, Volume 5, Issue 2, ISSN 2229-5518, 2014

[8] S. Raa Khimi, K. L. Pickering, “Comparison of dynamic properties of magnetorheological elastomers with existing antivibration rubbers”, *Composites Part B*, 2015

[9] Benxiang Ju, Rui Tang, Dengyou Zhang, Bailian Yang, Miao Yu, Changrong Liao, “Temperature-dependent dynamic mechanical properties of magnetorheological elastomers under magnetic field”, *Journal of Magnetism and Magnetic Materials*, 374, 283–288, 2015

[10] Weihua Li, Xianzhou Zhang, Tongfei Tian, and Weijia Wen, “Fabrication and characterisation of patterned magnetorheological elastomers”, *AIP Conference Proceedings* 1542, 129, 2013

[11] Khairunnisa Hairuddin, Saiful Amri Mazlan, Ubaidillah, Hairi Zamzuri and Norazman Mohamad “A Feasibility Study of Magnetorheological Elastomer Base Isolator” *Applied Mechanics and Materials*, Vol. 660, 763-767, 2014

[12] Sung Soon Kang, Kisuk Choi, Jae-Do Nam and Hyoung Jin Choi, “Magnetorheological Elastomers: Fabrication, Characteristics, and Applications”, *Materials 2020*, 13, 4597, 2020

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APPLICATIONS OF MATHEMATICS IN REAL LIFE

Prof. **Deepika Panchal**, Assistant Professor , Atharva College of Engineering, Malad(W), Mumbai.
Prof. **Priyanka Malgaonkar**, Assistant Professor, Atharva College of Engineering, Malad(W), Mumbai.
Prof. **Vinayak Sawant**, Assistant Professor, Atharva College of Engineering, Malad(W), Mumbai.

Abstract – A brief summary of the applications of mathematics in real life is provided in the review paper. It supports advancements in telephony, transportation, building, banking, the internet, entertainment, graphics, and medicine. Humans used mathematics to develop robotics and artificial intelligence, analyse data, and navigate satellites.

Keywords : *Cartography , search engine , image compression, probability , thermodynamics, statistics.*

INTRODUCTION

In today's school and college curriculum the focus is mainly on how to solve numerical problems in Mathematics rather than the applications. There is a wide gap between the school taught concepts and applying in real life. This paper will shed light on th aspect of real life applications of Mathematics.

DISCUSSION

A) Weather Prediction

The weather is a phenomenally complex system due to the interaction of billions of molecules. Even with the vast network of weather station satellites and the largest supercomputers on the planet, weather forecasting is extremely difficult due to this.

The Navier Stokes equations are a set of rules that must be followed by fluids like the atmosphere.Unfortunately, we are unaware of a direct solution to these equations, one of the most difficult mathematical puzzles to be solved and a contender for the $1 million Millennium Prize.Instead, supercomputers divide the entire atmosphere into millions of blocks, each approximately one cubic kilometer in size, in order to produce a high-resolution forecast.

B) Cartography

It is challenging to depict our spherical, three-dimensional Earth on a flat, two-dimensional map. We must always slightly stretch or compress specific regions of the world. But math may be useful! Making maps is the subject of cartography. The difficulty of depicting the Earth in 2D space has been attempted through a wide variety of map projections.

C) Glaciers melting

One of the biggest problems facing humanity this century will be climate change Particularly noteworthy is the melting of the polar icecaps, which has a significant effect on global sea level and temperature.

Alas, information about the condition of the entire ice shield or the mechanisms causing its melting is scarce from satellite photographs taken from above. Statistics and probability can be used to analyse environmental data, such as the thickness and composition of ice.

Scientists can better comprehend the interactions between wind, sea ice, ocean currents, and heat transport by utilising sophisticated mathematical models that combine differential equations and thermodynamics.

D) Search Engines

Every day, billions of people utilise the internet. One of the reasons is how simple it is to find information rapidly on the internet, for instance when utilising search engines like Google.

The entirety of the internet is represented by Google in a massive matrix in order to identify the most helpful websites and display them at the top. The matrix contains information about the connections between the different websites, and you may utilise graph theory and linear algebra probability to identify the most popular websites.

Numerous other Google services, such as Maps, Gmail's spam filtering, Android's voice recognition, the compression of YouTube videos, the detection of faces in photos, and text translation, all involve mathematics**.**

E) Language Recognition

The challenge of speech recognition is intriguing. There are specific vocabulary, grammar rules, and pronunciations for each language. People use languages differently even within one another. Computers are capable of hearing. To determine what the sounds signify, they employ sophisticated statistical models.

Take the English word "potato," which has three syllables. This kind of tree displays the statistical likelihoods that the speaker's pronunciation will occur. According to the three, there is a 60% likelihood that the first syllable will sound like "Poh," and a 40% chance that it would sound like "Pah."

The more syllables a phrase has, the more complicated the probabilities become. For instance, a computer might pick up on the following: r eh k ao g n ay z s p iy ch. The calculator evaluates this based on typical English sound combinations.

Speech recognition software will soon have 60,000 words available. This implies that there are 216 trillion possible combinations for a three-word statemen

F) Crowd management

Large crowds at sporting events, concerts, festivals, or religious gatherings pose a threat in and of itself. There have been innumerable instances of fatal catastrophes in the past, and it is very challenging to anticipate crowd behaviour in these situations.

Every human's movement is reliant on the movements of everyone in their immediate vicinity. Similar to how the velocity of air and water molecules is influenced by the motion of nearby molecules fluid mechanics

It may be possible to decrease the likelihood of accidents in the future by using mathematics and computer simulations to analyse the complex behaviour of crowd dynamics. This will only be possible if we can comprehend how local changes in human behaviour and architectural design affect the crowd as a whole.

G) .Optimization of traffic

Systems for transportation are created by transportation engineers. They employ data analysis to find traffic flow issues. One of the intriguing phenomena they research is phantom traffic congestion.

Generally, rush hour, major events, construction, or crashes cause traffic bottlenecks. We anticipate being able to pinpoint the cause of traffic congestion. On occasion, there are no apparent causes for traffic delays. According to the data, phantom traffic bottlenecks can stretch up to 100 kilometres and happen at a speed of 15-20 km/h. Roadways may attempt to stop this occurrence by gradually lowering the posted speed limit in congested regions. This raises the flow rate to a level that is more desirable.

H) Image Compression

With the introduction of the Eastman Kodak PetaPixel camera, digital photography was born. Even photographs from five years ago don't appear the same as they do now. Poorer quality images are frequently referred to as "pixilated." This appearance is actually a result of digital image compression. Although the underlying arithmetic is challenging, the concept is straightforward.

Image compression solves the issue that an image contains far too much data to be stored in its entirety. If there isn't enough storage and the photographs aren't changed in any way, they will appear evenly pixilated and possibly have odd colours. The most vital portions of the image, those that the eye is drawn to, are preserved via image compression algorithms. The components that don't important as much for visual perception are changed.

I) Music playing

Music shuffle looks like a pretty straightforward problem, right? Play any song you choose at random. After the song is finished, choose and play a random tune. This can be modelled using probability.

Consider taking a marble out of a bag, noting its color, and then replacing it. In essence, this is what happens when random music is shuffled. This suggests that you might select the same marble (music track) as you did in the past. or, if not twice, before you've heard every song on the album.

In fact, when music shuffling first appeared on the market, this is essentially how it operated. People commented that the song selection didn't feel random because some songs were played more frequently than others. Then, engineers created patterns that make music that has been jumbled appear random. However, this indicates that music shuffle is not completely random.

J) Skate Park Planning

Skating requires movement. Speed can be a deciding element in how well a technique is executed. Pushing off the ground is how skaters increase their speed. Speed can be increased by using the skate park.

The slope of the surface can have a significant impact on the ride. Speed, for instance, may be provided by a slope. Bowls are a unique type of sloping design. The skater's speed is influenced by the bowl's simple harmonic motion. A shallow bowl generates less speed. It is better suited to skaters who are new or nervous. It's possible that these bowls don't always move fast enough to create big air. Bowls with a high curvature offer increased speed over shorter distances. Bowls are often included in skaters' routes prior to high-speed stunts. When they are in the air, skaters move according to the laws of projectile motion. When designing fun rides for skateboarders, park designers take into account all speed requirements.

K) Cosmetic Surgery

After an illness or damage, plastic surgeons repair various body components. To graft onto tissue in another section of the body, surgeons take healthy tissue from one area of the body. Getting the blood vessels to integrate is challenging when shifting tissue around in this way.

When the healthy tissue contains a specific number of blood vessels, the likelihood of success rises. And a specified percentage of these blood vessels have a diameter above a set level. Up until recently, before beginning surgery, surgeons had to determine whether the healthy tissue met the requirements of a blood vessel. Mathematicians developed a method for simulating the diameters and clusters of blood vessels in various tissues. Differential equations are used in the models. This aids in locating quality donor tissue before the surgery procedure is begun.

CONCLUSION:

As we have seen in the above examples, there are many more instances where Mathematics is applied to real life. Life without practical mathematical approach is not imaginable. The paper gives an insight to the beauty of Mathematics, rightly coined the Queen of Sciences.

REFERENCES

1. Far Eastern University on 2022-09-04
2. Instituto de Empress S.L. on 2010-02-16
3. mathigon.org

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MODERN SYMMETRIC KEY ENCRYPTION

Ashwini R. Kachare, Assistant Professor Atharva College of Engineering, Malad West,Mumbai : kachareashu014@gmail.com
Suchetadevi M. Gaikwad, Assistant Professor, Atharva College of Engineering, Malad West,Mumbai : sucheta.gaikwad4@gmail.com
Kriti Das, Assistant Professor Atharva College of Engineering, Malad West,Mumbai kriti.mitra@gmail.com
Krutika Jain, Assistant Professor Atharva College of Engineering, Malad West,Mumbai krutikajain20@gmail.com

Abstract: In the time of Modern Symmetric Key Encryption, the info distribution quickly enlarged. Wholly records sent or conventional are exposed to countless dynamic and passive attacks. Consequently, the data throughout statement is the greatest significant anxiety. Cryptography does a vital role to dwindling statement in the system then it arises with a great result to supply the wanted safety in contradiction of the intruders of data. Over a considerable time, the methods of data encryption seized an enormous bound from actual easy approaches to exact rough precise designs to produce robust safety aimed at statement. Conversely motionless sideways through their exertion, the procedures of cryptography are horizontal to various occurrences

Introduction

Symmetric Key Encryption

A symmetric key is used both to encode and decrypt info. For these resources that near decrypt evidence, one must have the identical key that was used to encrypt it. The keys, in rehearsal, characterize a collective clandestine amid dual or additional gatherings that canister be castoff to conserve a remote info relative. This ailment that together assemblies must entree the undisclosed key is one of the core problems of symmetric planned encryption, in assessment to public considered encryption.

Alphanumeric data is categorized into threads of binary numbers in dissimilar letters. Contemporary cryptosystems want to practice these binary threads to translate them into alternative binary strings. Built on how these binary threads are managed, symmetric encryption outlines can be classified into Block Ciphers and Stream Ciphers

Block Cryptographs

Now the system is simple binary manuscript administered in blocks of bits at a period a hunk of plaintext bits is designated, and a sequence of tasks is completed on this chunk to create a block of cipher text bits. The amount of bits in a chunk is secure. For specimen, the systems DES and AES have block dimensions of 64 and 128, correspondingly.

A block cipher incomes a block of plaintext bits as well as creates a wedge of cipher manuscript bits mostly of the similar scope. The dimension of a block is static in the assumed system. The best of block size fixes not straight disturb the asset of the encryption system. The asset of the cipher is dependent on the important distance.

Creek Ciphers

Now this system, the plaintext is appreciated single bit at a period one bit of plaintext is reserved, and a sequence of actions is achieved arranged it to yield unique bit of cipher text. Exactly, creek cryptographs are block symbols with a slab extent of one bit.

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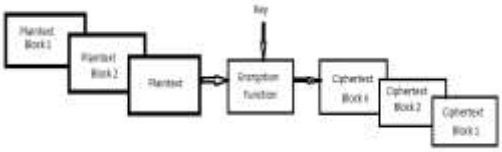

- **Block Size**
- Motionless some scope of a dose is fitting; ensuing sorts are abided in notice while picking a scope of a block.
- Evade exact lesser chunk unpackaged − about a chunk unplanned is n bits. Formerly the believable plaintext minutes assemblies are formerly 2n. If the impostor realizes the basic script blocks result in certain beforehand shown cryptograph text blocks, then the enemy can arrange a form of 'vocabulary attack' by erection up a lexis of plaintext/cipher text sets led using that encryption knowingly. A superior chunk scope type attacks stiffer as the vocabulary needs to be greater.
- Fix not must actual big block size − through an actual large block size, the cipher converts blocked towards drive. Such plaintexts will necessity toward extended before being encoded.
- Manifold of 8 bits − selected chunk quantity is a manifold of 8 as it is informal aimed at performing as greatest computer mainframes grip annals in a manifold of 8 minutes.
- Packaging in Chunk Cipher
- Chunk cipher method chunks of safe masses. The objectivity of plaintext is frequently not numerous of the chunk scope. For sample, a 150-bit plaintext delivers dual blocks of 64 bits each with a third chunk of equilibrium of 22 bits. The previous slab of bits wants to remain expanded up through fired material so that the measurement of the last block is equivalent to the block scope of the structure. For Sample the residual 22 bits are vital to have a further 42 dismissed bits added to deliver a whole block. The method of controlling moments to the previous block is raised to packaging.
- Besides ample bulk makes the scheme muddled. Also, the lining can extract the structure unconfident at stretches; doubt the stuffing is complete with the similar bits continuously.

Block Cryptograph Systems

- Nearby is a massive quantity of block cipher systems that remain in use. Numerous of them remain widely recognized. Greatest general and bulging chunk ciphers are itemised below.
- Three-way NES − It remains irregular system founded on recurrent NES requests. It is quite appreciated block cipher then inefficiently likened to the fresh earlier block ciphers accessible.
- Progressive Encryption Normal It is a moderately fresh block cipher founded on encryption.
- KNOWLEDGE − It is acceptably robust block cipher with a block scope of 64 then a key scope of 128 bits. Some requests habit KNOWLEDGE encryption, counting first varieties of the Attractive Decent Secrecy protocol. The usage of the KNOWLEDGE design.
- Unnatural espousal owed to obvious matters.
- Two fish − this arrangement of block cryptograph usages a block scope of 128 bits as well as important of adjustable distance. It remained one of the qualifiers. It is constructed scheduled the former block cipher Blowfish with a block scope of 64 minutes.

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Operation of ASE

ASE is an iterative slightly feisty cipher. The aforementioned is built scheduled 'replacement–change network'. This one contains a sequence of associated actions, certain of which contain trading inputs by exact productions and others include scuffling bits about.

Stimulatingly, ASE does altogether its calculations happening bytes somewhat than bits. Henceforward, ASE luxuries the 128 bits of a plaintext chunk as 16 bytes. These 16 bytes remain decided in four pillars and four dins for dispensation by way of a medium

Unlike DES, the amount of discs in ASE stays mutable as well as be contingent scheduled the span of the key.

The problematic part of devious a feistily Cipher is a group of rotund functions 'f'. To be an indestructible scheme, this purpose wants to have numerous significant goods that stand outside the scope of our discussion.

Encryption Process

Now, confine to a account of a characteristic rotund of ASE encryption. All rounds comprise four sub progressions.

Byte Spare

The 16 contribution bytes are replaced by observing a secure table assumed in the enterprise. The consequence remains in average of 4 noises then 4 pillars.

Move Dins

Every of the 4 noises of the medium are gutted to the port- hand. Some tickets that decrease off are re-inserted on the correct lateral of noise. Alteration is settled ready as shadows

- Head noise remains not detached.
- Another noise is untied single location to the leftward.
- Third ruckus is cleaned dual sites to the port.
- Quarter noise is moved three places to the port.
- The outcome remains a fresh medium involving of the similar 16 bytes nonetheless lifted with admiration to every further.

Combination Pillars

Every pillar of 4 bytes is currently partial spending singular exact purpose. These drive takings as input the 4 byte of one pillar and productions 4 totally original bytes, which substitute the unique pillar. The consequence is extra new medium containing of 16 new bytes. It must remain famous that this phase is not complete in the previous rotund.

Add Rotund Key

The sixteen byte of the medium is now careful by way of 128 minutes as well as is XO Red toward the 128 minutes of the rotund important. Doubt this is the preceding plump formerly the production is the code text. Or else, the resulting 128 bits are understood as sixteen bytes as well as instigate additional comparable rotund.

Decryption Procedure

The procedure of decryption of an AES code text is comparable toward the encryption procedure cutting-edge converse instruction. All round comprises of the four processes lead in the contrary command

Enhance rotund key

Combination pillars

Change rackets

Byte replacement

Meanwhile sub processes in all rotund are cutting-edge opposite method, different aimed at a feistily Cipher, the encryption as well as decryption procedures necessity to remain distinctly applied, though they remain actual carefully connected.

ASE Study

In current cryptography, ASE is broadly accepted as well as steel-clad in in cooperation hardware and software. Moreover, ASE consumes integral plasticity of main distance, which permits a degree of 'future-proofing' in contradiction of progress in the aptitude to do extensive key explorations. Though, impartial as for DES, ASE retreat is certain only if it is acceptably applied and good key organization is active.

References:

[1] Symmetric and Asymmetric Encryption Computing Surveys by GUSTAVUS J. SIMMONS., December 1979

2] Overview of Modern Symmetric 2Key Cipher Cryptanalysis Techniques by Sylvain Martinez.

3] A Review on Symmetric Key Encryption Techniques in Cryptography , International Journal of Computer Applications August 2016 by Mohammad Ubaidullah Bokhari and Qahtan Makki Shallal

4] A New Symmetric Key Encryption Algorithm With Higher Performance International Conference on Computing, Mathematics and Engineering Technologies by Abid Murtaza, Syed Jahanzeb Hussain Pirzada, Liu Jianwei, School of Electronic and Information Engineering Beihang University (BUAA) Beijing, China.

5] A Symmetric Key Cryptographic Algorithm International Journal of Computer Applications by Ayushi Lecturer, Hindu College of Engineering H.No:438, sec-12, sonipat, Haryana

6] Symmetric and Asymmetric Encryption Sandm Laboratories, Albuquerque, New Mexico 87185 by GUSTAVUS J. SIMMONS

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ORGANIC–INORGANIC HYBRID COATING USING SILICA-SOL

Dr. Priyanka Patel, Dr. P.N. Nemade Asst. Prof. Atharva College Of Engg.,Mumbai .
Dr. B. Sonawane Prof. Atharva College Of Engg.,Mumbai .

Abstract. Organic inorganic hybrid coating possess superior coating properties. In the current paper studies have been carried out to compare the coating properties of pure organic polyurethane and inorganically modified polyurethane. By changing the concentration of Si in polyurethane matrix various results were compared for hardness, flexibility, adhesion, scratch resistance, storage stability. Our results concluded that inorganically modified polyurethane with 8% Si has optimum coating properties.

INTRODUCTION

Surface coatings are at the leading edge of advance technology as well as part of the traditions of old graft. Despite the fact that surface coatings have been known since the beginning of time, the subject is still very present today in research laboratories worldwide. Coatings play a significant role in modern technology, and this role is escalating as expectations for coating's quality of performance and range of applications increases. Coatings are no longer just passive barriers, but increasingly play an active role, chemically, electrically and biologically. For instance, they are designed to release inhibitors for corrosion prevention, to release biocides. It is clear that there is growing scope for research and development in an area of coating technology that continues to expand.

Surface coatings are classified on basis of elements present in backbone chain which can be organic coatings, inorganic coatings and organic-Inorganic hybrid coatings [1-3]. It is observed that organic coating and inorganic coating have few drawbacks like lower durability, dependence on substrates, less U.V. resistance, etc. Some of these drawbacks can be eliminated by using organic inorganic hybrid coatings. Hybrid coatings are known to exhibit superior coating properties as compared to organic coatings and inorganic coatings. Hence, in the current paper we have concentrated on hybrid coatings. There are various methods for preparation of organic-inorganic hybrid materials. One of them is SOL-GEL method [4]. The sol-gel process is a convenient means of producing hybrid nanocomposites. Hybrid nanocomposites rely on the history of organic and inorganic phases incorporated into the material.

Polyurethane has better crosslinking properties as compared to polyester [4]. Hence, we have used polyurethane as an organic component which is prepared by reacting polyester with polyisocyanate. Polyester was prepared using trimethylol propane, neopentyl glycol and azelaic acid. This polyester was then inorganically modified using TEOS to enhance its coating properties, which was was further reacted with TMP-TDI adduct to give polyurethane.From thermodynamics, it is known that polyester is directly incompatible with TEOS hence MEMO is used as a coupling agent. TEOS can be directly hydrolyzed and it can be used to modify polyester, but this would yield inferior coating properties [6,7]. Hence use of coupling agent is preferredIn the present study we have compared coating properties of pure organic polyurethane and inorganically modified polyurethane. By varying the concentration of inorganic component we have determined the concentration at which optimum properties were obtained.

A. Experimental

Raw materials

Raw materials used in this project are Tetraethoxy methasilane (TEOS), 3methaacryloyloxy propyl trimethoxy silane **(C.R)** (MEMO), Methanol, **(A.R),** Hydrochloric acid **(A.R),** Azelaic acid **(A.R),**

Neopentyl glycol **(A.R),** Trimethylol propane **(A.R),** Toluene diisocyanate **(A.R),** Dibutyltin dilaurate **(A.R)**

Synthesis of materials

1. Synthesis of sol

52 g TEOS was dissolved in 42.2 g of absolute ethanol at 52^0 C and was hydrolyzed with 2.25 g of water and 0.55 g nitric acid. The sol was then heated at 53^0 C for 60 min before addition of 2.25 g of water. After heating another 10 min at 53^0 C, 31 g of MEMO was added resulting in silane/silica ratio of 1:2. The sol was heated for 30mins before adding another 4.5 g of water and heated at 53^0 C continuous for another 30 mins and solvent was removed by vacuum distillation. [U.S. Patent no. 5231156]

2. Synthesis of gel (Polyester)

A 500 mL capacity three necked flask, equipped with motorized stirrer, a nitrogen gas inlet tube and a reflux condenser, was placed with weighed quantities of azelaic acid, trimethylol propane and neopently glycol. Depending upon the calculated Hydroxyl value (OHv) accurate weights of all the above were taken. Initially glycol components were charged in a reaction vessel and mixture was heated at about 70^0 to 80^0 C till it melts. After the complete melting of glycols, measured quantity of azelaic acid was added to the mixture and the reaction temperature was further raised to 235-240^0 C and the reaction was continued for another 6-7 hours till the calculated amount of water is being removed.

Final traces of water were removed in the form of azeotrope using xylene as a solvent. The reaction mixture was stirred continuously and a slow stream of nitrogen gas was passed through the mixture at a constant rate to provide inert atmosphere. Once the required temperature was reached the heating was discontinued. Condenser tube was then placed in distillation position and the polyester so formed was heated under reduced pressure and at a temperature which was maintained at 70^0 C .The polyester so formed was then cooled to room temperature and stored in an air – tight bottle. However, just prior to use, polyester formed was dried again under vacuum at about 100^0 C to 110^0 C. To remove any traces of water, which might have got in during storage. The polyester so formed was stored in an airtight bottle.

1. Synthesis of sol-gel hybrid i.e., inorganically modified polyester:

A 500 mL capacity three necked flask, equipped with motorized stirrer, was placed with weighed quantities of SOL and GEL which was obtained from above process. Varying quantity of SOL, it was added to GEL and calculated amount of ethyl acetate was added. Resulting solution was stirred for 30 mins at 160^0 C to obtain SOL-GEL hybrid. This hybrid was inorganically modified polyester.

SOL concentration were varied as 0%, 3%, 8%, 10% and 15%

2. Synthesis of polyisocyanate:

A 500 mL capacity three necked flask, equipped with motorized stirrer, nitrogen gas inlet tube and a reflux condenser, was placed with weighed quantities of trimethylol propane and toluene diisocyanate. TMP was taken in small batches and was added to total weight of TDI taken. TMP was taken in batches in order to avoid any increase in temperature as this is an exothermic reaction and has to be carried out around 60^0 C. The reaction mixture was heated to a temperature of about 60^0 C to70^0 C for about 4 to 5 hours. The reaction mixture was stirred continuously and a slow stream of nitrogen gas was passed through the mixture at a constant rate to provide inert atmosphere. Calculated amount of solvent i.e. ethyl acetate was added. Solvent was added to ensure proper mixing of TMP and TDI. As the temperature increases above 60^0 C, heating was discontinued. Condenser tube was placed in distillation position and the polyisocyanate was heated under reduced pressure. The polyisocyanate so prepared was stored in airtight bottle.

However, just prior to use, the polyisocyanate was dried again in an oven maintained at 100^0 C to 110^0 C to remove any traces of moisture, which might have got in during storage.

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3. Synthesis of inorganically modified polyurethane:

Prepared polyisocyanate and inorganically modified polyester were weighed accurately and was directly mixed. 2-3 drops of DBTDL catalyst was added. Synthesis of inorganically modified polyurethane is described in Fig. 1.

RESULT AND DISCUSSION

Characterization

1. Characterization of SOL (Particle size analysis):

Particle size is an important factor in deciding the final industrial use of siliceous soil. Particle size was measured using 'Malvern Instrument India Ltd' at 25°C. Mean intensity particle size diameter of TEOS-MEMO adduct i.e. SOL was found to be 90.1 nm as depicted in Fig. 2. The sol is considered to consist of nano particles of silica.

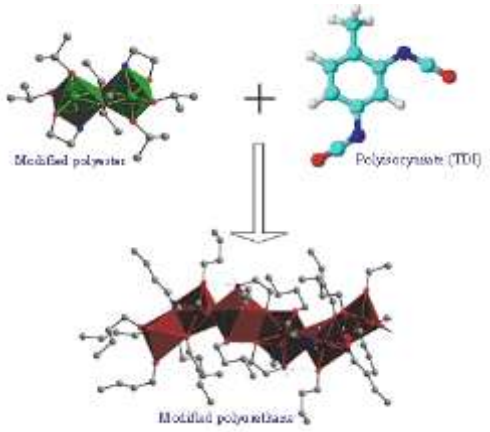

Fig. 1. Synthesis of Polyurethane

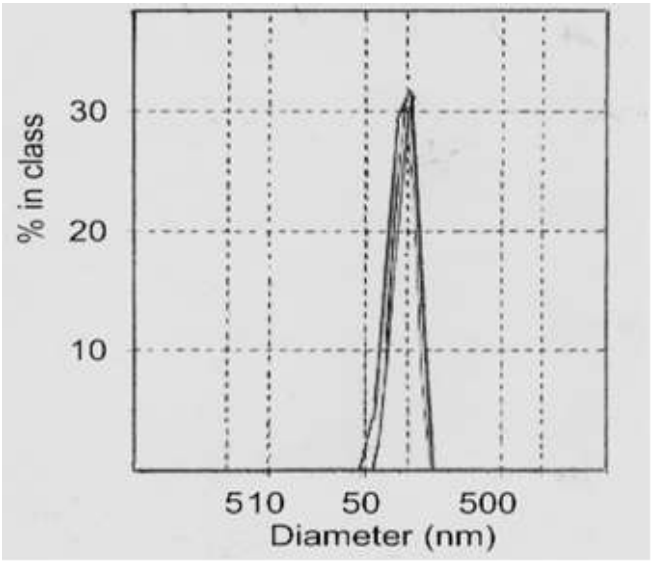

Fig. 2. Graph of particle size analysis

2. Using IR spectroscopy:

IR spectroscopy has been found to be highly useful in the field of polymer chemistry. It is use to indicate the functional group present and also give information about H-bonding, conformation orientation.

Shimadzu FTIR – 4200 dual beam spectrophotometer was used to record IR Spectra of the polymer in the range of 4000-400 cm^{-1}. The tentative assignments of observed bands in modified polyurethane (8%Si) is shown in table 1.

Table 1. IR Spectra of polyurethane

Assignments	**Wavenumber (cm^{-1})**
-OH	3430-3300
-CH_2 stretching	2961-2967
Free C=O and hydrogen bonded C=O	1729,1731
C-N-C	1146
C-C skeleton vibration	1055
Si-O-Si	761, 735

1. Thermo-gravimetric analysis

Using 'Diamond' Perkin Elmer Analyzer, the decomposition profile of silica modified PU film were thermogravimetrically analyzed. Film samples extending from 4-6 mg were placed in platinum sample pan and heated from 30-800°C, under N_2 atmosphere at a heating rate of 100 C/min. Temperature difference and weight loss were recorded as a function of temperature. The table 2 displays the initial degradation temperature (IDT) and temperature at 50% (T50) weight loss for different silica hybrids.

Table 2. TGA thermogram data

Sample	Si (0%)	Si (5%)	Si (8%)	Si (10%)	Si (15%)
IDT	160^0 C	185^0 C	210^0 C	210^0 C	210^0 C
T_{50}	285^0 C	315^0 C	385^0 C	360^0 C	344^0 C

From the thermogram data it can be observed that initial degradation temperature was maximum for 8 % Si sample and then remained constant. Temperature at 50 % weight loss was found to be maximum for sample with 8 % Si which, clearly indicates that sample with 8 % Si has maximum thermal stability.

Analysis of coating properties of inorganically modified polyurethane

Mild steel panels of size 6'x 4' and glass panels used for coating were used after pre-treatment as described below:

1. Preparation of mild steel panels for testing of coating films:

The 24 – gauge mild steel panels of size 6'x 4' were first cleaned free of greasy materials by treating them with hot 10% sodium hydroxide solution, followed by rinsing with cold water. Rust that might have been present was removed by rubbing with sandpaper. Any emery particles left over, were cleaned off by cloth. The panels were dipped in phosphoric acid solution (1:1) at room temperature for one minute and then rinsed immediately with distilled water for a minimum of 15 secs. Next, these panels were sprayed with 95

% denatured alcohol containing 1 % by volume of ammonium hydroxide. Finally, the panels were dried at 80-90^0 C and stored in a desiccator until needed.

Glass panels of size 6'x 4' were degreased in an alkali (sodium hydroxide) solution and swabbed subsequently with water and xylene before film application.

Method of Application of Resins on to the panels: All the samples of resins were applied onto mild steel and glass panels using a bar coater (18-cm film width, 50 µm film thickness, Sheen Instruments Ltd., Surrey, England). Drying times (air drying and baked drying at 120° C) of all the compositions was determined. The dried film obtained was approximately of about 35 ± 2 µm thickness.

The samples were studied for the various coating properties like hardness, flexibility, adhesion, impact resistance, chemical resistance and storage stability [8]. The results of all the tests thus performed are mentioned in the table 3.

Table 3. Coating properties at different percentage of Si

Coating properties	**AA+ NPG+ TMP**				
	Si (0%)	**Si (5%)**	**Si (8%)**	**Si (10%)**	**Si (15%)**
Pencil Hardness	H	2H	5H	4H	4H
Scratch Resistance (g)	1200	1400	>2000	1500	1500
Shore A Hardness	67	73	92	81	80
Flexibility	Passes	Passes	Passes	Passes	Passes
Adhesion (%)	100%	100%	100%	100%	100%
Impact resistance Direct/ Reverse (inch-lb)	100/100	120/120	160/160	140/160	140/160
Storage stability	>8 months	>8 months	>8 months	~4 months	~4 months
Chemical Resistance					
Water [a]	No effect	No effect	No effect	No effect	No effect
1% H_2SO_4 [b]	Slight blush	Slight blush	No effect	No effect	No effect
1% NaOH [c]	High blush	Slight blush	No effect	No effect	No effect

Where, a = immersed for 24 h in water.
b = immersed for 24 h in acid.
c = immersed for 24 h in alkali

CONCLUSION

By varying the different concentration of Si in PU matrix it was observed that the hardness properties (shore A and pencil hardness) were minimum for pure organic coatings but increases in hybrid coatings.

Maximum hardness was observed for hybrid coating containing 8% Si. Adhesion was found to be 100 % at all concentration and each and every sample passes the flexibility test. But impact resistance (direct/reverse) as well as scratch resistance was found to be minimum for pure organic coating and increased in hybrid coating. Impact resistance was 160 inch-lb (both direct as well as reverse) for sample with 8% Si and was found to be maximum. The scratch resistance was found to be more than 2000 for coating with 8% Si which clearly shows that hybrid coating (with 8% Si) have better property as compare to any other sample. Storage stability was found to be maximum for sample with 8% Si. This sample remained unaffected when tested with acid and alkali and have successfully passed water immersion test. Hence, it can be concluded that inorganically modified polyurethane with 8% Si has optimum coating properties.

REFERENCES

[1] R. Zandi, A. Rahimi, "Silica based organic–inorganic hybrid nanocomposite coatings for corrosion protection," Prog. Org. Coat, vol. 53, pp. 286-291, 2005.
[2] A. D. Wilson, J. W. Nicholson, H. J. Prosser, Elesevier Applied Science, 1987.
[3] C. Sanchez, B. Julia´n, P Belleville, M. Popall, "Applications of hybrid organic–inorganic nanocomposites," J. Mater. Sci., vol. 15, pp 3559-3592, 2005.
[4] D. Randall S. Lee, The polyurethanes handbook Wiley, 2003.
[5] Y. Chen, S. Zhou, G Chen, "Preparation and characterization of polyester/silica nanocomposite resins," Prog. Org. Coat, vol. 54, pp. 120-126, 2005.
[6] N.G. Cave, A.J. Kinloch, "Self-assembling monolayer silane films as adhesion promoters," Polym J., vol. 33, pp 1162-1170, 1992.
[7] Sajjadi, S. Pooyan. (2005). Sol-gel process and its application in Nanotechnology. J Polym Eng ., vol. 13. pp38-41, 2005.
[8] J. V. Koleske, Mechanical Properties of Solid Coatings. Encyclopedia of Analytical Chemistry, 2006.

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ANALYSIS OF THE MATCHED DETECTOR'S PERFORMANCE UTILISING AWGN AND OFDM UNDER LOW SNR REGION

Kavita Piyush Bani, Assistant Professor, Atharva College of Engineering, Mumbai

Abstract: To serve the tremendous demand for wireless applications, Cognitive Radio (CR) is investigated. CR technology is capable of accessing licensed users' spectrum dynamically. In this paper, the spectrum sensing method Matched Detector (MD) is analyzed under channel environment additive white gaussian noise (AWGN). MD is also performed for orthogonal frequency division multiplexing (OFDM) systems to utilize spectrum more efficiently under low SNR like -25 dB and -30 dB here. Low range SNR are focused over here due to Prior to the data sent by Primary users, the received signal is used to analyse the performance of MD. Results are validated based on parameters like various SNRs, Probability of detection, probability of false alarm. These parameters are studied practically and theoretically for each model.

Keywords: Cognitive Radio (CR), Matched Detector (MD),Probability of detection, Probability of false alarm

1. Introduction

Radio resources are very limited while the available radio spectrum is already occupied by all its licensed users. Due to the rapid growth of wireless users, there is a huge demand for wireless applications. In research [1], It has been found free slots in the licensed user's spectrum. Cognitive Radio (CR) is developed in Mitola's thesis [2,3] which is the smart radio access of the licensed user's spectrum dynamically when there is no transmission going on through primary user (PU)'s signals. CR suits best to serve the demand of wireless users [4]. CR networks enable the secondary user (SU)'s when there is a white space or PU's spectrum is idle for further transmission [5]. All SU's transmit their signal using a licensed band (PU's Spectrum) without disturbing the PU's signal. There is the main task of CR is to sense the PU's spectrum before utilising by SUs. There are various spectrum sensing techniques available based on which we can select the best suitable spectrum sensing technique.

Figure 1 shows the entire cognitive radio process cycle. The spectrum sensing is based on results of probability of detection (P_D) and probability of false alarm (P_{FA}). In spectrum sensing, probability of miss detection (P_{MD}) causes interference to PU while P_{FA} decreases the spectrum efficiency [5,6]. For efficient utilisation of spectrum, spectrum sensing technique should maximize the P_D , minimize the P_{FA} and avoid the P_{MD}. There are many different spectrum sensing methods available. Based on Primary User (PU)'s information is not available, partially available or available, one can select the best spectrum sensing technique for cognitive radio users [7-12].

TV channels conversion happened from analogue to digital, white space is created in spectrum. There is a IEEE 802.22 Wireless Regional Area Network (WRAN) standard used for utilising TV white spaces [13]. Instead of single spectrum sensing, Cooperative Spectrum Sensing (CSS) technique is also used. In CSS, a decision is not taken by a single CR user but based on distributed or centralized type of approach used.

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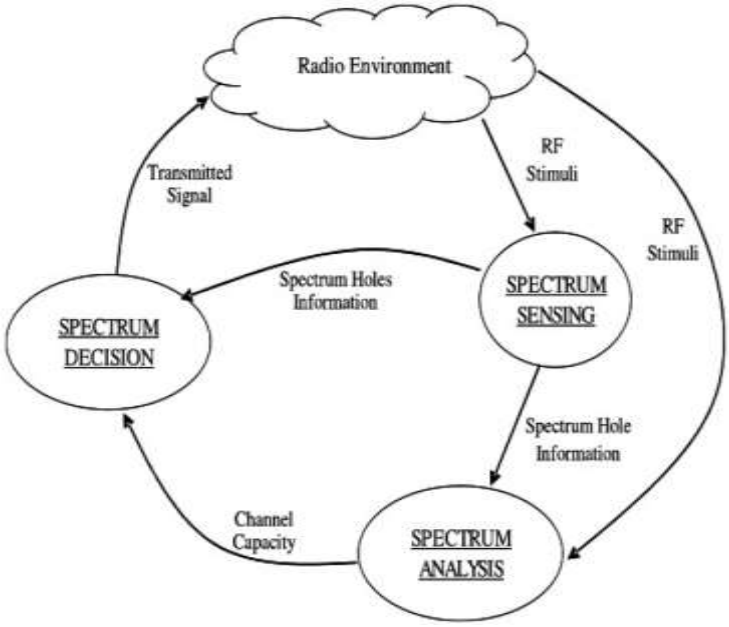

Figure 1 Cognitive Radio Cycle

2. Background Theory

In [14], MD is studied for identification of PU's signal and also recognizes the power level of PU' signal. Comparative study of energy detection spectrum sensing techniques for CR networks under different channel environments like AWGN , Rayleigh fading channel in [15] and SNR is chosen -1 dB , 4 dB , 7 dB and 9 dB to simulate ROC parameters. Spectrum sensing based on cooperation among SUs is used to improve detection of PU's signal [16]. In a cooperative environment, a number of CR users/ SUs made grouping based on their observations [17]. In CSS, centralized approach, SUs sense the channel and send their observations to Fusion Centre [18].While in CSS , distributed approach, SUs decision does not depend on Fusion Centre but each SU takes their decision itself only[19]. To increase probability of detection with relevant probability of false alarm, SU's data is weighted where algorithm can find errors of SU without relevance of malicious effect on it [20].

In [21], all transmitter based spectrum sensing techniques are analyzed like Energy Detector, Matched Detector and Cyclostationary Feature Detection. In [22, 23], improved ED is shown with a dynamic threshold for increasing probability of detection at -20 dB SNR. In [24], IEEE 802.22 WRAN standard parameters are analyzed for cognitive radio networks.

3. System model

Here MD is designed under AWGN channel environment and OFDM environments which are represented by their system models respectively in section 3.1 and 3.2.

3.1 Spectrum Sensing using Matched Detector in AWGN channel

Under Additive White Gaussian Noise channel, cognitive radio networks use matched detector spectrum sensing.The system model is designed below through Eq.(1) with two hypothesis :

Hypothesis 0 (H0) : y= n &
Hypothesis 1 (H1) : y= n + x , x is a known pilot vector and w is a noise (1)
while using known value of x, we can perform matched filter operation as

$$\tilde{y} = X^H y \quad (2)$$

Now put value of Eq. (2) in Eq. (1) to both hypothesis and estimated results are given as,

H 0: $\tilde{y} = X^H y = X^H n = \tilde{n}$

H 1 : $\tilde{y} = X^H y = X^H (x + n) + ||x||^2 \tilde{n}$ (3)

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In Eq. (3) noise ñ = X^H n which is Gaussian Random Variable with mean 0 & variance $\left||x|\right|^2\sigma_n^2$

Now to determine PU's signal, test statistics to decide H1 & H0 is in Eq. (4) ,

$\tilde{y} \geq \gamma \implies H1$
$\tilde{y} < \gamma \implies H0$ (4)

Probability of false alarm $P_{FA} = P_r(\tilde{y} \geq \gamma | H0) = Q(\frac{\gamma}{||x||\,\sigma_n})$ (5)

Probability of detection $P_D = P_r(\tilde{y} \geq \gamma | H1) = Q(\frac{\gamma - ||x||^2}{||x||\,\sigma_n})$ (6)

where threshold γ can be calculated using $\gamma = \left||x|\right| \sigma_n Q^{-1}(P_{FA})$.

3.2 Spectrum Sensing using Matched Detector in OFDM systems

Orthogonal Frequency Division Multiplexing (OFDM) is a key broadband wireless technology and it has a large transmission bandwidth which leads to significantly higher data rates. Several WI-FI and Wireless Local Area Network (WLAN) standards are based on OFDM. For cognitive radio networks operating in an OFDM Rayleigh fading channel, matched detector spectrum sensing is employed. The system model is designed below through Eq.(7) with two hypothesis :

H0 : y= n &
H1 : y= XH + n = x+n (7)

where x= XH and X is a known diagonal matrix and H is N*1 DFT coefficient vector , x is deterministic and known signal, using x , one can perform matched filtering as $\tilde{y} = x^H$ y

The result corresponding to both hypotheses is given as,

H0: $\tilde{y} = x^H y = x^H n$ = ñ
H1: $\tilde{y} = x^H y = x^H(x + n) = \left||x|\right|^2 +$ ñ (8)

In Eq.(8) , ñ = $x^H n$ is again Gaussian random variable with mean zero and variance $\left||x|\right|^2\sigma_w^2$

test statistics to decide H1 and H0 is,

$\tilde{y} \geq \gamma \implies H1$
$\tilde{y} < \gamma \implies H0$ (9)

for Eq. (9) γ can be selected as $\gamma = \left||x|\right| \frac{\sigma_w}{\sqrt{2}} Q^{-1}$ (PFA)

Probability of false alarm $P_{FA} = P_r(\tilde{y} \geq \gamma | H0) = Q(\frac{\sqrt{2}\,\gamma}{||x||\,\sigma_w})$ (10)

Probability of detection $P_D = P_r(\tilde{y} \geq \gamma | H1) = Q(\frac{\gamma - ||x||^2}{||x||\frac{\sigma_w}{\sqrt{2}}})$ (11)

Eq.(10) & Eq.(11) are used to calculate P_D and P_{FA} for spectrum sensing using OFDM environment for CR users.

4. Simulation Results

In this paper, Matched Detector has been analyzed using various channel platforms and techniques. Performance parameters like Probability of Detection (P_D) , Probability of False Alarm (P_{FA}), number of CR users on a network for cooperative spectrum sensing , different range of SNR and error probability are focused and simulated.

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4.1 Performance Analysis of Matched Detector using AWGN channel

Matched detector is simulated for the AWGN channel environment here. Figure 2 shows SNR vs. Probability of detection (P_D) results. It has been analysed for different ranges of Probability of false alarm from 10^{-6} to 10^{-1}. In figure 2 ,SNR is varied from -20 dB to +20 dB . Results say that when SNR is increasing from -20dB to +20 dB, P_D is increasing from 0 to 1. It shows for a higher value of SNR, there are better results for P_D, nearer to 1 value. In Figure 2, the ROC curve for a matched detector under the same scenario, is plotted using simulated and analytical results for different SNR values. P_D and P_{FA} are calculated using Eq. (5) and Eq. (6) shown in section 3.1. In this ROC curve, simulated and analytical results are matched for SNR values like -20 dB, -10dB , 0 dB and 10 dB . Results are proved that the performance of the matched detector is better for SNR value 10 dB compared to -20 dB , -10 dB. and 0 dB.

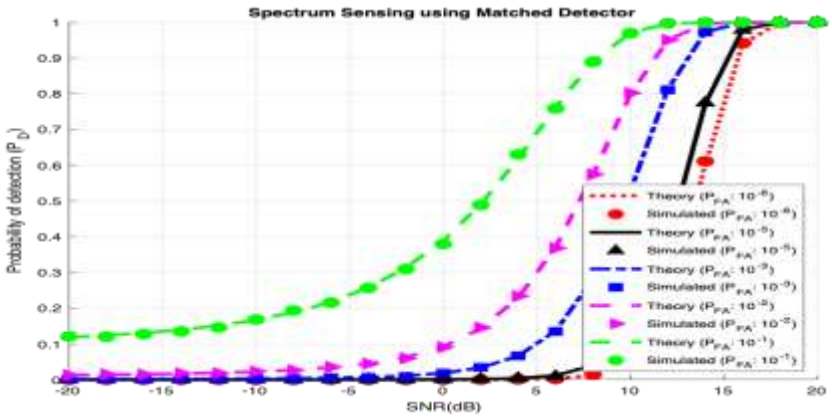

Figure 2 SNR (dB) Vs. Probability of detection (P_D) graph for P_{FA} :10^{-6} to 10^{-1}

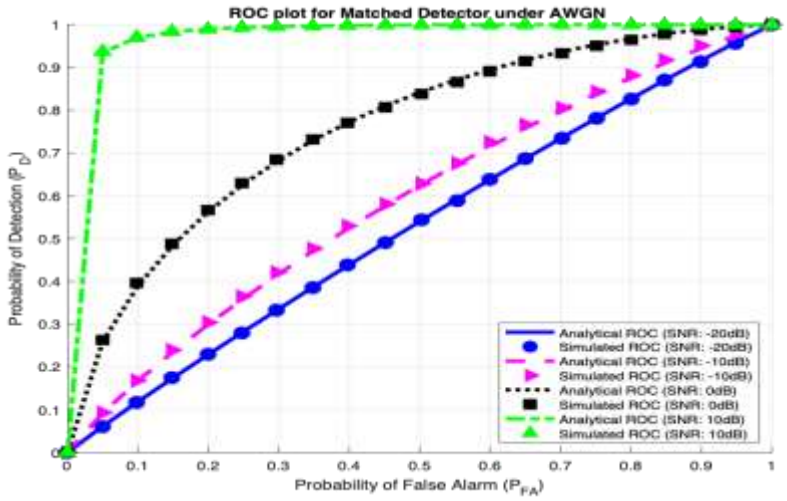

Figure 3 Probability of False Alarm (P_{FA}) Vs. Probability of detection (P_D) graph for SNR : -20 dB to 10 dB .

4.2 Performance Analysis of Matched Detector using OFDM systems

OFDM technique has been added to the previous section 4.1 with Matched Detector spectrum sensing for cognitive radio network environments shown in Figure 4. Using OFDM, spectrum sensing can be done under the worst SNR scenario like -25 dB & -30 dB .There is also advantage of OFDM Matched Detector spectrum sensing technique to utilize the available spectrum efficiently due to orthogonality in carrier signal. Figure 5 shows OFDM Matched Detector spectrum sensing technique under Cooperative Spectrum Sensing (CSS) heterogeneous environment. All algorithms of CSS , perform similar results in terms of P_D and P_{FA} with SNR range -30 dB to -15 dB (low SNR region).

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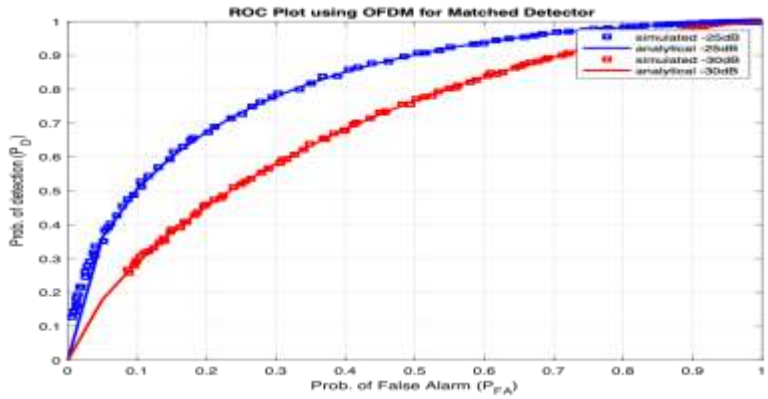

Figure 4 Probability of False Alarm (P_{FA}) Vs. Probability of Detection (P_D) for OFDM Matched Detector for SNR -25 & -30 dB .

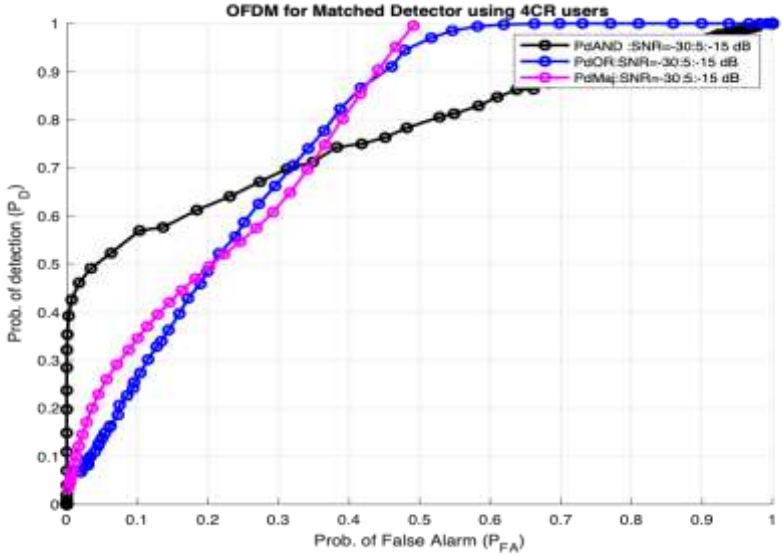

Figure 5 With CSS: Probability of False Alarm (P_{FA}) Vs. Probability of Detection (P_D) for OFDM Matched Detector for SNR -30: 5: -15 dB .

5. Conclusion

In this paper, Matched Detector spectrum sensing technique is analyzed under AWGN environment. Further, OFDM has also been added to sense the spectrum under lower SNR regions. The different parameters like Probability of Detection (P_D) , Probability of False Alarm (P_{FA}), are tested in this different channel environment. Results have also been compared with Cooperative Spectrum Sensing (CSS) heterogeneous environment. It states that using CSS, performance of detectors has increased with OR logic. When the Detector operates in low SNR zones, its output is lowered. When there is a good SNR, the detector performs better in terms of PU signal detection and 0 error probability for Cognitive Radio Networks. In this paper, it's targeted on SNR like -10 dB to -30 dB(low region) and obtained good results practically and theoretically. Detector is targeted Matched Detector in this paper for all performance parameters analysis. Matched Detector required PU's signal prior information to generate reference signal.

References

[1] Federal Communications Commission, "Spectrum policy task force report, FCC 02-155," Nov. 2002.
[2] J. Mitola and G.Q.Maguire," Cognitive radios: Making software radios more personal," IEEE Pers. Commun., vol. 6, no. 4, pp. 13-18, Aug. 1999.

[3] J. Mitola,"Cognitive radio: An integrated agent architecture for software defined radio," PhD. diss., Royal Inst. Technol. (KTH), Stockholm, Sweden, 2000.
[4] S. Haykin, "Cognitive radio: Brain-empowered wireless communications," IEEE J. Selected Areas Communications, vol. 23, no. 2, pp. 201- 220, Feb. 2005.
[5] I. F. Akyildiz, W.-Y. Lee, M. C. Vuran, and S. Mohanty, "A survey on spectrum management in cognitive radio networks," IEEE Communications Magazine, vol. 46, no. 4, pp. 40–48, 2008.
[6] A. M. Wyglinski, M. Nekovee, Y. T. Hou,"Cognitive Radio Communications and Networks: Principles and Practice" Elsevier, December 2010.
[7] Y. C. Liang, Y. H. Zeng, E. Peh, and A. T. Hoang, "Sensing–throughput tradeoff for cognitive radio networks," IEEE Trans. Wireless Commun., vol. 7, no. 4, pp. 1326–1337, Apr. 2008.
[8] H. Urkowitz, "Energy detection of unknown deterministic signals," Proc. IEEE, vol. 55, no. 4, pp. 523–531, Apr. 1967.
[9] F. F. Digham, M. Alouini and M. K. Simon, "On the Energy Detection of Unknown Signals Over Fading Channels," in IEEE Transactions on Communications, vol. 55, no. 1, pp. 21-24, Jan. 2007.
[10] S. Kim, J. Lee, H.N.Wang, and D.Hong," Sensing performance of energy detector with correlated multiple antennas," *IEEE Signal Process. Lett.*, vol. 16, no. 8, pp. 671–674, Aug. 2009.
[11] Ashish Bagwari, Brahmjit Singh," Comparative performance evaluation of Spectrum Sensing Techniques for Cognitive Radio Networks, 2012 Fourth International Conference on Computational Intelligence and Communication Networks, IEEE 2012.
[12] G. Yang et al., "Cooperative Spectrum Sensing in Heterogeneous Cognitive Radio Networks Based on Normalized Energy Detection," in IEEE Transactions on Vehicular Technology, vol. 65, no. 3, pp. 1452-1463, March 2016.
[13] C. Cordeiro, et al., "IEEE 802.22: An Introduction to the First Wireless Standard based on Cognitive Radios," Journal of Communications, Vol. 1, No. 1, April 2006.
[14] X. Zhang, R. Chai and F. Gao, "Matched filter based spectrum sensing and power level detection for cognitive radio network," 2014 IEEE Global Conference on Signal and Information Processing (GlobalSIP), Atlanta, GA, USA, 2014, pp. 1267-1270, doi: 10.1109/GlobalSIP.2014.7032326.
[15] R. Abdelrassoul, E. Fathy and M. S. Zaghloul, "Comparative Study of Spectrum Sensing for Cognitive Radio System Using Energy Detection over Different Channels," 2016 World Symposium on Computer Applications & Research (WSCAR), Cairo, Egypt, 2016, pp. 32-35, doi: 10.1109/WSCAR.2016.13.
[16] Prince Semba Yawada, Mai Trung Dong, "Performance Analysis of New Spectrum Sensing Scheme Using Multi antennas with Multiuser Diversity in Cognitive Radio Networks", Wireless Communications and Mobile Computing, vol. 2018, Article ID 8560278, 13 pages, 2018.
[17] A. Ostovar and M. Zheng, "Low-SNR Energy Detection Based Cooperative Spectrum Sensing in Cognitive Radio Networks," Wireless Personal Communications, 2017.
[18] J. Liu, R. Xiao, H. Zhang, and Z. Zhang, "A reliable cooperative spectrum detection scheme in cognitive radio networks," Wireless Networks, vol. 23, no. 3, pp. 651–661, 2017.V
[19] V. Arthi, P. S. Chakkravarthy, and R. Ramya, "Improved Two Stage Detection in Cooperative Spectrum Sensing In Cognitive Radio Networks," Cognitive Radio Networks, vol. 6, no. 9, Article ID 581, 2016.
[20] P. Prasain and D.-Y. Choi, "Nullifying malicious users for cooperative spectrum sensing in cognitive radio networks using outlier detection methods," Lecture Notes in Electrical Engineering, vol. 331, pp. 123–131, 2015.
[21] Ejaz, W., ul Hasan, N., Azam, M.A. et al. Improved local spectrum sensing for cognitive radio networks. EURASIP J. Adv. Signal Process. **2012,** 242 (2012).
[22] S. Nandakumar *et al*., "Efficient Spectrum Management Techniques for Cognitive Radio Networks for Proximity Service," in *IEEE Access*, vol. 7, pp. 43795-43805, 2019, doi: 10.1109/ACCESS.2019.2906469.
[23] Kavita Bani and Vaishali Kulkarni, "Analysis of energy detector with improved ED and variable threshold ED suitable for digital TV IEEE 802.22 WRAN", 2020, Journal of Physics, 1706 (2020) 012061.
[24] K. Bani and V. Kulkarni, "Simulation and Analysis of IEEE 802.22 Cognitive Radio Network," 2020 First IEEE, International Conference on Convergence to Digital World - Quo Vadis (ICCDW), Mumbai, India, 2020, pp. 1-4, doi:10.1109/ICCDW45521.2020.9318712.

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GROUP DISCUSSION: AS AN INNOVATIVE TOOL TO BE EMPLOYABLE IN THE PROFESSIONAL INDUSTRY.

Dr. Ritu Sharma, Department of Humanities and Applied Science, Atharva College of Engineering, Mumbai : drritusharma@atharvacoe.ac.in

ABSTRACT-
Applying group discussions as a teaching and learning method, graduate students can improve their fundamental interpersonal skills. Graduate students need the fundamental skills.
Interpersonal skills are necessary for people to succeed in their personal lives and get work on the international job market. The goal of the current study is to provide a comprehensive overview of the paradigm shift that has occurred in teaching in today's modern education from a teacher-centric approach to a participatory student-centric strategy for imparting skill-based education. Collaborative teaching strategies have been demonstrated to increase students' involvement in the learning process. One of the best collaborative techniques for teaching students fundamental interpersonal skills in a situation they will encounter in the real world is group discussion.

Keywords- Group Discussion, presentation skills, body language, leadership, listening, communication skills.

INTRODUCTION-

Any private enterprise, including banks, business schools, and other organisations, should value group discussion.
Discussion in the group reveals the group leadership skills and interpersonal skills of the participants. A technique to assess a candidate's personality qualities is group discussion. It is a method for assessing a candidate's various traits to determine whether she or he is qualified for the coveted position or admission. The current competitive environment demands that candidates for a given position have the ability to multitask. On the other hand, leading group discussions at schools offers a chance to develop one's own talents as well as. Obtain admittance to a reputable college or university. Participating frequently in group conversations enhances the candidate's capacity to engage in debates about current events and learn the most recent information. As a strategy, it is important to enhance personal features, but it is also crucial to gauge the participants' general level of attentiveness. A skilfully facilitated group conversation evaluates the young participants' enthusiasm for topics of national importance. Most frequently, we see that while our students are eager to voice their opinions on many social issues, they are unable to do so in a methodical manner. Thus, conversation in groups becomes a potent means of expression. In order to demonstrate how group discussion enables a candidate to achieve brilliant achievements in their personal career, the current research article exhibits the prerequisites of group discussion on the one hand and its entire breadth on the other. A group discussion is a casual conversation in which individuals who share the same educational level talk about a subject of interest. It has been used for final selection of candidate in interview process.
Group discussion is the most effective method for choosing the best among the finest... As far as the number of participants in a group discussion is concerned, it is observed that "based on the early works of Robert Bales (1954), most authorities believe that a group with five to seven members is the ideal size." Let's now explore the criteria and domain of group discussion in order to define its goal and how it fosters success.

DEFINITION OF GROUP DISUSSION-

A group discussion (Group Discussion) is an official gathering of six to 10 people who gather together to discuss a subject or a case that has been provided for this reason

This method is used by an organisation to determine whether a candidate demonstrates specific personality traits or skills that are sought in them. Each participant tosses the ball to a teammate while they work toward a common goal, similar to a football or hockey game. GROUP DISCUSSIONs are won by the team with the best coordination and talent, just like in comparable games. In GROUP DISCUSSIONs, the team members must interpret, discuss, and defend the topic or case as a whole.

Why is Group Discussion important?

The aim of the Group Discussion is to elicit all participants' opinions and, through vigorous discussion, develop a consensus. There were five to ten contestants. It aids in determining a candidate's interpersonal aptitude and teamwork capabilities. It cultivates crucial soft skills needed for the planning and management of employee group activities. The group discussion is used as a tool for determining a candidate's fitness for a job since numerous personality traits emerge during the discussion, which aids the potential employer in evaluating the applicant. Some of these essential qualities for professional success include having an aptitude for learning quickly, mature responses to other people's opinions, and an optimistic outlook on problems, leadership abilities, persuasiveness, and aptitude for analysis, aptitude for communication and listening, and group dynamics.

Difference between Group Discussion and Debate-

A formal debate is not the same as a group conversation. You are supposed to speak for or against a motion during a debate. On the other hand, in Group Discussion, every group member is expected to thoroughly consider the matter, and anyone may alter their opinion if they become persuaded of the validity of the opposing viewpoint. In debates, where speakers for and against the motion prepare their arguments in advance and the contestant is not required to argue for both sides, this type of position shift does not occur. This is not the situation in group discussions, where the conversation just naturally develops without any need for proof from the beginning. Due to the very nature of group discussion, participants must be flexible, and any lack of flexibility or resulting stubbornness or rigidity is viewed as a serious flaw in their personality.

How do I begin with Group Discussion?

The first impression is always the last, they say.
It happens to be true occasionally. Here are a few effective methods for starting a group discussion.
Quotes: Using quotations correctly at the beginning of your argument can help you create a strong first impression.
Definition: It is an initiative to define the subject or a key term within the subject.
Shock Statement: It works best for drawing attention right away. It aids in establishing the desired environment.
Use of Facts, Figures, and Statistics: when starting a group discussion with numbers, facts, and statistics, more care must be used. Employing them serves no value if they are not accurate. There is worry that if the facts are based on false information, a bad impression would be created.
Short Story: We pay close attention to the story. In India, the tradition of telling stories is vast. Short stories are useful for making strong first impressions. But in this case, it is essential to be specific.

GROUP DISCUSSION TYPES: There are two kinds of Group Discussions:

1. Topic-based
2. Case- based

Topic-based Group Discussions can be divided into three types:

1. Factual topics
2. Abstract topics

3. Controversial topics
4. Case study-based discussion

FACTUAL TOPICS-

Most topics assigned to groups are factual in nature. These are associated with current socioeconomic data or environmental concerns. For instance, factual issues include the expansion of Indian tourism and higher education.

Abstract topics-

The presentation of abstract concepts is at a higher level. These are typically of an immaterial kind. You must approach these subjects with lateral thinking and innovation. Examples of abstract themes include statements like "blue is better than green," "all are equal, but some are more equal than others," "money makes you poor," etc.

Controversial topics-

These subjects are naturally divisive. Divergent viewpoints among the participants are inevitable. These subjects are covered in order to gauge the participants' maturity level about them. You shouldn't lose your temper or view the topics being discussed narrowly. For instance, you can be requested to tackle contentious themes like - In India, reservations must be eliminated or women cannot serve in the military.

Case study-based discussion-

These are realistic simulations of actual events. These typically involve a challenge that needs to be overcome. There is no right or wrong response to such questions, so choosing how to solve the problem is crucial.

Group Discussion Requirements:

- **Knowledg**e: Without enough subject knowledge, participation in group discussion is not possible. The group discussion topic should be familiar to participants. Participants can get a better perception of the speaker's presence if they are knowledgeable about the subject. Participants should be well informed about all relevant facts and numbers, such as socioeconomic trends, cultural news, and political news; this can only be done by developing strong reading habits. It is very beneficial in group talks**.**
- **Listening**-- Participants frequently fail to listen, which is a necessary but often-overlooked element of group talks. Without the ability to listen well, no one can speak well. All of your colleagues' arguments must be heard, therefore pay attention to them all. It offers the chance to present your thoughts and comprehend other participants' arguments in an organised manner.
- **Presentation** - Participants' presentation of their ideas will have a significant impact on how the listener perceives them. Although subject knowledge is vital, the manner of presentation is more crucial. The likelihood of influencing the listeners improves with effective presentation. Knowledge should be presented in an honourable manner because it is so vital. One needs to develop these abilities through practice.
- **Body language**- A non-verbal type of communication is body language. Along with speech communication, nonverbal communication is frequently used. A person can communicate nonverbally through their posture, demeanour, gestures, facial expressions, and eye contact. This is crucial in the choosing process. More than spoken words, facial expressions and body language convey information.
- **Communication skills**- A two-way process, communication. It is essential to every organization's success. Effective communication takes conscious efforts from all parties. In GROUP DISCUSSION, participants must display effective communication as well as listening and answering abilities.

COMPONENTS OF THE EVALUATION –

The first includes components like the applicability of the opinions expressed, the importance of the information presented, the frequency of interaction, and responses to other people's opinions. The second speaks to the delivery of presentations and interventions. The third abilities include body language, voice modulation, pronunciation, and delivery. The fourth skill set comprises the capacity to spark conversation, steer it in the proper direction, maintain effective communication, and encourage the group to come to a consensus position or solution. The fifth speaks to the virtues of respect for others, compassion for their feelings, and interest in hearing all members' opinions.

Contribution quantity and quality-

Each participant in group discussion is expected to add to the conversation. A person may initiate the discussion if they are well-versed in the problem or issue at hand or are knowledgeable about the subject. The relevance of what participants stated and if their input will result in a solution or assist the group in reaching the right conclusion is the two criteria used to evaluate the quality of a contribution.

Techniques used for discussion-

Following a summary of what has already been said, participants are free to respond or share their opinions. However, if you'd like, you can state your position forcefully right early and then refute any points made by previous speakers, demonstrating to the audience why what you have to say is more pertinent or valuable in resolving the problem.

Communication skills—

Both verbal and non-verbal forms of communication are mentioned here. Verbal communication includes the capacity to select words and form phrases that are both appropriate for the situation and acceptable from a grammar and usage point of view. The other verbal communication abilities are effective speaking and active listening.

Leadership qualities-

During a group discussion, one or two individuals take the lead in the conversation. These characteristics would be sought after by the evaluation panel in your contribution to the conversation. You need to be able to do the following in order to be a successful leader:

To come up with fresh thoughts or angles on the situation or topic at hand:
To reply to other people's opinions in a mature manner;
To see the bright side of things;
To keep the conversation on track;
To listen carefully and communicate effectively;
To persuade other participants of your viewpoint to renounce an earlier position if a more reasonable or acceptable option is provided;

Group behaviour-

During a group discussion, one or two individuals take the lead in the conversation. These are the attributes that the evaluation panel would search for in you. The capacity of an employee to perform well in a group is highly valued in the business sector. Participants must have a sense of teamwork and be able to work cooperatively with others in order to achieve success. This trait should be demonstrated by group discussion participants' willingness to listen to devastating remarks and biting criticism while maintaining a smile, their enthusiasm and amiability, their spirit of accommodation to others' points of view, and their emotional fortitude to remain cool and collected even in the face of rude responses.

Starting a Group Discussion-

Occasionally, it is seen that some individuals attempt to quickly open the group discussion. They believe that the one who starts the conversation will undoubtedly be chosen or receive higher marks. This idea is untrue. In actuality, despite you want to start the discussion right away, you should wait

until you have enough points to get it started. Any of the participants may start the conversation, but everyone should make an effort to speak up and contribute as soon as they can. Poor starts or hurried conclusions lead many group discussions to fizzle out. Often, the one who starts the conversation is unaware that they don't know enough about it.

Recapitulating a discussion in a group-

The conclusion of a group discussion is just as significant as the beginning. Be brief and direct to conclude the group discussion. Stay away from making new points. Don't merely state viewpoint. Actually, try to incorporate the important points brought up by the entire group. The abrupt end of a group discussion is sometimes perplexing and annoying.

CONCLUSION-

In the present circumstances, professional competition is inevitable. Jobs in the public and commercial sectors are difficult to find. Employers search for the best individuals for the open positions. As a result, they use a variety of approaches to evaluate the candidate's aptitude. Not only is it important to earn marks and land a job, but it's also important to demonstrate your abilities and please your employers. In recent years, group talks have become more and more common. A candidate's attitude, awareness, expression, and attentiveness can be evaluated.

Students aspiring for significant positions in the public sector should be aware of the value of group discussions and make every effort to improve their competency in discussions. Group discussions might provide opportunities for career achievement.

REFERENCES-

[1] John Jeffrey Gorrell, “Language, and self: A dissertation”1975.P. VIII Ibid. P.I
[2] Radiance: Communication Skills”, Orient Black Swan, Mumbai, 200
[3] Ganguly,Anand. (2008). Group Discussion: For Admission and Job. New Delhi: Pustak Mahal.
[4] Young,Sue Kathryn & et al. (2007). Group Discussion:A Practical Guide to Participation and
Leadership.IL: Waveland Press.Inc.
[5] Mengxiao Zhu ; Mo Zhang “Examining the patterns of communication and connections among engineering professional skills in group discussion: A network analysis approach” 2016 IEEE Integrated STEM Education Conference (ISEC)
[6] G.R.Blackwell, “Group discussion techniques in a technical course” Proceedings Frontiers in Education Twenty-First Annual Conference. Engineering Education in a New World Order
[7] Tobias Hecking ; Irene-Angelica Chounta ; H. Ulrich Hoppe, “Analysis of User Roles and the Emergence of Themes in Discussion Forums” 2015 Second European Network Intelligence Conference

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EMERGING TECHNOLOGIES IN ELECTRICITY DISTRIBUTION CONTRIBUTING SUSTAINABILITY.

Prof. Pragya Jain Professor, Department of Electrical Engineering, Atharva College of Engineering, Mumbai, India
Ashweni Kumar Jain AVP, Adani Electricity Mumbai Limited, Mumbai, India

Abstract— India is currently the fifth biggest economy and touted to be third biggest economy by 2030 with GDP(Gross domestic product) of USD 7.5 trillion overtaking Japan and Germany. India has been posting a year-on-year growth of more than 6%. By 2025, India is expected to have more than 250 Unicorns or start-up with valuation of 1 billion or above. For Indian companies to enter in elite class of Fortune 500, it is pertinent to meet the global standards of quality, safety and ESG(Environmental, Social and Governance). A good ESG strategy ensures a boost to brand image, earn investors and customer confidence, reduce environmental and legal obligations and related overheads, improve asset management and overall profitability. ESG benchmarking allows stakeholders and companies to set a tone for improvement, identify impediments and chalk-out future strategies and create long term business value without any adverse effect on environment and society.

Environment is the backbone of sustainability in view of global warming and its long-term effect on humanity and flora and fauna. Electricity sector being the most energy intensive Industry is relevant to emerging technologies which can ensure and establish a greener and sustainable tomorrow. For few years, Electricity distribution sector is witnessing the new trends like use of bio-degradable transformer oil(Ester oil), Green gas for switchgears in place of SF6, Solar rooftop PV generation to reduce carbon footprint of utility, Reliability centered maintenance for assets to reduce consumption of resources like mineral oil, SF6 gas etc. Avenues like use of ethanol blended petrol for operation, use of LED lamps in place of HPSV lamps are also being availed by leading utilities in India. An effort is made through this technical paper to touch upon emerging trends in electricity distribution, associated challenges and mitigation.

Keywords— GDP, ESG, Sustainability, Ester oil, Solar PV, Ethanol blending

I. INTRODUCTION

India has been witnessing the windfall in IT, Infrastructure, energy sector, manufacturing and Bio-medical. As per the report of Morgan Stanley[1], it is envisaged that India will be the third largest economy at the end of 2030. India's GDP shall surpass more than twice the size of current GDP by 2031. The unprecedented rise of Indian economy is the result of liberalization, export-oriented approach, direct foreign investment due to high confidence level of investors and young and cheap labor. Young demographic of India implies that in next year, about quarter of the global workforce shall be supplied from India[2]. 2020-2050 is the next Indian golden age wherein the working population will continue to dominate. The has been witnessed for China in past which has contributed to its phenomenal growth as next superpower during last 30 years.

ESG(Environmental, Social and Governance) framework allows organizations to exhibit to their shareholders and investors how they manage risks and opportunities beyond environment and carbon neutrality[3]. ESG benchmark organizations and emphasize the sustainability of organization in terms of

risks envisaged in future on account of changing regulatory, climatic and social demographics besides providing global recognition. ESG disclosure as of now is not mandatory through any statute thoughdriven by market mandates and organization culture and aspirations. ESG framework is adopted by leading Indian organization to compete in global market and onboard big investors across the boundaries of nation.

II. ESG FRAMEWORKS, ENVIRONMENTAL RISKS AND OPPORTUNITIES

An ESG framework only provides an outline of disclosure and not the complete methodology for data collation, compiling and reporting. ESG standards are specific and set criterion for reporting. They also mandate the information collection and reporting methodology. ESG framework[4] is grouped into three categories namely Voluntary disclosure framework, guidance framework and third-party aggregators.

A. Voluntary disclosures frameworks

Under this framework, an organization declares its ESG related policies, the practices being followed and related performance data. Most popular voluntary disclosure frameworks are CDP(Carbon disclosure project), DJSI(Dow Jones Sustainability Indices) and GRESB(Global Real Estate Industry Benchmark). Main focus areas through these frameworks are organizational carbon footprint, water security, occupying commercial and office space's ESG data, assets and real estate portfolios etc.

B. Guidance frameworks

Through this framework recommended methodologies and outlines to identify, administer and publish the ESG performance are prescribed. The very common guidance frameworks are SASB(Sustainability Accounting Standard Board), TCFD(Task Force on Climate related Financial Disclosures), CDSB(Carbon Disclosure Standard Board), GRI(Global Reporting Initiative) and IIRC(Internal Integrated Reporting Council). Focus areas through this framework are financial performance related critical ESG issues, governance and transparency, strategy and risk management and baseline for corporate sustainability which can be referred across industry and countries.

C. Third Party Aggregators

Through this framework organization performance is assessed through publicly available information like company filings in regulatory and other forums, websites, annual reports and CSR reports. Main players under this framework are Bloomberg Terminal ESG analysis, ISS ESS(Institutional Shareholder services) and Quality Score(ISS), MSCI and Sustainalytics. Focus areas are organizational performance assessment through available public domain resources.

As per the ESG survey[5] for Top 100 listed companies in India(excluding public sector undertakings and government banks), the major findings were related to lack of consistent and comparable disclosures, low divergence between ESG parameters among high scoring companies and poor performance of E & S factors as compared to G factor suggesting regulatory gap.

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Overall ESG & Factor wise Score (Graph 1)

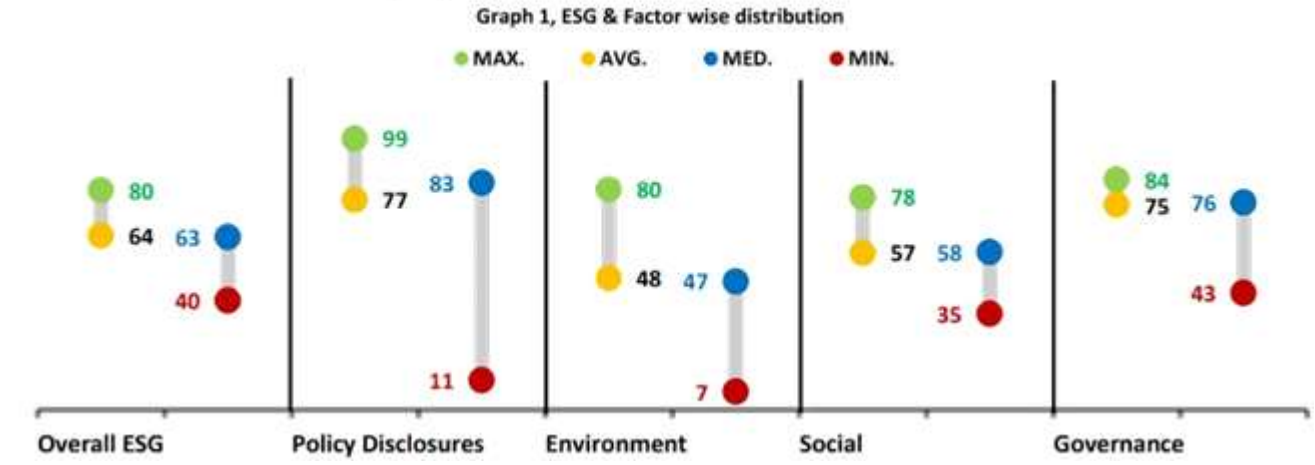

Fig 1.1 ESG Score distribution (Credit:ESG report by SES)

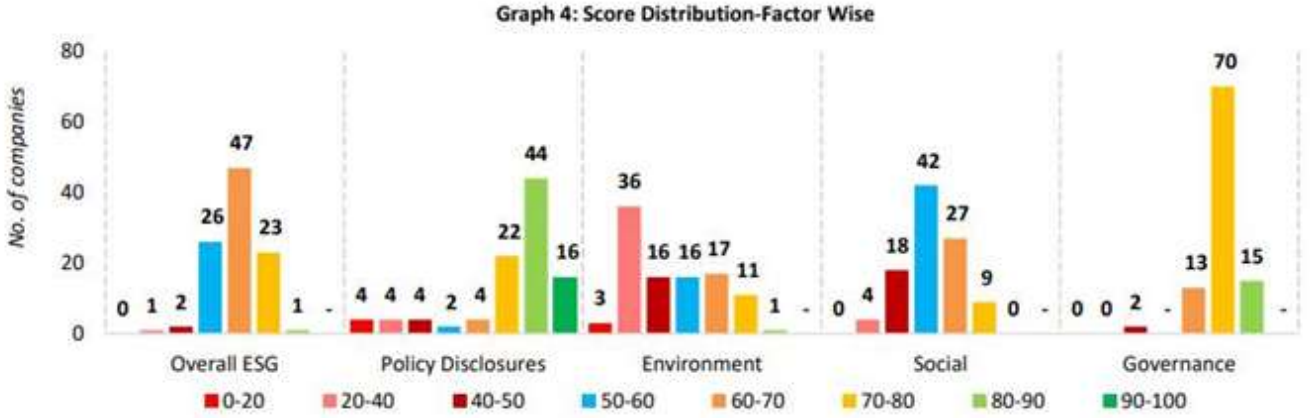

Fig 1.2 ESG Score distribution – Factor wise vis a vis Companies(Credit:ESG report by SES)

Only two power sector companies, namely Adani Transmission Limited and Adani Green are in the top 100 companies as per the said report. The electricity sector being a highly energy intensive industry requires a greater focus in terms of environment factor under ESG framework. In global energy transition, India's T&D sector is going to play a significant role. T&D sector is undergoing a major transformation considering huge capacity addition, upgradation of networks through regulatory approved DPRs, Open access regulations and multifold increase in renewable capacity and technology upgradation. Hence to benchmark the performance of Indian Electricity utilities, ESG performance and in particular environment performance shall be pertinent. Environmental Risks for Electricity Distribution sector as envisaged are as below:

A. Impact on global warming due to GHG(Green House Gases) in operation
B. Level of Energy intensity as per mix of renewable and non-renewable sources
C. Impact on biodiversity due to use of hazardous products/non-biodegradable products in operation
D. Sensitivity to extreme weather events : Incremental cost or potential physical impact on assets[6]

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III. ESG Environment factor for Electricity Distribution Utilities - opportunities

A. Green Gas in place of SF6 gas

Since 2000, nineteen out of 22 years have been the warmest years recorded in modern history, which is result of Greenhouse effect. Greenhouse gases (GHGs) are responsible for climate change. Sulfur hexafluoride (SF6), an insulating gas is used in high-voltage(>66 kV) and medium-voltage(33/11 kV) switchgears. It is estimated that it has 23,500 times more impact than carbon dioxide (CO2) to the greenhouse effect. Further it has a long stable life and can sustain 3,200 years in atmosphere[7]. In view of it, efforts have been made by various OEMs and researchers to find reliable and sustainable substitute of SF6. GE(General Electric) has come up with g^3 solution, which is a mixture of O_2, CO_2 and Novec^{TM} 4710 fluoronitrile introduced by 3M company[8]. Many grid operators in Europe have chosen g^3 to reduce the environmental impact of their operation. This has also reduced their physical and economic footprint by way of engineering interventions and compliance management.

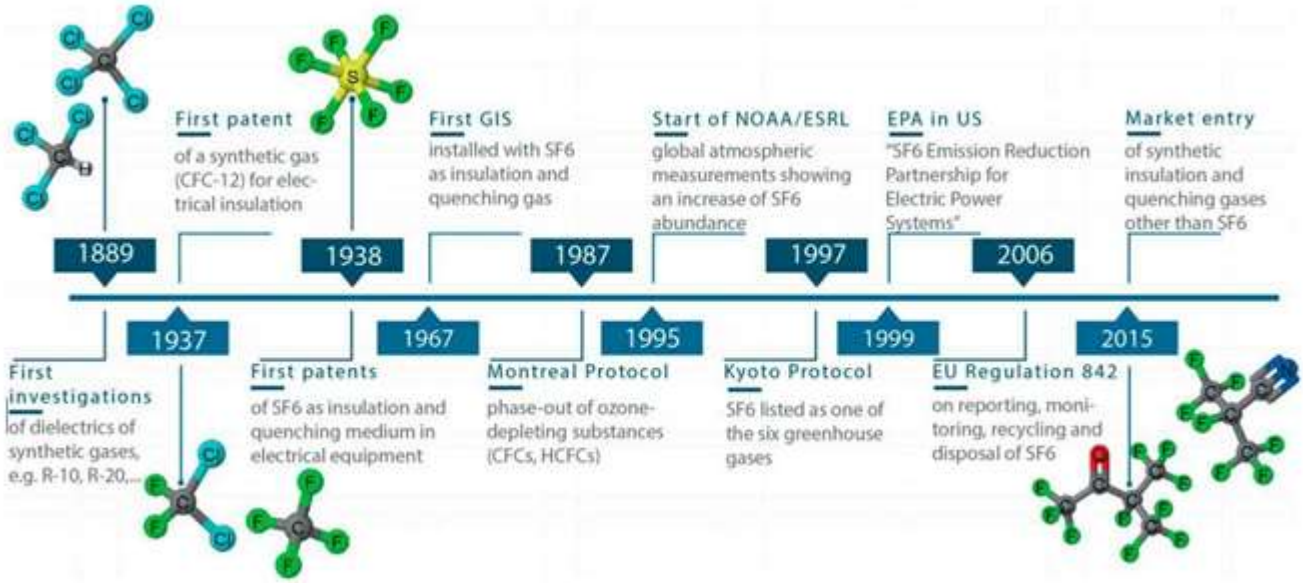

Fig 1.3 Evolution of Sf6 alternate gas (Credit: www.switchgearcontent.com development SF6 alternative gases in switchgear)

Compounds		Chemical abstracts service (CAS) Nr° [1]	Concentration, %	Concentration, ppm
CO_2 (*carbon dioxide*)	g^3	124-38-9	93.50	935,018
$(CF_3)_2CFCN$ (*heptafluoroisobutyronitrile or Novec 4710*)		42532-60-5	4.06	40,600
CO (*carbon monoxide*)	by-products	630-08-0	2.4	24,000
CF_2=CFCN (*perfluoroacrylonitrile*)		433-43-2	0.013	130
CN–CN (*ethandinitride*)		460-19-5	0,0065	65
CF_3–CF_2–CN (*pentafluoropropionitrile*)		442-04-08	0.006	60
CF_3–CN (*trifluoroacetonitrile*)		353-85-5	0.0058	58
$(CH_3)_2SiF_2$			0.0052	52
COF_2 (*carbonyl fluoride*) + C_3F_8 (*octafluoropropane*)		353-50-4 + 76-19-7	0.0014	14
$(CF_3)_2CHCN$ (*hexafluoroisobutyronitrile*)		NA	0.00019	1.9
$(CF_3)_2C=CF_2$ (*perfluoroisobutene*)		382-21-8	0.00013	1.3

Fig 1.4 Composition of g3 – an alternate to SF6 (Credit: CIRED - 24th International Conference & Exhibition on Electricity Distribution)

Following factors have supported the transition from SF6 to g^3 (Credit: GE Grid Solutions, g^3 Technology):

1. Easy retro filling options with support from leading industrial gas suppliers

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2. Device interoperability for diagnostic of $g^{3.}$
3. Easy end of life management
4. g^3 gas is applicable to all voltage levels ranging from MV to EHV
5. g^3 gas is usable for similar ambient temperature ranges as that of SF6.
6. g^3 gas is nontoxic and categorized in the equivalent safety class as SF6.

Comparing g^3's global warming potential(GWP), GWP reduces by 98% when evaluated against SF6. When filled in the GIS, the GWP of the gas is further reduced by more than 99% as required gas mass of g^3 for one bay is approximate half that required quantity for SF6. The g^3-GIS has 15% increased impact on ozone depletion on account of greater use of polytetrafluoroethylene (PTFE) substance in the circuit breaker to align with properties of the substitute gas. As PTFE quantities are miniscule, this rise is marginal (only 2.8 g of CFC-11 equivalent weight over the life cycle).

Fig 1.5 Use case of g3: Europe(Credit: g3: The SF-free solution in practice White paper, GE Grid Solution)

B. Rooftop solar PV for customers

Solar rooftop PV system has solar panels mounted on residential or commercial spaces. They provide an option of distributed generation thereby not only reducing the customer dependency on electricity utility but also provide revenue earning opportunities to customer, housing societies and commercial complexes. Depending on tariff option and state wise provisions, solar units more than threshold are banked and purchased by utility at the end of year as per regulatory directions. Housing societies have handsome opportunities through rooftop solar PV installation to utilize their idle space and reduce monthly electricity overheads. As per MCAP(Mumbai Climate Action Plan), Mumbai has solar potential of 1724 MW through rooftop solar plants. This can help meet half of the city's demand during summer[9]. Case study of one of the housing societies is explained.

Case Study – One of the Housing societies in Kandivali West installed three nos. Rooftop Solar plants(Total 20.52 kW) on terrace as per the common connection connected load. Half cut mono PERC solar cells panels were used with 535 W 24 V capacity. Half-Cut cell mono PERC solar module's solar cells are cut in half due to which its performance and efficiency enhances. Enhanced performance is exhibited through less resistive losses and more power output. Smaller cells are also durable as they are subjected to less mechanical stress and reduced possibility of cracking due installation and operation. Half cut cell also has high shade tolerance as they are connected in parallel and under performance of single cell does not affect the overall module efficiency.

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Reading of solar meters were recorded for period of 7 days and vis a vis generation potential is calculated. Based on it, the payback period for 20.33 kW plant is calculated. GHI(Global Horizontal Irradiation) potential for Mumbai is 5.4-5.6 kWH/Sq m/day[11]. Day light hours vary in Mumbai from 12:07 Hrs in Mar, 13:17 Hrs in June, 12:08 Hrs in September and 10:59 hrs in December. Clear sunny days are approximately 250 days. Total Area of solar panel is 82.69 Sq m. Considering the GHI, daily solar irradiation is 447 kWH. Efficiency of solar cell is 21%. **Solar generation envisaged/day is 93.7 kWH.**

PV nstalled Capacity (kW)	KWH (Generated) measured through Solar Meter						
	6/01/2023	7/01/2023	8/01/2023	9/01/2023	0/01/2023	1/01/2023	2/01/2023
3.56 KW	4	3	4	4	4	4	3
3.56 kW	5	4	5	5	5	5	2
3.21 kW	2	1	2	2	2	2	1
Total kWH	1	8	1	1	1	1	6
Daylight hrs[10]	1:07:15	1:07:51	1:08:28	1:09:06	1:09:45	1:10:25	1:11:06

Table 1 : Solar PV Rooftop Plant 20.33 kW data (Housing Society, Kandivali West)

Summary – Mumbai has the potential to generate 4.6 solar units per kW. Rate per kW of 535W Mono cut solar panel including material, installation and liasioning is INR 58,642/. Average unit cost of electricity is considered as INR 8.5/unit. Simple payback period calculated is 5.6 Years. Carbon footprint reduction achieved through 20.33 kW Solar rooftop PV plant in Mumbai is 21.12 Mtoe/Year[12].

C. Use of Bio-degradable Ester Oils in Transformers

Mineral Oils which are byproduct of petroleum have been the obvious choice of most of the electrical utilities for transformer insulating and cooling media in view of standard performance, no strict regulation for use and disposal, relaxed fire safety norms and low cost. As an estimate global Transformer oil market is set to grow at CAGR of more than 8% surpassing 30 billion $ in 2027. Mineral oil contributes 65% of the total market share. Mineral oil being petroleum based product is plagued by factors like low flash and fire point and are not recommended to be installed in basement and stilt of building as per CEA regulations. Further disposal of mineral oil is done only through authorized agencies in view of non-biodegradability and toxic nature. Natural ester (vegetable oils) are innovative alternative to mineral oil and offer multiple advantages beside providing a fire safety(Natural Ester are k-Class liquids with fire point > 300 Deg C). Comparison of mineral and natural ester oil is as per attached shown table:

Parameter	ASTM Test Method	Mineral Oil (Applicable Std.)ASTM D3487	Natural Ester (Applicable Std.) ASTM D6871
BDV (kV) 2mm gap	D1816	≥ 35	≥ 35
Water/Moisture Content (mg/kg)	D1533	≤ 35	≤ 200
Acid number/Acidity (mg KOH/g)	D974	≤ 0.03	≤ 0.6
Flash point (°C)	D92	≥ 145	≥ 275
Fire point (°C)	D92	-	≥ 300
Viscosity (cSt) 100°C	D445	≤ 3.0	≤ 15
Viscosity (cSt) 40°C	D445	≤ 12.0	≤ 50
Biodegradability[13]		Non-biodegradable	100%

Table 2 :Comparison of Properties Mineral Oil & Natural Ester Oil

Natural Ester oil filled transformers offers following advantages over Mineral oil filled transformers:

1. Readily bio-degradable and nontoxic. Emits less GHG compared to mineral oil.
2. Enhance life of transformer insulation – Insulation class with NE oil is upgraded due to higher thermal conductivity as IEEE C57.154. Due to it, transformer can be overloaded up to 110% on a continuous basis. Alternately for similar rating, transformer size can be reduced up to 10%.
3. High resistance to moisture due to transesterification process.

Apart from procuring the new transformer procured with Natural Ester oil as dielectric insulating fluid, electrical utilities have the option to convert the currently mineral oil filled transformer to natural ester filled transformer through retro filling. In retro filling process, existing breathing transformer is converted to sealed type transformer by installing NRV(Non return valve) or COPS(Conservator Oil preservation system) and filled with NE oil post flushing the mineral oil through transformer winding. Leading utilities like Adani Electricity and Tata power have retro filled distribution transformers satisfactorily.

Summary – In view of multiple benefits, Natural ester oil provides an edge over mineral oil filled transformers. Calculation of LCC(Life cycle cost) indicates that though capital cost being on higher side, LCC is comparable for both options. Fire safety and biodegradability are added features which utilities need to capitalize.

IV. CONCLUSION

Indian Electricity sector is getting ramped up and keeping pace with global players in terms of capex infusion, use of digital technologies and setting up a frame work for sustainability. There is huge potential for Indian utilities to adopt new technologies like use of methanol blended petrol for operations, integrating the solar, wind and battery storage systems to create a micro grid, self-healing grids to reduce the environmental impacts due to contingency power purchases. Besides use of sensorization and AI in

applications related to maintenance and monitoring shall ensure reliability centered maintenance of assets which shall fortify the ESG compliance of electrical utilities.

REFRENCES

1. https://www.cnbc.com/2022/12/01/india-to-leapfrog-to-third-largest-economy-by-2030.html#:~:text=S%26P's%20forecast%20is%20based%20on,from%20current%20levels%20by%202031.
2. https://www.thehindu.com/business/Economy/indias-gdp-can-grow-to-40-trillion-if-working-age-population-gets-employment-cii-report/article65286806.ece
3. https://corporatefinanceinstitute.com/resources/esg/esg-environmental-social-governance/
4. https://greenbusinessbureau.com/esg/esg-reporting-esg-frameworks/#:~:text=To%20solve%20this%20issue%2C%20the,are%20working%20to%20change %20this.
5. 1649043402_ESG-Scores---Top-100-Listed-Companies-in-India.pdf (sesgovernance.com)
6. https://www.spglobal.com/_media/documents/ratingsdirect_esgindustryreportcardregulatedutilitiesnetworks_41535202_may-17-2019.pdf
7. https://www.gegridsolutions.com/hvmv_equipment/catalog/g3/
8. https://www.gegridsolutions.com/app/resources.aspx?prod=g3&type=13
9. https://timesofindia.indiatimes.com/rooftop-solar-power-can-meet-close-to-50-of-citys-peak-electricity-demand-bmc-report/articleshow/90331045.cms
10. https://www.timeanddate.com/sun/india/mumbai?month=1
11. https://kredlinfo.in/solargrid/Solar%20radiation/Solar%20radiation%20DPR.pdf
12. https://greencleanguide.com/calculate-your-carbon-footprint/#:~:text=Electricity%20%3D%200.85%20kg%20CO2,planning%2Fcdm_co2%2Fcdm_co2.htm
13. https://www.maximizemarketresearch.com/market-report/transformer-oil-market/11266/
14. https://www.outlookindia.com/business/india-to-be-world-s-2nd-largest-economy-by-2050-to-add-a-trillion-dollar-to-gdp-every-12-18-months-gautam-adani-news-238578

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MODELLING THE LEARNERS' BEHAVIORS USING CLASSIFICATION ALGORITHMS IN WEKA ENVIRONMENT

S. Bhuma Devi Research Scholar, Department of Mathematics and Statistics, Banasthali Vidyapith - 304022, Rajasthan, India

Abstract
The learning environments are essential part of training and learning process for every country. Learners' study-life balance could be transformed through the effects of learning activities in learning eco-systems. Sentiment analysis could be done for adaptability of situational necessity in evaluation process, along the methods of learning in offline, online and hybrid. Machine learning classification algorithms like a rule-based, decision tree, Bayes and combination of logistic regression and decision tree classification models which are the inbuilt in WEKA-environment. The real time problems solutions or inputs could be drawn from primary datasets, it was observed that rule-based model's accuracy was more acceptable for the conditional situation for assessment process in virtual learning scenario. Knowledge from the decision tree model was most evidently indicating that the direct contact method of learning leads a positive approach in maintaining relation among the family members.

Key words: Learners' behavior, Learning environment, study-life balance, Machine learning classification algorithms.

I. Introduction

The quality of humans' life could be assessed based on their life-style which could be derived from their mental, physical fitness. The gist of these qualities could be availed from the existing learning eco-systems. Learning eco-systems should possess the experiential learning features. The development of skill among the individuals is inclined towards their learning behaviors. Higher education learners' behavioral part is one of the most significant aspects in acquiring knowledge for their betterment.

Machine learning part of artificial intelligence are inseparable catalyst in fetching information from the primary and secondary educational datasets. Simple and multiple linear regression models are very familiar in education sector. (Bhuma Devi & Jain, 2020) discussed about the simple linear regression model of the higher education learners' performance in usual and online methods of assessments for prediction, and analyzed about the factors like effectiveness of online teaching, educator's audibility, concept acquisition level and learners' recalling level during the virtual learning process. (Bhuma Devi & Jain, 2021) analyzed about the requirement of weekly preparation time for the learners depending upon number of subjects and number of online lectures during online learning using multi-linear regression model.

Learners' opinion about the online learning, expectations towards method of learning, difficulty level of assignments and compatibility of online assessments, regular learning activities like classwork, homework and relation with peer-group and family members are essential and unavoidable aspects for the humans' learning process. Insights from the ML-models will be studied, based on metrics like accuracy and kappa statistic. Comparison of classification ML-models and its metrics and special outputs of the analysis will be discussed in this study.

The main objectives of this paper are,

- To analyse the learners' preference about the online assessment using machine learning classification algorithms.
- To extract the most significant feature which affects the learners' study-life balance, especially with their relations with family using classification algorithms.

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II. Related work

The learners' learning behavior, their mental health, study-life balance and their emotions towards the virtual learning have been studied and modelled using clustering, tree-based, and many classification algorithms for getting insights for the real time learning related problems. Models' metrices like recall, precision and F1-scores had been observed and compared in the following literature.

(Ratnapala, Ragel, & Deegalla, 2014) compared two courses among which first course was non-graded second was graded course for full semester in MOODLE plate form. Authors studied about the learners' online self-directed learning behaviours using clustering algorithm and concluded that the online learning could be improvised by introducing proper assessment process.

(Golino & Gomes, 2014) discussed the essentiality of tree-based machine learning models in predictions of academic performance of medical students, from the second and third year of a private Medical School from the state of Minas Gerais, Brazil. Psychological and educational attributes like approach of learning, educational background, recalling and application ability had been considered in model creation. Sensitivity of Boosting model was very high among four models, Bagging and Random Forest were stable models in this work.

(Srividya, Mohanavalli, & Bhalaji, 2018) investigated about the mental health features of two distinct targeted groups, first was between 18 to 21, second was 22 to 26 years. Labeling the target variable had been done using clustering algorithm. Authors discussed about the scaffolding for assessing metal health and using classification algorithms like Logistic regression, Naïve Bayes, support vector machine, Bagging, Decision tree, KNN and Random Forest had been modelled the behavioral features for the predictions.

(Shen & Yuan, 2021) utilized the clustering ML algorithm to analyze learners' study-life quality, form the data collected from the digital campus platform all-in-one card system of a University from China. In this study, authors observed 2017 learners' spending, learning and living patterns with the data analysis, through which they could find a group of learners' behavioural, economical and learning issues. Considerable recommendations had been suggested for the quality improvement, for the better learning environment to the learners, educators and managements of that particular University.

(Yayla, Yayla, Ortaç, & Bilgin, 2021) proposed a classification model using natural language processing for understanding the people's emotions towards distance education. Tweets in Turkish language had been considered for this study. First, the tweet-comments will be translated into English language, secondly those statements will be analyzed as supported, not-supported and neural comments against virtual learning. Lastly, the proposed model will be classifying those comments into distinct categories. From against and neural comments' emotions had been considered for solving problems. Authors concluded that some of the problems could be solved using social media discussions with the help of NLP-modelling.

(Webb, et al., 2021) discussed about the similarity and importance of the machine learning and human learners. Machine learning systems could be converted to deep learning systems which will be useful to solve the social and technical problems. For creation of such systems the learners should be trained from the school level education. This could be possible by providing sustainable resources, creating trained educators, finding the gaps between the actual and existing systems and researches should flow in the same directions.

(Hamid, Ismail, Hamzah, & Malik, 2021) developed a student engagement model, for continuing learning activity effectively in online mode, using learning management system (LMS) in a public Malaysian University. With the help of literature review in learning analytics field, authors included the activities like collaboration, submission, view and discussion to improve the student engagement model. Data had been collected form LMS, explored, analyzed and validated the model with experts. Authors had concluded that the behavioural pattern of other Malaysian Universities students could be observed and studied using this above-mentioned model.

(Yilmaz, 2022) analyzed, the relation between the online skill management in self-regulation learning activities, acceptance of process of virtual learning and recognizing the learning. Data of 415 learners

had been collected from a particular University of country Turkey. Author studied the relations between the attributes through structural equation modelling and concluded that the proper self-regulatory aspects should be introduced for optimizing the online learning.

III. Methodology

WEKA datamining tool have been used to compare machine learning models. Classification and decision tree ML-models have been deduced by exploring the datasets in WEKA environment.

Datasets

Understanding the behavioral aspects of learners will be helpful in drawing progress steps for designing better learning environment. Insights and knowledge will be derived with the help of machine learning models.

Two data sets have been considered for this study.

- First dataset is primary data which had been collected from 219 engineering learners as their opinion. Related to their approach towards online learning, comfort level of online assessment, acceptance level in assignment and revision activities, leaners' opinion about instructors' knowledge and comfort agreement in mode of online assessments (Yes, No).
- Second dataset had been taken from Kaggle website.

Data collection

During online learning time of COVID-19 pandemic period, all the teaching-learning processes were performed in virtual mode. Receiving and mounting in those situational exercises of learning were bit difficult for the learners and educators. Maintenance of harmony in that process was a prime motive for the stakeholders. Educators were in the position to consider learners' background, metal and physical health to overcome crisis. Feedbacks and opinions were the only medium to handle the situation better, which have been taken through Google form.

After the pandemic situation the learning environments, learning activities and learners' attitude towards learning and keeping the relation with their peer and family got affected. The second dataset which was taken form Kaggle website for the study purpose for analyzing the learning-life balance.

Data pre-processing

Proper perceptions could be gained about the factors which are affecting learners' behaviors like the learning environment, learning activities and relationships with friends and family using machine learning models. Microsoft excel tool has been used to pre-process the data. The primary data which had been collected from the first- and second-year engineering learners were arranged properly. Dependent and independent variables had been set. As per the requirement of the datamining WEKA tool, for the second dataset the dependent variable had been converted as categorical data.

Selection of machine learning model

Distinct ML-models could be extracted for the processed of datasets, through WEKA-environment. ML-models could be trained, tested and validated in the same environment. The ML-models' classification accuracy, kappa statistics could be compared and studied for getting the suitable knowledge from the data.

IV. Model predictions and evaluations

Discussion about Assessment compatibility

During adaptation stage of virtual learning process, the educators were in a position to make learners comfortable for new normal learning situation. Sentiment analysis was essential to cope up the new state of learning process. Main purpose of learning is to adapt new knowledge for the better cognitive development or to use new process for the task completion or to acquire new skill for the betterment. Assessment is the unavoidable aspect in the training and learning process.

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Compatibility of online assessment among the engineering learners was studied with binary classification problem. Learners' opinion had been taken through Google-form, the following questions were the part of questionnaire

Table 1 Questions and Categories

Sr.No.	Questions	Categories		
1.	Are you comfortable with online lectures?	Easier	Neither easy nor tough	Tougher
2.	What kind of moderation do you expect in the way of teaching and learning process?	Speed of explanation of the concepts should be reduced	One to one correspondence for clarity of the concepts.	An increase in number of solved examples
3.	The instructor was very knowledgeable about the topic that was taught	Fair	Good	Excellent
4.	Difficulty level of Assignment	Easier	Normal	Tougher
5.	Are you comfortable with same evaluation pattern for the internal assessment?	Yes	No	

ML-Classification algorithms' prediction-accuracy attainment has been observed from the following figure.

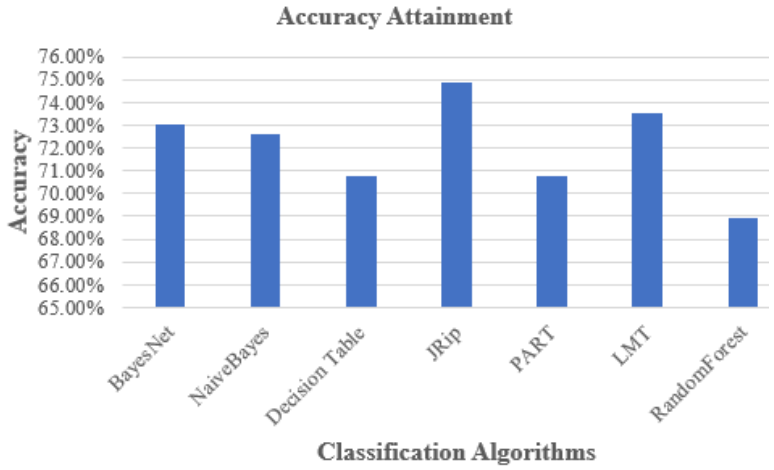

Fig.1 For Primary Dataset

Real time opinions could be studied by the machines with distinct ML-algorithms and give the favorable results to the mankind. The above table shows machine predictions of the respective ML-models. Sentiment analysis could be done using categories in WEKA environment. It is clear that decision tree ML-models' accuracies are lower in predictions. Sequential features' patterns could be learnt by the machines with proper weighted rules, measurable cropped and maximized information from the dataset. Better predictions were observed from logistic regression-decision tree model (LMT) and repeated incremental pruning to produce error reduction (RIPPER) a rule-based model (JRip). The false positive rate of acceptance class was observed in higher level compared to non-acceptance class which was for compatibility of online assessment.

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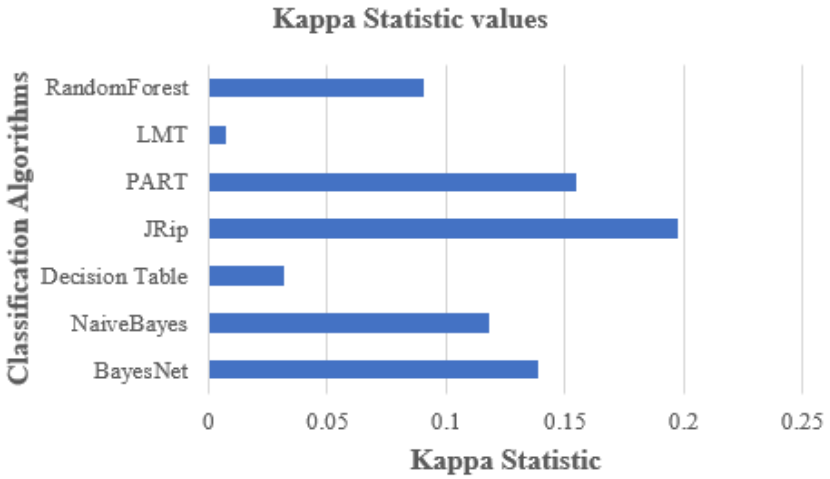

Fig.2

Discussion about Behavioral insight from the secondary dataset

The secondary dataset was containing fourteen features, the following figure describes them. The training process had been observed based on leaners' behaviour towards learning activities.

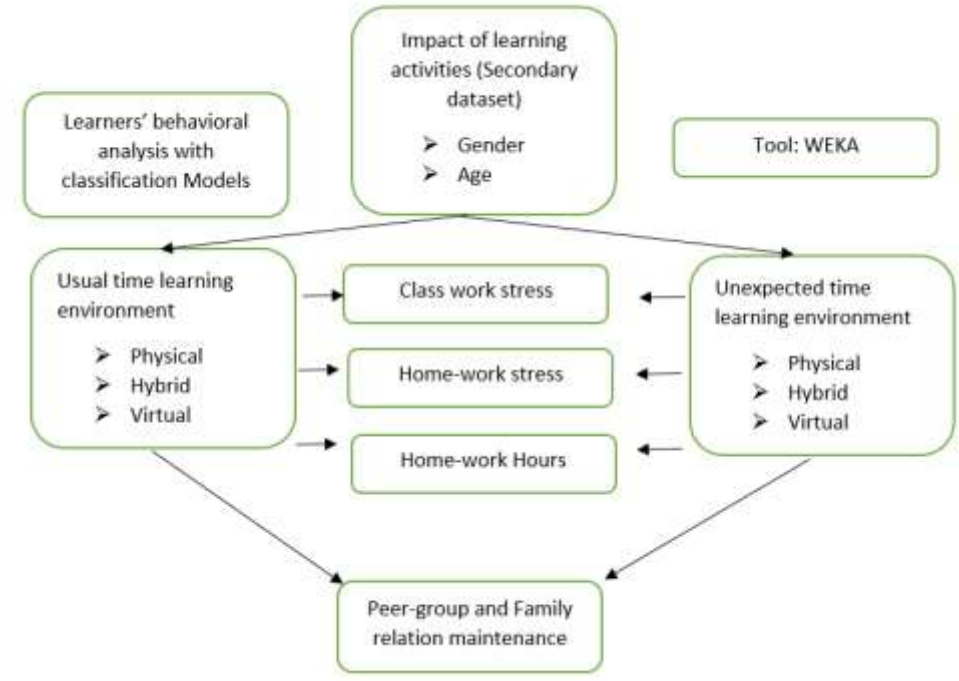

Fig.3

Many learning activities which are affecting the learners' life. Proper study-life balance among the learners could be estimated by their relations with peer group and family. The relationship index values were available in Kaggle dataset, which was taken for this study. Since the WEKA environment is good in finding insights for classification problems. The dependent variable's values had been changed from numeric to categorical values.

Machine predictions for training and testing had been compared. The split for training and testing it had been considered as 75% and 25% respectively. Rules.PART model's prediction were more accurate in training. Meta.Bagging and Trees.DecisionStump, NaïveBayes, Meta.AdaBoostM1 models' predictions for testing were 80%, 90% and 100% respectively.

The connections between features could be studied with help of decision trees and rule-based ML-algorithms. Machine predictions for the entire dataset had been observed, even if the accuracy of the

model is not up to the mark. Model's knowledge representation about study-life balance for the learners could be observed more evidently. Most contributing factor for the balance is study-environment.

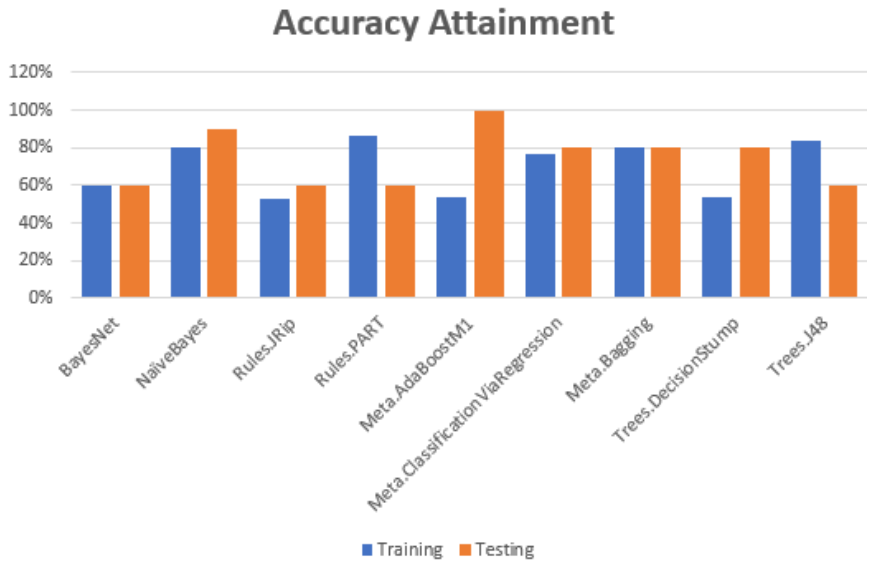

Fig.4

Conclusion

Very big virtual world has been created by the technical work-force of many countries' people. The data form many sources are collected every day. Many experts are working to extract new knowledge from distinct form of data. New perceptions could be extracted for the education sector, especially from training and learning data. Micro-level extracts from ML-models could contribute for macro-level positive change in country level. Modelling of learners' behavior with their learning activities towards their relations with stakeholders should be studied in every educational institution, to bring feasible solutions and to create acceptable or updated policies for the betterment of learning process in their respective institutions. Based on the information from ML-models, educators could be reconstructing the learning activities for the maximizing the learning among learners. Creating competence among the learners, skill acquirement part is prime factor, which could be drawn from logical and analytical subjects. Further part of research work will be carried out, for the higher education learners' skill acquirement part, which will be studied using Mathematics learning. Performance of ML-classification models and the insights from relation among features will be analyzed.

References

Bhuma Devi, S., & Jain, P. (2020). Predictive Model of Learning Analytics for On-Ground Verses Online Assessment. *International Journal of Education and Psychological Research*, 56-59.

Bhuma Devi, S., & Jain, P. (2021). Impact of Lockdown on Virtual Learning and Learning Analytics. *Educreator Research Journal, 8*(2), 16-22.

Golino, H., & Gomes, C. (2014). Four Machine Learning Methods to Predict Academic Achievement of College Students: A Comparison Study. *REVISTA ELETRÓNICA DE PSICOLOGIA, EDUCAÇÃO E SAÚDE*, 68-101.

Hamid, S., Ismail, S., Hamzah, M., & Malik, A. (2021). Developing Engagement in the Learning Management System Supported by Learning Analytics. *Computer Systems Science & Engineering*, 1-16.

Ratnapala, I., Ragel, R., & Deegalla, S. (2014). Students Behavioural Analysis in an Online Learning Environment Using Data Mining. *IEEE*, 1-7.

Shen, X., & Yuan, C. (2021). A College Student Behavior Analysis and Management Method Based on Machine Learning Technology. *Hindawi, Wireless Communications and Mobile Computing*, 1-10.

Srividya, M., Mohanavalli, S., & Bhalaji, N. (2018). Behavioral Modeling for Mental Health using Machine Learning Algorithms. *Springer Nature*, 1-13.

Webb, M., Fluck, A., Magenheim, J., Malyn-Smith, J., Waters, J., Deschênes, M., & n Zagami, J. (2021). Machine learning for human learners: opportunities, issues, tensions and threats. *Education Tech Research Dev*, 2109–2130.

Yayla, R., Yayla, H. N., Ortaç, G., & Bilgin, T. T. (2021). A Classification Approach with Machine Learning Methods for Technical Problems of Distance Education: Turkey Example. *Open Praxis*, 312–322.

Yilmaz, Y. (2022). Structural Equation Modelling Analysis of the Relationships Among University Students' Online Self-Regulation Skills, Satisfaction and Perceived Learning. *Participatory Educational Research*, 1-21.

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ECOMMERCE DATA MANAGEMENT

Prof. **Anuradha Lumba**, Dept of INFT , Atharva College of Engineering, Maharashtra, India
Mr. Chandra jagan Kumar, Markem-imaje, Noida, India

Abstract
Product management is crucial for e-commerce businesses, and it can help you crush the competition if you have the correct e-commerce data management software in place. You are only as successful in the realm of online commerce as the administration of your product data. Data is the new money in the online and digital world. You can outperform your rivals and boost your profitability if you know how to use it to your advantage. Ecommerce data management, to put it simply, is a highly collaborative and organised modern system that assists you in managing, sharing, and accessing vast quantities of essential product data that are highly valuable to your company. By allowing you to respond to market demands more swiftly, effective data management also aids in keeping you competitive. When meeting the needs of your consumers, EDM enables you to work moreefficiently and with less time and human mistake [13]. Product Data Management is a structured approach to assist in managing, gaining access to, and disseminating vast amounts of essential product data that is highly beneficial to your company. The product catalog, attributes, product content, and the consumer data gathered are typically included in this information in eCommerce. In this paper , we have studied How to choose a database management system. There are several database management systems available. Each of them has benefits and downsides in its own particular ways. We tried to compare the databases that are frequently used for both small web applications and massive data warehousing systems, even though we haven't even touched on a third of all databases. So, how do for your own software program? Did you choose the best choice? Databases like MySQL might be a logical starting point for local eCommerce businesses that are just getting off the ground and are compatible with OLTP and web-based BI TOOLS. If you want to create a massive eCommerce company that offers a full customer journey, Cassandra is a good option.. You may also attach the Elasticsearch database solution to it to give it a strong search engine as an addition. In relation to Cassandra, it'salso a respectable option for data centres and real-time analytics with massive amounts of data. It may be fair tochoose NoSQL databases like MongoDB when discussing analytical tools without numerous data layers. It works great for product catalogs as well. MSSQL is also important to note in the context of data warehousing applications, especially for businesses that have several different Microsoft subscriptions. Oracle is a strong option as well for developing OLTP solutions and data warehousing applications. Our list of the finest use cases for Redis will be summarized by IoT applications and microservice architecture that prefer to scale its data hosting. Yes, there are more database systems to take into account. Your business concept and needs will determine everything. Currently, e-commerce websites not only supply massive amounts of data to e-commerce businesses, but also provide insights data using so many analytics techniques [5].

Keywords—ecommerce data management, MySQL, NoSQL, OLTP, or online transactional processing

1. Introduction:

The two primary types of DBMSs are relational and non-relational DBMSs, commonly referred to as SQL andNoSQL, respectively.

1.1 Relational or SQL databases: An explanation of the name is that In a relational database, data is arranged into tables that are linked to one another to create a form of data repository. Foundation of these systems is Structured Query Language, which gave rise to its second term, SQL databases. It is used to interact with and maintain these databases. Data is stored in rows (also known as records) and columns (also known as attributes) using a specified schema in

RDBMSs. Since each record typically contains a value for each attribute, there are definite relationships between the various data points in this situation **Scalability**: Relational databases typically scale vertically, which means that data resides on a single server, and scaling is accomplished by enhancing the server's computing resources (CPU, GPU and RAM) power to that one server. However, there is a lot of downtime when switching from smaller to larger units. Since it calls for data format modifications and additional engineering work, horizontally scaling a SQL database over several servers can be challenging. **Performance**: On small to medium datasets, relational databases perform admirably when read/write operations are demanding. By including indexes to data fields, they also provide faster table joining and querying. However, performance may decrease as data volume and user demand increase. Security: Creating well- protected SQL databases doesn't take much engineering work because of the integrated structure and data storage mechanism. They are an excellent option for developing and maintaining complicated software solutions where every interaction might have a variety of effects. ACID compliance (Atomicity, Consistency, Integrity ,Isolation, Durability)) is one of the cornerstones of SQL[7]. If you develop applications like eCommerce or financial ones,where database integrity is crucial, ACID compliance is a recommended choice. The list of SQL databases including: MySQL MariaDB, Oracle, PostgreSQL. MSSQL

1.2 **Non- relational or NoSQL databases:** Non-tabular databases that use distinct data models for data storage, management and access are known as non-relational databases. The most common data models are--Data can be represented as a set of key-value pairs, where keys are unique strings with corresponding values for the data;can be stored in a graph, where nodes are data points and edges indicate their relationships; and data can be stored, retrieved, and managed as JSON documents.• wide-column, which allows for flexible columns that canchange from row to row inside the same table while storing data in a tabular format. These databases are knownas NoSQL since they aren't constrained by a table structure. They enable the storage of unstructured data in a variety of formats, including texts, images, videos, PDF files, and many others[7]Though not necessarily organized into rows and columns like in a relational database, data is nonetheless easy to query. **Scalability**: When the amount of data and requests rises, non-relational or NoSQL databases are often scalable horizontallyby adding more servers to the pool. They lower the request-per-second rate of each server by distributing data over numerous servers, each of which holds only a fraction of the total[7]. Non-relational databases are well known for their excellent **performance** because of their distributed design, which reduces the performance load on the system and enables numerous users to access the database at once. These databases provide limitless storage capacity for data sets of all sizes and kinds. Additionally, they are able to adjust to shifting data types. Security: Because NoSQL databases lack strong security, many infrastructures are quite concerned about them, in contrast to relational systems. While they might offer ACID assurances, they usually only apply to one database partition, even if certain DBMSs offer sophisticated security capabilities that adhere to stringent compliance and security requirements[7]. It makes sense that NoSQL databases continue to gain popularity because they enable grouping different data kinds into reservations and scalability by expanding over numerous servers. A wonderful alternative for startups using sprint-based Agile development is to create an MVP Fast, lag-free modifications to the data structure are made simpler by NoSQL since no pre-deployment preparations are necessary[7]. such NoSQL databases as: MongoDB, Redis, Cassandra, Elasticsearch, Firebase [14].

1.3

Architecture:

1) RDBMS architecture: An RDBMS is a type of database management system (DBMS) that stores data in a row-based table structure that links pertinent data items. An RDBMS provides features that maintain the data'saccuracy, consistency, reliability, and security. This is different from how a DBMS stores files. Three differenttypes of DBMS architecture exist: one, two, and three tiers. Fig1.1[9]

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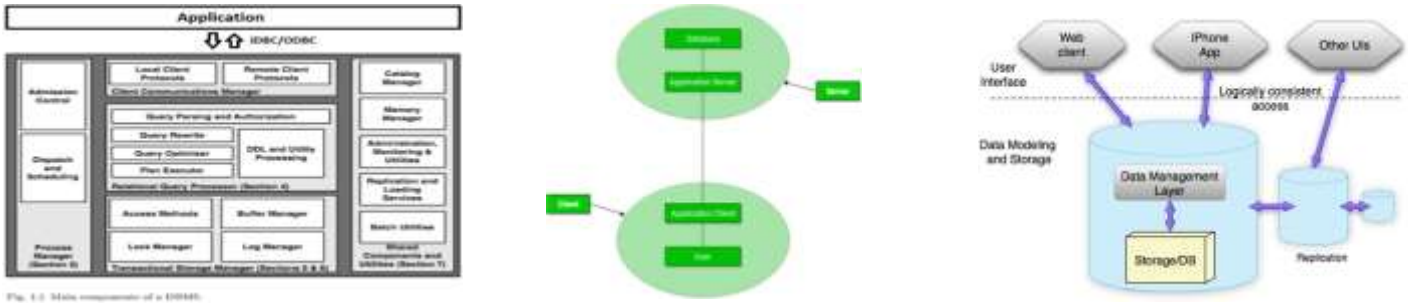

Fig1.2 3- Tier Architecture[10] 2) Architecture with NoSQL Fig 1.3[8] NoSQL Databases Enable **Horizontal Scaling (Scaling Out)** This architecture is often referred to as 'horizontal scale,' or 'scaling out' (NoSQL database horizontal scaling). Administrators can easily increase the number of nodes in a NoSQL database to increase its capacity in contemporary cloud environments. These are the four main categories of NoSQL databases: document databases, key-value stores, column-oriented databases, and graph databases. It's important to comprehend how to separate data management and data storage concerns in order to correctly construct applications using NoSQL databases. It's important to comprehend how to separate data management and data storage concerns in order to correctly construct applications using NoSQL databases..The previous era of SQL-based databases made an effort to use databases to address both issues. This is exceedingly challenging, and Programs would inevitably assume part of the responsibilities for data maintenance, carrying out some validation tasks, and incorporating modelling logic. One of the main ideas behind NoSQL is to make databases concentrate on the job of high-performance [8] scalable data storage while allowing for low-level access to a database. Data management tasks can now be easily written in the preferred programming language, as opposed to being spread among Turing-complete application languages, SQL, and occasionally even DB-specific stored procedure languages.

3Architecture with IOT :

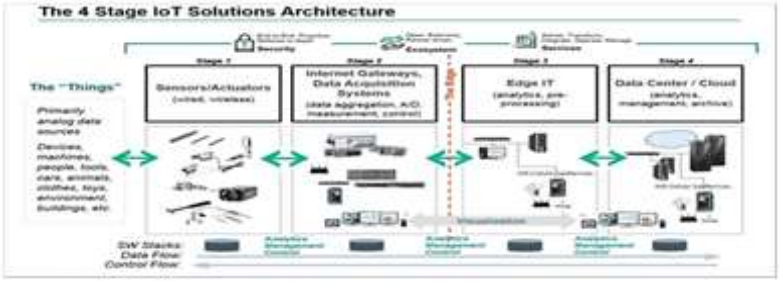

Fig 1.4[11]

To provide clients specialized services, IoT mixes corporate data and personal data. To better serve their customers, several retailers offer more specialized activities, information, and data integration for houses or specific members based on the social connections of their customers.

4. Methodology

One of the most popular languages for creating eCommerce platforms is **Python** since it can process millions of customer requests at once. With Python, there is possible both horizontal as well as vertical scaling for web and mobile eCommerce applications. Additionally, it aids in improving the website's performance and speed. **MySQL** offers the ability to scale and be adaptable enough to efficiently manage enterprises' growing data needs. It can swiftly scale to meet the growing demands, from deeply embedded applications to large-scale applications that stack terabytes of data [7].

NoSQL Databases and **MongoDB:**

One of the best NoSQL e-commerce systems, in my opinion. It is also very simple to transform queries and results into a language that your front-end code can understand because MongoDB stores

documents in a JSON-like manner. This removes , need to write object-relational mappers (ORMs).
The condensed code editor Visual Studio Code supports task execution, debugging, and version management. It seeks to give programmers the bare minimum of tools required for a short cycle of building code and debugging, leaving more complex procedures to IDEs with more functionality, like Visual Studio IDE.VS CodeOK for Python. Python is completely supported by the free source code editor Visual Studio Code, which also has practical elements like real-time collaboration. It is very adaptable to support your classroom and your preferred teaching style.
Python developers can use a variety of essential features provided by **PyCharm**, a specialist Python Integrated Development Environment (IDE). These tools work together closely to build a practical environment for productive Python, web, and other programming projects and data science development
Django, a high-level Python web framework, allows for the quick creation of trustworthy and secure websites. Django, created by seasoned programmers, handles a lot of this. Instead of having to reinvent the wheel, you can focus on creating your app by avoiding the hassles involved with web development.

4.1 Proposed System:

The Product Order Database for sellers, customers.

5. Implementation:

Project1: In this project, Ecommerce record storage, assume that you have to keep the record of the customersand Sellers along with the different products available for purchase and the orders placed by different customers. The focus of the project will be to learn data modeling and implement various functionality based on that. You will use numerous commands, knowledge about MySQL, and MySQL for database storage.. In this project, writing a Python program to implement the functionality of connecting to a database and performing the basic CRUD operations. Drawing ER diagram of the database Creating schema and tables. Use either Python program or MySQL Workbench UI. The data is stored in MongoDB. The project's main goal is to develop some data modeling skills in MongoDB and create various functions using those skills.
project 2: The Product Order Database project. The Product Order database maintains an inventory of Fridge products of various brands and models. It allows users to place orders for one or more of these items, and offersdiscounts on these purchases. four categories of information User information Product information Order information Inventory information Doing this project with NoSQL databases, the approach taken is different. NoSQL databases are generally designed to be distributed systems, with the data stored spread across multiple nodes. Also, the way the information is modeled - is designed to depend on the use case at hand. This project inthe MySQL perspective, followed the database normalization process while modeling this information, and found that splitting this information into the **Product** and **Product Details** tables, with a foreign key relationship between them, allowed us to bring it into 3NF. This was an advantage, from a data integrity perspective. In the case of MongoDB, it stores data in Object format, using the JSON notation. This allows us to store documents in a collection - with an arbitrary level of nesting of information - since information is storedand retrieved as objects. In MongoDB, in addition to nested information, it is possible to store aggregate objects (such as lists, or arrays) as well. Therefore , since a single order can contain multiple items - it is possible to store the entire information relevant to an order - as a single document. Programming MongoDB With PyMongo
.a way to create, insert information into, and access that information from a MongoDB database - using the PyMongo Python programming client. After installing the PyMongo client, can write a simple client program. Augmenting The Utility Functions :The aggregate() Function, The update() Function ,The delete single() Function ,The delete multiple() Function ,Client Code: Running Some New Queries ,Some More Read Queries
,Some Queries Involving Aggregation ,Some Queries With Indexing ,Some Update Queries ,A

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Delete Query.

6. Result Analysis:

INSERT Operation: A database table can have new rows of data added to it using the INSERT INTO Statement. The analysis reveals that MongoDB executes the INSERT operation more quickly than other databases..

DELETE Operation*:* Existing records in a table can be removed using the DELETE query. In order to prevent the deletion of all entries, we combine the DELETE query with the WHERE command. We can see that

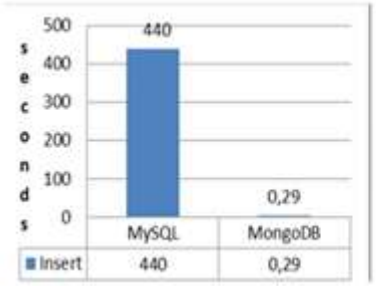


Fig 1.5 [6]

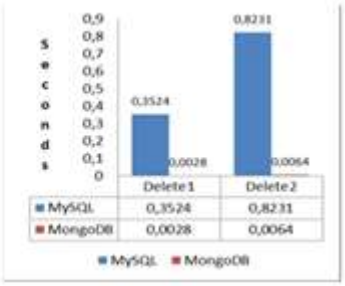


Fig 1.6[6]

MongoDB performs better than MySQL. A query that alters many records simultaneously is called an update. Since then, noted that MongoDB shows superiority. The data in Datasheet view is displayed via a database object known as a select query. This query doesn't actually store any data; it only displays the informationthat is present in the tables [6].

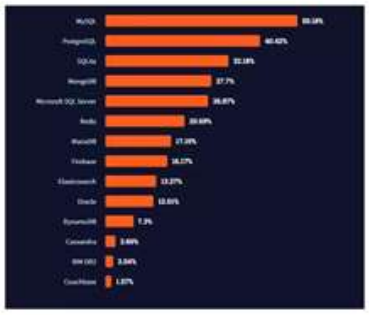
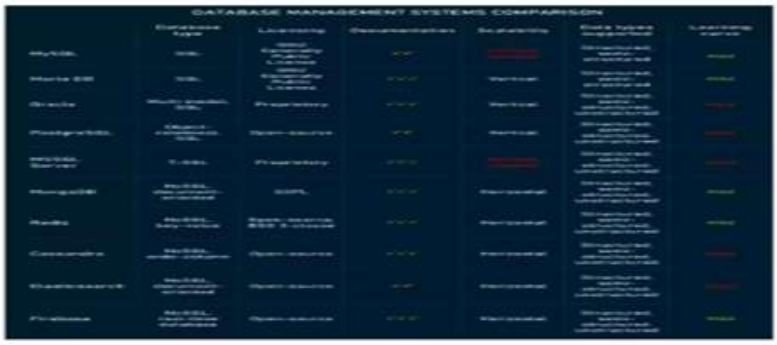


Fig 1.7[7]



Most popular database systems Fig 1.8[7]

7. Future Scope

There will be more internet retailers as entry barriers decline. Even as regions begin to reopen, ecommerce growth is still rising. In 2022, it's anticipated that global e-commerce sales would amount to $5 trillion.by 2024,plus $6 trillion. Merchants are swarming to ecommerce in previously unheard of numbers as they continue to meet online customer demand. The latest trend in the e-commerce industry is AR, Augmented reality (AR) has fundamentally altered the rules of e-commerce. Customers can actually see the goods they're buying with this type of technology,

8. Conclusion:

A database's major job in an e-commerce application is to store data that can be retrieved to keep track of transactions, find out about customers and products, and keep track of stocks. One of the primary benefits of having a database for e-commerce is the capability to arrange massive amounts of shop data.

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References:

[1] M. A. Hassan, "Relational and NoSQL Databases: The Appropriate Database Model Choice," 2021 22nd International Arab Conference on Information Technology (ACIT), Muscat, Oman, 2021,p.1-6, doi: 10.1109/ACIT53391.2021.9677042.

[2] A. Anchalia, A. Paudel, R. Sanjeetha and A. Kakati "Transforming NoSQL Database to Relational Database:An Algorithmic Approach," 2022 IEEE 3rd Global Conference for Advancement in Technology (GCAT),Bangalore, India, 2022, pp. 1-9, doi:10.1109/GCAT55367.2022.9972168.

[3] J. Li and R. Gai, "Survey of Performance Comparison Based on Non Relational Database," 2021 IEEE 23rdInt Conf on High Performance Computing & Communications; 7th Int Conf on Data Science & Systems; 2021'sHaikou, Hainan, China will host the 19th International Conference on Smart Cities and the 7th InternationalConference on Dependability in Sensor, Cloud, and Big Data Systems & Applications(HPCC/DSS/SmartCity/DependSys).2278-2282,doi:10.1109/HPCC-DSS-SmartCity- DependSys53884.2021.00342.

[4] S. Chittayasothorn, "The Misconception of Relational Database and the ACID Properties,"20228th International Conference on engineering, Applied Sciences, and Technology (ICEAST),Chiang Mai, Thailand, 2022, pp. 30-33, doi: 10.1109/ICEAST55249.2022.9826318.

[5] V. Attri and A. Kapoor, "A Relative Study on Existing Models of e-Commerce Sites Based on Analytics,"2021 10th International Conference onSystem Modeling & Advancement in ResearchTrends (SMART),MORADABAD,India2021,pp.635-639,doi:10.1109/SMART52563.2021.9676292.https://ieeexplore.ieee.org/document/9676292

[6] Disha A Nakhare and Prof Amit Hatekar, "A Comparative study of SQL Databases and NoSQL Databasesfor E- Commerce" InternationalJournal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321- 9653; IC Value: 45.98; SJ Impact Factor: 7.429,Paper Id : IJRASET39263, Volume9 Issue XII Dec2021- Available at www.ijraset.com https://www.ijraset.com/research-paper /sql-databases- and-nosql-databases-for-e-commerce

[7] Comparing Database Management Systems:MySQL, PostgreSQL, MS SQL Serve;MongoDB, Elasticsearch, and others.Last Updated:27 Oct, 2021 https://www.altexsoft.com/blog/business/comparing- database-management-systems- mysql-postgresql-mssql-server-mongodb-elasticsearch-and-others/

[8] NoSQL Architecture " sitepen"https://www.sitepen.com/blog/nosql-architecture

[9] 17-July-2022 — A relational database management system, Published inDev Genius.https://blog.devgenius.io/relational-database-management-system-rdbms-architecture-2-6a88d5c014ce

[10] DBMS Architecture 1-level, 2-Level, 3-Level 16-Sep-2022, " geeksforgeeks". https://www.geeksforgeeks.org/dbms-architecture-2-level-3-level/

[11] PaulStokes,PublishedinDataDrivenInvestor"4stagesofIOT architecture"https://medium.datadriveninvestor.com/ 4-stages-of-iot-architecture-explained-in-simple-words-b2ea8b4f777f

[12] " University of California, Santa Barbara", Yinlu Li and Corresponding author. Email: liyinlu1@gmail.com, "Marketing Strategies for Ecommerce WebsitesUnder the New Media Trend" Advances in Social Science, Education and Humanities Research,volume 631 Proceedings of the 2021 International Conference on Social Development and MediaCommunication (SDMC 2021)https://www.atlantis-press.com/article/125968490.pdf

[13] Why Ecommerce Data Management Is Crucial for Yours Online ...https://www.ingeniumweb.com/blog/post/why- ecommerce-data-management-is-crucial-for-your-online- business/4911/

[14] mongodb vs sqlite vs redis - Evo Media Lab.

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A SURVEY OF MITIGATION TECHNIQUES OF DENIAL-OF-SERVICE ATTACK ON INTERNET OF THINGS

Ruchi Chauhan, Electronics and Telecommunication, Atharva College of Engineering, Mumbai, India ruchichauhan@atharvacoe.ac.in
Shikha Malik, Electronics and Telecommunication, Atharva College of Engineering, Mumbai, India shikhamalik@atharvacoe.ac.in

***Abstract*—** IoT is a new technology which is finding its presence in many domains which includes industry, home appliances, and automobile sector etc. One of the foremost aims of IoT devices is to capture data and exchange the same seamlessly into information network. Vulnerability of IoT network to many attacks leads to major concern of security in IoT devices. One such attack is Denial of service attack which blocks the authentic user from accessing network and makes network resources unavailable for an uncertain period of time. To extenuate Dos, attack some technique is required which can sense the attack and prevent it from damaging the network. This paper aims to review different methods and techniques and suggest the use of AI, ML and trust- based mechanism to attenuate DoS attack on IoT.

Keywords— Internet of Things, Security, DoS attack, Mitigation

I. INTRODUCTION

Internet of Things (IoT) also known as Internet of Everything as it is a system of sensors embed with hardware and software enabling items to trade information with the administrator, maker, specialist co-op, as well as other associated gadgets [1]. In general IoT can be defined as the network of sensors integrated with other electronic devices which have capabilities to sense, process and communicate data with the computer to take decisions artificially with minimum human interventions. More than 100 billion devices are estimated to be connected by IoT by the year 2025 and it will be 11 trillion dollar industry. Concurrent to this rise, IoT industry is also facing many obstacles in terms of hacking of IoT devices, infiltration issues along with intrusion in privacy [2].

DOS attack causes damage to the network availability and is among one of the most severe attacks on IoT network [3]. DOS attack aims at making services or resources unavailable by flooding it with traffic from a number of systems or BOT in short span. DOS attack affects every layer in IoT stack and has critical impact on confidentiality, integrity and availability of a data as well as resources [4].

II. IOT ARCHITECTURE AND SECURITY ISSUES

A. IoT Architecture

IoT communications structure [5] as shown in below figure has four different stages consisting of sensors and smart items, clever devices and gateways, and back-end data centers and services.

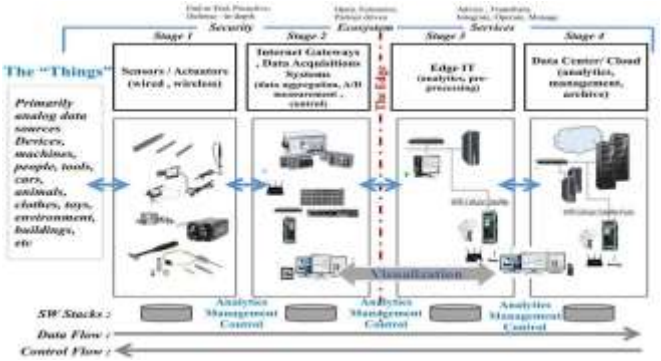

Fig 1. IoT Architecture [5]

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Stage 1. Sensors / Actuators: Sensing devices gathers data from the environment or things under measurement and convert it into some measurable data [5]. Actuators can also arbitrate to change the physical conditions that produce the data. An actuator can shut off a power supply, adjust valve of air flow, or move a robotic arm in an aggregation process.

Stage 2. The Internet Gateway: The sensors and actuators gather data is in the analog form. Further processing of the data requires it to be converted into digital streams [5]. The Internet gateway which can be border router (BR) routes these digitized data over Wi-Fi, wired LANs, or the Internet to next stage for further processing.

Stage 3. Edge IT: Digitized and aggregated data require further processing which is done by edge IT [5] systems before sending it to next stage.
Stage 4. Cloud and data center: At this stage a more in-depth processing of IoT data is carried out using robust systemswhich examine, control and firmly store the data.

A. *IoT Protocol Stack*

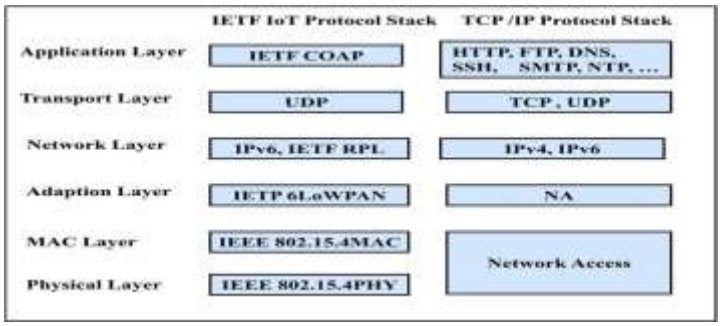

Fig.2 Protocol Stack of TCP/IP network Vs IoT Network [7]

The traditional TCP/IP network stack is heavy (requires large memory and computational power). In case of IoT devices there are various protocols available at application layer like CoAP, MQTT etc. The transport layer is occupied with Datagram Transport Layer Security which is a alternate variation of TLS made for IoT devices [7]. As IoT devices uses IPv6 addressing scheme the protocol used at the network layer is RPL Protocol based on IPv6.

B. *IoT Security Issues*

IoT devices form a network of billions of devices continuously exchanging information. The security of the network is impacted by poorly connected devices which pose a challenge to the entire Internet. This challenge is further augmented by lack of common standard and architecture for the IoT security [6]. Following are some of the main challenges in IoT

1. *Privacy Issues:* A lot of IoT nodes collect very critical and private information like name, mobile number, account number etc. This hypersensitive information is transmitted across over the net without any significant guard which is a big threat as intruder may get access to it.

2. *Inadequate authentication/authorization:* Huge number of IoT devices (web cameras, Television, door locks etc) present in the market are found not to have secure passcodes. Usually, a lot of devices uses identical passcodes which leads to an intruder getting access to all easily.

3. *Absence of transport encryption/standard:* IoT framework lacks a proper structure and there is no encryption of data in network transmission of IoT devices. Standard transport encryption systems are requirement of present time to preserve privacy of information.

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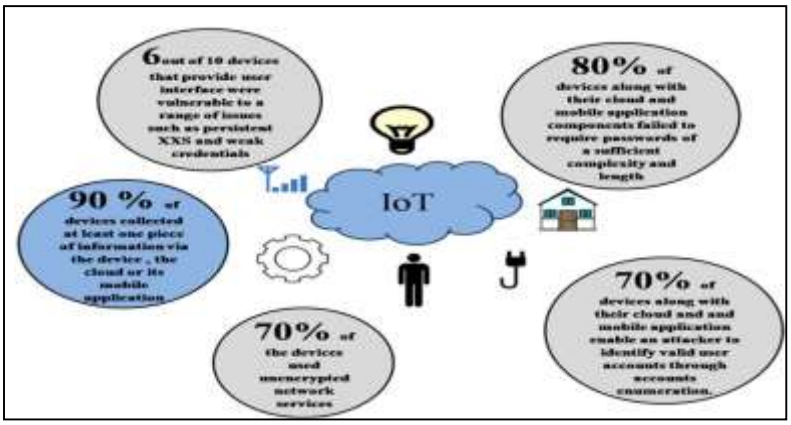

Fig. 3. Security Issues in IoT devices [6]

4. *Web interface vulnerability:* Attackers use this security gap to capture access in various network applications. Periodic cross-site design, endangered fragile sessions and substandard administration are big security problems .

5. *Software and firmware vulnerability:* Due to lack of encryption structure, 60% or more IoT devices have vulnerable software and hardware. Remote access to these devices by malicious software and firmware can happen through system updates.
Another key issue in IoT is privacy conservation of IoT devices and users which results in non-optimum utilization ofmultiple devices in IoT network.

III. DENIAL OF SERVICE (DOS) ATTACK

DOS attack prevents the legitimate user to access the information, services or resources they expect to use. This attack is done by the third-party invader aiming to make system or network unavailable to the actual user [8]. The attack is carried out by flooding the victim machine with traffic or by dispatching some information which leads to crash. DOS attack impacts all layers of IoT network. The below explained are two types of DOS attacks.

A. *Flooding attack*
B. *Crash Attack*

A. Types of Flooding Attack

1. *UDP Flood Attack*: A connectionless protocol User Datagram Protocol (UDP) is used to launch the attack. The host machine random port receives huge number of UDP packets causing the legitimate user system to continuously check forlistening port and revert with ICMP packets making target host unavailable

2. *ICMP Flood Attack:* In Internet Control Message Protocol (ICMP) flood DOS attack, the attacker delivers spoofed packets to all the targeted system in the network to take benefit of any flawed system device.

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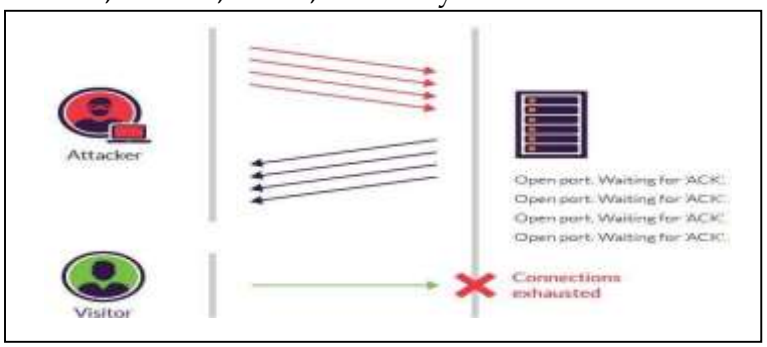

Fig 4. SYN Flood Attack [19]

3. *SYN Flood Attack:* It uses exposed and liable Transmission Control Protocol (TCP) connection three-way handshake. In this attack the intruder sends repeatedly SYN packets using Spoofed IP address to the victim machine which responds to it by sending SYN ACK to the attacker machine [19]. The intruder does not revert with SYN ACK packet and if spoofed IP address is used it never receives any acknowledge packet. But till the connection time out occur the victim machine has to keep the port open to listen and before the time out attacker send another packet as a result the service becomes unavailable.

B. Crash Attack are classified as:

1. *Smurf Attack:* System can be completely shut down in this type of attack. Intruder generates large number of ICMPpackets with victims IP address and by using an IP Broadcast Address such packets can be broadcast in the network [21].On receiving ICMP packets the network machines responds by sending response to target machine. If the devices in the network are huge and each machine is responding to target machine than the victim's system is crashed and it becomes almost impossible to work.
2. *Ping of death (POD) attack*: In this type of attack scenario a packet bigger than the maximum IP packet length is send to the victim system [20]. 65,535 bytes is the utmost length of IP packet. In usual case a large packet is broken downinto fragments and is reassembled to make the entire IP packet. But in case of POD the fragments are injected with malicious content as a result the host reassembles a packet larger than the maximum length which causes buffer overflow leading to Denial-of Service attack for authentic packet request.

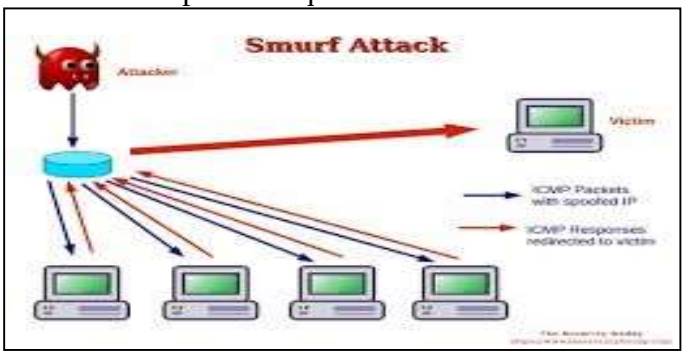

Fig. 5 Smurf Attack [21]

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Fig. 6 Ping of Death Attack [20]

IV. A REVIEW OF MITIGATION TECHNIQUES FOR DOS ATTACK

In this section, we address different mitigation technique used for DOS attack in IoT network.

The authors of [9] studied the consequences of DOS attack on Wireless and Wired LAN interface. Using Raspberry Pi Open WRT and Open v Switch authors evaluated that with the rise in DOS attack from Wired to Wired interface ping time also rises and 70% packet loss was observed with DOS on wireless interface to wired interface and conclude that severity of DOS on wired to wireless interface is most on IoT gateway.

Authors of [12] have created three test bed using data logging hardware to analyze the aftermath of DOS attack on IoT sensor node and found that DOS attack impact the availability of data of sensor node considerably and suggested the use of some IDS for prevention of DOS attack.

Santosh kumar et .al [10] proposed Topology Management Method (TMM) to mitigate DOS attack constructed on nodes behavioral examination. They also implemented Fine grained Detection Algorithm to find the deviation of node behavior from normal behavior and emphasis that deauthentication attack has low false positive rate of detection and detection of DOS attack is better than Wired IDS

The authors of [11] proposed an IDS forth with IPS based on machine learning for detecting DOS attacks which not only detects but also prevents victim from DOS attack. More than 96% accuracy and detection rate was achieved using above method.

Authors of [13] analyzed the DOS effect for UDP based DTLS and mitigated DOS attack by using HMAC –MD5 encryption and cookie interchange in DTLS handshake procedure and observed that 9% energy saving were achieved using enhanced DTLS.

Gronza et.al [14] proposed a formal method of automatic detecting DOS attack. Proposed method was able to mitigate resource exhaustion attack and allowed in depth valid protocol.

The authors of [15] propose mitigation of DOS attack in MQTT publish and subscribe architecture by CoP (control (lane) in which trusted nodes implies security policies to the gateway which in turn collects feedback from nodes and selects messages as per security policy.

Rahman et al [16] uses watermarking-based technology which used traced back method for examining the trust of incoming packets and permit only trusted nodes to communicate in the network.

Authors of [17] uses Advanced Encryption System (AES)to mitigate the security issues like CIA for IoT. Authors made alteration in the standard AES by doubling the encryption of AES and addition of white box. This white Box was used in place of S box (Substitute-Byte) in the traditional AES. The advantage of using white box is to decompose AES cipher into round functions. By doubling the AES process, it becomes difficult for the attacker to interrupt the network and is able to mitigate DOS attack.

In paper [18] authors used J48 machine learning technique to create an IDS which can detect Dos attack. 100% accuracy was achieved in detecting DOS attack with system ability to capture 75% of packets.

The authors of [19] modified and put into use three network-based mitigation strategies for TCP SYN authentication as a possible countermeasure, their modifications make it possible to deflect even more sophisticated SYN floods that are capable of evading the majority of conventional methods. This results in a delayed initial connection attempt, but there is no significant additional latency in any subsequent SYN segments (<; 0.2ms).
Based on an analysis of energy consumption, the paper [20] proposes a novel strategy for detecting cyberattacks in the Internet of Things infrastructure. The method also makes use of an analysis of the IoT software's actions in order to increase the accuracy with which cyberattacks can be detected. With a detection rate of up to 99.95 percent, the proposed method makes it possible to detect attacks like DoS/DDoS with high efficiency

TABLE I. MITIGATION TECHNIQUES FOR DOS ATTACK

Author and **Year**	**Attacks**	**Technique**	**Conclusion**
Maslina Daud et.al 2018 [9]	SYN flood attack using hping3 program	Testbed created using OpenWRT and OVS	Ping time rises with rise in DOS attack and up to 70% packet loss rate
Yungee Lee, Wangkwang Lee and Kyungback Kim, 2017 [12]	Application layer DOS	Testbed setup for IoT sensor node and attacker	Lifespan of IoT nodes reduces with DOS attack
S. Santhosh Kumar ; K. Kulothungan ,2017 [10]	Flooding attack	Topology management method and fine-grained detection algorithm	Detection Accuracy of 80% and 84% precision
Y Maleh, A Ezzati, M Belaissaoui ,2016 [13]	IP spoofing attack DOS Attack	Encryption by HMAC-MDS	Enhanced DTLS with 9% energy saving
Masudur Rahman and Wah Man, 2014[16]	SYN Flood Attack	Hardware based watermarking and filtering method	Consume less resource and provides an additional defense layer against DOS
Bogdan-Cosmin Chifor, Ion Bica, Victor-Valeriu Patrici, 2017 [15]	DOS attack on MQTT protocol	MQTT based CoP	Address DOS attack and suggested use of distributed architecture
Yasir Javed, Adnan Shahid Khan, Abdul Qahar, Johari Abdullah, 2019	Application layer DOS	Modified Advanced Encryption System	Addresses DOS attack but proposed method needs to be evaluated in real time

[17]			
Mayank Agarwal ; Santosh Biswas ; Sukumar Nandi, 2015 [11]	De- authentication DOS	Machine learning based IDS	Accuracy and detection exceed 96%
Bakhtiar, F. A., Pramukantoro, E. S., & Nihri, H. (2019) [18]	SYN Flood and UDP Flood	J48 machine learning based IDS	100% detection accuracy and 75% packet capture
Patrik Goldschmidt; Jan Kučera (2021) [19]	SYN Flood Attack	Modified versions of three network-based mitigation techniques for TCP SYN authentication	Delayed initial connection attempt, but no further latency in any subsequent SYN segments
Kira Bobrovnikova; Oleg Savenko; Sergii Lysenko; Ivan Hurman (2022) [20]	DOS /DDoS Attack	Energy Consumption Analysis	High Efficiency with 99.95 % detection

v. CONCLUSION

Denial of Service attack on IoT devices has a severe impact on availability of services and resources leading to compromise of confidentiality, integrity and availability. DOS attack is broadly classified into two categories flooding attack and crash attack. This paper emphasizes on various mitigation techniques used to address Dos attack in IoT. However, many methods are still at proof-of-concept level. The focus of research community should be on Artificial intelligence, machine learning and trust-based mechanism which should be able to quarantine IoT network from all types of DOS attack.

REFERENCES

[1] Rwan Mahmood, Tasneem Yousuf, Fadi Aloul,Imran Zualkernan, “Internet of Things(IoT) Security: Current status, Challenges and Prospective Measures”, The 10th International conference for Technology and Secured Transactions(ICITST-2015).

[2] Q.Jing, A.V.Vasilakos ,J. Wan , J. Lu and D. Qiu,”Security of the Internet of things: Prespectives and Challenges”, Wireless networks, vol. 20, no. 8 ,pp. 2481-2501,2014

[3] Qifeng Chen , Haoming Chen , Yanpu Cai , Yanqi Zhang , Xin Huang ,”Denial of Service Attack on IoT System”,2018 9th International Conference on Information Technology in Medicine and Education (ITME), 27 December 2018

[4] A. Rghiout, A. Khannous, and M. Bouhorma, “Denial-of-service attacks on 6lowpan-RPL networks: Issues and practical solutions,” Journal of Advanced Computer Science & Technology, vol. 3, no. 2, pp. 143–153, 2014..

[5] Mohammed Ali Jabraeil, Jamali,Bahareh Bahrami, Aash Heidari, Parisa Allahverdizadeh, Farhad Norouzi,” IoT Architecture”, eai/springer Innovations in communication and computing book series, June 2019

[6] S. Raza, L. Wallgren, and T. Voigt, “Real time intrusion detection in the internet of things,” Ad-Hoc Networks, vol. 11, no. 8, pp. 2661–2674, 2013

[7] Pallavi Sethi and Smruti R. Sarangi ,”Internet of Things: Architectures, Protocols, and Applications”,,Journal of Electrical and Computer Engineering , 2017,Article ID 9324035

[8] K. Munivara Prasad, A. Rama Mohan Reddy & K.Venugopal Rao,”DoS and DDoS Attacks:

Defense, Detection and Traceback Mechanisms -A Survey ,Global Journal of Computer Science and Technology: E Network, Web & Security ,Volume 14 ,Issue 7 Version 1.0 2014 (USA) ISSN: 0975-4172 & Print ISSN: 0975-4350

[9] Maslina Daud ; Rajah Rasiah ; Mary George ; David Asirvatham ; Abdul Fuad Abdul Rahman ; Azni Ab Halim,"Denial of Service (DOS): Impact on Sensors", 2018 4th International Conference on Information Management (ICIM) Oxford, UK

[10] S. Santhosh Kumar ; K. Kulothungan,"An Anomaly Behavior based Detection and Prevention of DoS Attack in IoT Environment",2017 Ninth International Conference on Advanced Computing (ICoAC)

[11] Mayank Agarwal ; Santosh Biswas ; Sukumar Nandi," Detection of De-Authentication DoS Attacks in Wi-Fi Networks: A Machine Learning Approach",2015 IEEE International Conference on Systems, Man, and Cybernetics

[12] Yungee Lee, Wangkwang Lee and Kyungback Kim," Assessing the Impact of DoS Attacks on Iot Gateway", Advanced Multimedia and Ubiquitiousb Enginering, Springer 2017

[13] Y Maleh, A Ezzati, M Belaissaoui ," DoS Attacks Analysis and Improvement in DTLS Protocol for Internet of Things", ACM International Conference on Big Data and Advanced Wireless Technologies, At Blagoevgrad, Bulgaria November, 2016

[14] Bogdan Groza Politehnica, Marius Minea," Formal Modelling and Automatic Detection of Resource Exhaustion Attacks" ASIACCS 11, March 22–24, 2011, Hong Kong, Chin

[15] Bogdan-Cosmin Chifor, Ion Bica, Victor-Valeriu Patrici," Mitigating DoS attacks in publish-subscribe IoT networks" International Conference – 9th Edition Electronics, Computers and Artificial Intelligence 29 June -01 July, 2017, Targoviste, Romania

[16] Masudur Rahman and Wah Man, "A Novel Cloud Computing Security Model to Detect and Prevent DoS and DDoS Attack" (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 5, No. 6, 2014

[17] Yasir Javed, Adnan Shahid Khan, Abdul Qahar, Johari Abdullah," Preventing DoS Attacks in IoT Using AES",Journal of Telecommunication,
Electronic and Computer Engineering, e-ISSN: 2289-8131 Vol. 9 No. 3-11

[18] Bakhtiar, F. A., Pramukantoro, E. S., & Nihri, H., "A Lightweight IDS Based on J48 Algorithm for Detecting DoS Attacks on IoT Middleware", 2019 IEEE 1st Global Conference on Life Sciences and Technologies (LifeTech). doi:10.1109/lifetech.2019.8884057

[19] Patrik Goldschmidt; Jan Kučera , " A Defense against SYN Flood DoS attack using Network Based Mitigation Techniques", 2021 IFIP/IEEE International Symposium on Integrated Network Management (IM), 17-21 May 2021. France

[20] Kira Bobrovnikova; Oleg Savenko; Sergii Lysenko; Ivan Hurman, "IoT Cyberattack Detection Approach Based on Energy Consumption Analysis",2022 12th International Conference on Dependable Systems, Services and Technologies (DESSERT), 09-11 December 2022, Greece

[21] imperva.com.'TCP SYN Flood',[Online].Available https://www.imperva.com/learn/application-security/synflood/.[Accessed: 2- March -2020]

[22] pluralsight.com,'ping of death and other DoS network attacks',2009. [Online].Available:https://www.pluralsight.com/.[Accessed:2- March -2020]

[23] thesecuritybuddy.com,'what-is-smurf-attack',2017. [Online]. Available: https://www.thesecuritybuddy.com/dos-ddosprevention/what-is-smurf- attack/. [Accessed: 2-March-2020]

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V2X SAFETY AND SECURITY ISSUES: A REVIEW

Nileema Pathak, *Computer Science and Engineering*, Sandip University, Nashik, India
nileemap@gmail.com
Dr. P.R Patil *Computer Science and Engineering* Sandip University Nashik, India
purushottam.patil@sandipuniversity.edu.in

Abstract— Vehicle to Everything (V2X) is a communication system used in a Vehicular Adhoc Networks that supports the exchange of information from a vehicle to moving components of the traffic system that might impact the vehicle. Technologies such as the Machine Learning, Internet of Things (IoT), 5G, cloud computing, have enhanced the digital capabilities of V2X technology. However, along with communication performance improvement there is increase in security and privacy issues. A trust value has to be calculated to mitigate the uncertainties and risk caused by unreliable information in vehicular environments. In this paper, a fuzzy trust model based on various vehicular parameters is proposed to secure the vehicular network.

Keywords— MDS, V2X, BSM, C-ITS

I. INTRODUCTION

The V2X technology is evolving at a very fast pace. It will transform the mobility ecosystem and the way drivers interact with their surrounding environment. The transportation systems are expected to provide low latency and reliable information flow between various entities involved in the traffic network. V2X communication involves various entities as shown in figure 1. In a Cooperative Intelligent Transportation Systems (C-ITS) these entities, connected vehicles and infrastructure collaboratively interact using specific message formats. Safety messages for V2X communications follow the BSM (Basic Safety Message) standard as stated by the international standards for vehicle communication [1]

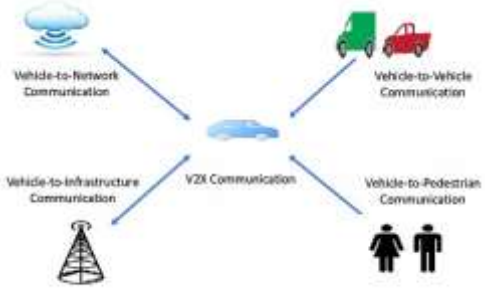

Fig.1 V2X System

As the BSM are constantly broadcasting data such as vehicle speed and location, this raises a threat about how to address privacy and data protection. In this paper the security architecture for handling the misbehaving vehicles in VANET, is discussed.

Vehicles in V2X can face security threats either from external intrusion or internal misbehaviour. Intrusion threats can be caused due to DOS attack, jamming attack, Sybil attack, and Wormhole attacks to name a few [2].
Whereas misbehaviour attacks are initiated from within of the network by capturing a legitimate vehicle and tampering its BSM to share misleading information among the neighbouring vehicles.

Such false information misguides the vehicles who receive the tampered BSM. This can cause dangerous hazards which may impact the traffic flow and also threaten the life of drivers. Therefore, protecting the safety messages from the misbehaving attackers is a very crucial activity to protect the V2X system from road traffic hazards.

Security systems can be classified broadly as proactive and reactive. Proactive security is basically an Intruder Detection system that prevents external attackers to access the system. Public Key Infrastructure (PKI) and certificates issued by authorized entities can be used for providing proactive security. Reactive security is a provision to identify malicious activities within the system, deliberately done by internal attackers. Reactive security systems use mechanisms that analyse system behaviour or state to detect attacks and failures.

II. Misbehavior Detection System

Basic safety message (BSM) are a packet of data generated by a node in a network. BSM packet is made up of information about vehicle status (position, velocity, size etc), timestamp, pseudonym, signature. These messages can be a means of attack and misbehaviour in the system. Misbehaviour Detection System (MDS) as a reactive security measure is required to detect misbehaviour and take action against it.

Misbehaviour in the system can be detected and analysed based on two approaches, namely:

- Entity centric misbehaviour
- Data centric misbehaviour

III. Entity-centric Misbehaviour Detection

Entity or Node misbehaviour detection involves behavioural and trust based detection. The main aim of these mechanisms is to find the trustworthiness of a vehicle or node in a VANET system [4].

Behaviour detection: Behavioural patterns of misbehaving nodes are analysed at protocol level. It also analyses the number of messages transmitted by a node in a particular time duration, or correctness of their format. It does not consider the data semantics.

Trust-based detection: The Trust-based mechanism requires collaborating with infrastructure to find the reputation of the nodes. It works on a recommendation system to find the correctness of information.

IV. Data-centric Misbehaviour Detection

Data-centric misbehavior detection analyses safety messages to verify trustworthiness of packets. It mainly checks for two characteristics in the data, namely plausibility and consistency.

Plausibility based detection is done to check whether the content of a received message is acceptable or not [4].
For example, plausibility of message travelling from one node to another can be verified using two subsequent basic safety messages. The time required and distance travelled is compared with the speed with which the message reaches the destination.

Consistency of information is checked on time series basis for a single packet. Also the consistency of the same data from multiple sources is also checked to determine the trustworthiness of received data. For example, a consistency check can be done to compare the vehicle speed mentioned in newly received message, with the previously calculated average speed of the vehicles that is being

analysed. Deviation from the average value are considered as inconsistent information and can thus be considered suspicious.

V. Misbehaviour Architecture

The misbehaviour detection system can use the local data stored in individual vehicles as well as the data that is stored on the cloud system. The misbehaviour architecture consists of Onboard units (OBU) in individual vehicles, Road side units (RSU) which serves specific area in the VANET environment and the cloud infrastructure that collects information like the vehicle ID, pseudonym of the vehicle, position time series data about all the individual vehicles [2].

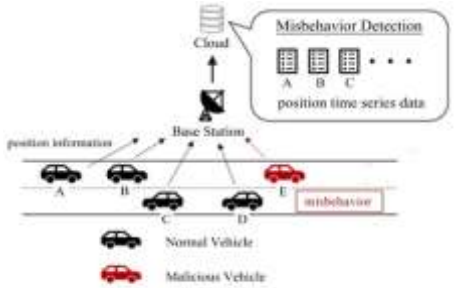

Fig.2 Misbehavior Architecture

Once the misbehaving nodes are detected, the details are stored on the global system. Trustworthiness is based on two types of trusts namely direct trust and indirect trust [6].

Direct trust refers to the trust value associated by between two nodes. It can be calculated based on previous mutual experience between the pair of nodes.
For example node A checks the location parameter of node B for the newly received packet and compares it with a recently received packet from node B to check its validity.

Indirect trust is trust obtained from other source or neighbouring vehicles. Once a trust relation is established between two nodes, the nodes can recommend each other to other nodes in the network. For example, when node A communicates with node B, there is a direct trust between node B and node A, but Node B can also communicate with neighbouring nodes like nodes C and D and ask for their recommendation about node A. Finally, the indirect trust value is collected from all nearby neighbours and an average trust value is calculated. The indirect trust has less weightage as compared to direct trust value [5].

VI. Fuzzy Trust Model

Since there is uncertainty in finding the trustworthiness of a node in a VANET system, Fuzzy logic can be an appropriate approach to identify the discrepancies in the network.
Fuzzy Logic can be used in decision making or classification of the input into fixed output classes, when the input is in a fuzzy state or a grey less state in between 0 and 1 logic.
Fuzzy Logic can be applied in two phases:

- First phase, the node centric method, node authentication is done to check the validity of the node. The invalid nodes are identified as outsiders and are filtered out.
- Second phase, the plausibility and consistency verification, the time stamp of the message is checked. If the received message time is in the acceptable threshold range, it is processed further. Then location accuracy and speed consistency is also checked.

Trust establishment model involves:

- the direct trust establishment wherein every node is responsible to maintain its past experience with the neighbours
- the indirect trust establishment where trust is calculated based on recommendation and collaboration with other nodes and infrastructure
- the above information is used for trust evaluation process through fuzzy logic [7].

Table 1. Fuzzy Logic

Node ID	**Direct Trust**	**Indirect Trust**	**Final Trust**
Node A Node B Node C	1. Static Node centric information verification based on protocol. 2. Local Plausibility, consistency check within trustee and trustor nodes.	1. Behaviour and trust between multiple neighbouring nodes and RSU / Cloud (Recommendation or Reputation system) 2. Plausibility and consistency check in Collaboration with other nodes.	Fuzzy logic applied to direct and Indirect trust weights

A rule base is created to classify the input fuzzy levels to two categories of output namely Trusted node and Not Trusted node. The raw inputs of direct and indirect trust weights are converted into fuzzy sets using the fuzzfier. The fuzzifier output is fed to the inference engine which uses the rule base to classify the input. Finally the defuzzifier converts the fuzzy set obtained from inference engine to a fixed logic.

VII. CONCLUSION

Trust management solutions should be able to identify trustworthy vehicles or messages from untrustworthy once. This is a challenge in ad-hoc networks due to uncertainties in the network. In this paper, we have discussed various threats that contribute to the trust weight calculation and the trust model establishment in VANET. A Fuzzy logic based approach using direct and indirect trust management is proposed. Major challenge in establishing trust is deciding the appropriate trust threshold. False positive and false negative alarms need to be avoided in future work related to misbehaviour detection.

REFERENCES

[1] Sultan Ahmed Almalki & Jia Song "A Review on Data Falsification-Based attacks In Cooperative Intelligent Transportation Systems" International Journal of Computer Science and Security (IJCSS), Volume (14) : Issue (2) : 2020

[2] Jyoti Grover, Manoj Singh Gaur, Vijay Laxmi "Trust Establishment Techniques in VANET" Springer-Verlag Berlin Heidelberg 2013 DOI: 10.1007/978-3-642-36169-2_8

[3] Rens W. van der Heijden, Stefan Dietzel, Tim Leinm¨uller, Frank Kargl "Survey on Misbehavior Detection in Cooperative Intelligent Transportation Systems" IEEE Communications Surveys & Tutorials · October 2016, DOI: 10.1109/COMST.2018.2873088

[4] Xiaoya Xu , Yunpeng Wang and Pengcheng Wang "Comprehensive Review on Misbehavior Detection for Vehicular Ad Hoc Networks" Hindawi Journal of Advanced Transportation Volume 2022, https://doi.org/10.1155/2022/4725805

[5] Kealan Mannix, Aengus Gorey, Donna O'Shea and Thomas Newe "Sensor Network Environments: A Review of the Attacks and Trust Management Models for Securing Them" Journal of Sensor and Actuator Networks https://doi.org/10.3390/jsan11030043

[6] Toshiki Okamura, Kenya Sato "Misbehavior Detection Method by Time Series Change of Vehicle Position in Vehicle-to-Everything Communication" Journal of Transportation Technologies, April 2021, https://doi.org/10.4236/jtts.2021.112018

[7] Rasheed Hussain , Jooyoung Lee, and Sherali Zeadally "Trust in VANET: A Survey of Current Solutions and Future Research Opportunities"
IEEETransactions on Intelligent Transport Systems IEEE 2020 Digital Object Identifier 10.1109/TITS.2020.2973715

[8] Sohan Gyawali, Yi Qian, and Rose Qingyang Hu "A Privacy-Preserving Misbehavior Detection System in Vehicular Communication Networks" IEEE Transactions on Vehicular Technology : DOI 10.1109/TVT.2021.3079385

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SAFETY MONITORING ROBOT FOR COAL MINE

Manthan Amolchandra Raut, **Yogita Mahesh Madhav**, **Akshat Kaklotar**, **Pratik Sahebrao Nipane**
Student, Department of Electronics And Telecommunicaion, Atharva College Of Engineering, Malad
Project Guide: **Trisha Ghosh** *Professor, Department of Electronics And Telecommunicaion Atharva College Of Engineering, Malad*

Abstract— Coaling, the most important and abundant fossil fuel, has been used for centuries. Extracting coal from the coal mine is a complicated and risky process. Safely safeguarding a person's safety has been a primary concern in the underground coal mining industry. Ensuring the safety of miners has been a major challenge. Mining has posed a threat to miners' health and life due to its hazardous working environment and long-term effects. Due to the hazardous and damaging gases emitted by mining operations, the connected workers now face a survival threat. Placing significant pressure on the mining sector. To deal with these problems we have developed a safety monitoring robot for coal mine with wireless video streaming in the area which is hard to reach or hazardous areas.

Keywords — IoT, ESP32-CAM, NODEMCU ESP8266, MQ9 Gas sensor, dht11 sensor, Coal Mine.

I. INTRODUCTION

Coal is the most major and accessible fossil fuel in India, meeting 55% of the nation's energy demands and laying the groundwork for a long history of industrial development. Over the preceding 40 years, India's main energy consumption has climbed by over 700%. India now uses much less commercial primary energy per person annually than wealthy countries, at about 350 kgs. As a result of the nation's developing economy, expanding population, and desire for a higher quality of life, it is projected that India's energy consumption will increase. Due to the low reserve potential of petroleum and natural gas, environmental limits on hydroelectric projects, and the geopolitical context, coal will continue to play a significant part in India's energy picture.

For the upcoming century and beyond, Indian coal offers a distinctive environmentally favourable fuel source to the domestic energy sector. The majority of the country's hard coal deposits, which are dispersed throughout 27 major coalfields, are located in the east and south-central regions. (See Reserves of Coal.) The world's lignite deposits are estimated to be 36 billion tonnes, 90% of which are found in Tamil Nadu, a state in the south.

One of the most important factors in relation to industries, especially the mining industry, is safety. Human safety is the most crucial item to consider in underground coal mining. All mining industries adhere to a few fundamental precautions and guidelines in order to prevent any undesirable events. With several criteria being watched and required steps being made to avert hazards, communication is essential in every company nowadays. The primary goal of the project is to develop a wireless robotic system for industrial security applications that is both affordable and capable of wireless video streaming in dangerous or difficult-to-reach locations, thus replacing humans at these locations.

A robot is designed and constructed here to move into different locations and receive the details of that area with the help of inbuilt sensors on it. The sensors on it can detect gas like methane, smoke. The robot also detects the temperature and humidity. The robot operates in accordance with the program's instructions. It will be able to travel in all directions, including forward, backward, right, and left. The robot will transmit real-time streaming that can be viewed on a monitor or mobile device via a wireless Wi-Fi connection, meaning that one can control the robot using a mobile device or laptop via the Internet of Things (IoT), and all sensor data and alert notifications are always displayed on the Blynk app.

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II. LITERATURE SURVEY

Since George Devol developed the first robot in 1954, robotics has rapidly evolved in many fields. There are vast applications of robots in industrial and military work hence reducing manpower with the help of IOT and AI. In recent years robotics is also applied in security purpose or as surveillance robot in industries and military applications.

In paper [1] Proposed a study that uses sensors to measure gas concentrations, temperature and butane levels. The project's goal is to develop a Wi-Fi network between the Android phone and Raspberry Pi and a robot that can be controlled by an Android phone.

A wireless sensor network (WSN) based on ZigBee exploitation for mine environment observation system is proposed in this [2] paper. In this paper work, they demonstrate how to use humidity sensing equipment to measure the mine's humidity and carbon monoxide gas sensing equipment to measure the mine's temperature. Providing miners with an ID card for adequate mining security. To prompt the urgent emergency services to deliver the message to the fire and medical departments by connecting GSM to the server.

In paper [3] with the following sensors: tilt sensor ADXL335, gas sensor MQ2, temperature and humidity sensor DHT11. The receiver portion, located in the control room, will receive sensor data thanks to the presence of a zig bee module. The standalone wireless audio and video camera transmitter is placed on the robot. And keypad control for robots.

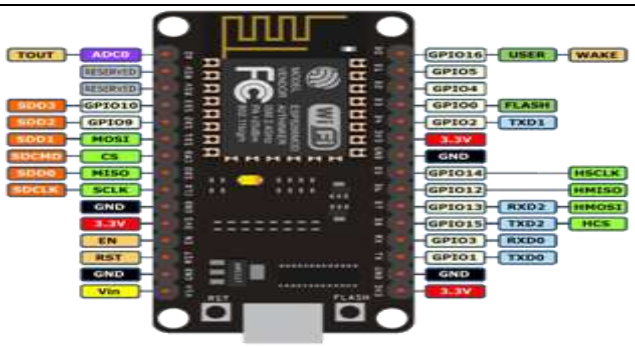
In paper [4] describes that it is dangerous for rescuers to enter mines without first familiarising themselves with the surroundings. Because an explosion might happen. Landslide, gas leak, high temperature, and other factors might all cause an explosion. A robot has been created to detect explosions caused by hazardous gas and high temperatures. The wireless camera on this robot is there for surveillance.

In paper [5] results obtained using a temperature sensor LM35 and the MQ 135 are presented. Wireless sensor network (WSN) based on Zig Bee. Robot enters coal mine, moves around, detects dangerous gas, offers protection from fire and explosion, warns underground dwellers of poisonous gases like CO, CO2, and CH4, and provides safety.

The paper evaluated the performance of wireless sensor network for underground mine's safety monitoring system based on Bluetooth technology. The system consists of MQ-4 is used for detecting hazardous gas and PIR is used for detecting obstacles. And wireless camera is used for live broadcasting [6].

III. NECESSARY REQUIREMENT OF THE PROPOSED SYSTEM

Table 1: Necessary Requirement of the Proposed System

Sr. No.	Components	Description	Structure
1	NODEMCU ESP8266	NodeMCU 8266 is a development board that supports various applications and is versatile enough to support programming languages. Hardware is based on the ESP-12 module with 128kb ram and 4Mb flash memory, and firmware is running on the ESP8266 Wi-Fi SoC from Espressif Systems.	 Fig.1: NODEMCU ESP8266

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2	MQ9 Gas sensor	It is used to detect the presence of LPG, methane, Butane, Smoke, and flammable gases etc.	 Fig.2: MQ9 Gas sensor
3	Dht11 sensor	The Dht11 sensor is temperature and humidity sensor.	 Fig.3:Dht11 sensor
4	Esp32 CAM	ESP32 Cam can be used for surveillance as it supports OV2640 and OV7670 cameras with built-in flash. It also supports uploading over Wi-Fi.	 Fig.4: Esp32 CAM
5	L2982A motor driver	It serves as a motor driver module for DC and stepper motors. It can be used to speed- and direction-control 4 DC motors or 2 motors.	 Fig.5: L2982A motor driver
6	4X Gear motor	The motor has four gears. A gear motor is a part whose mechanism varies the motor's speed, causing it to run at a particular speed.	 Fig.6: 4X Gear motor

IV. STRUCTURE OF THE PROPOSED SYSTEM

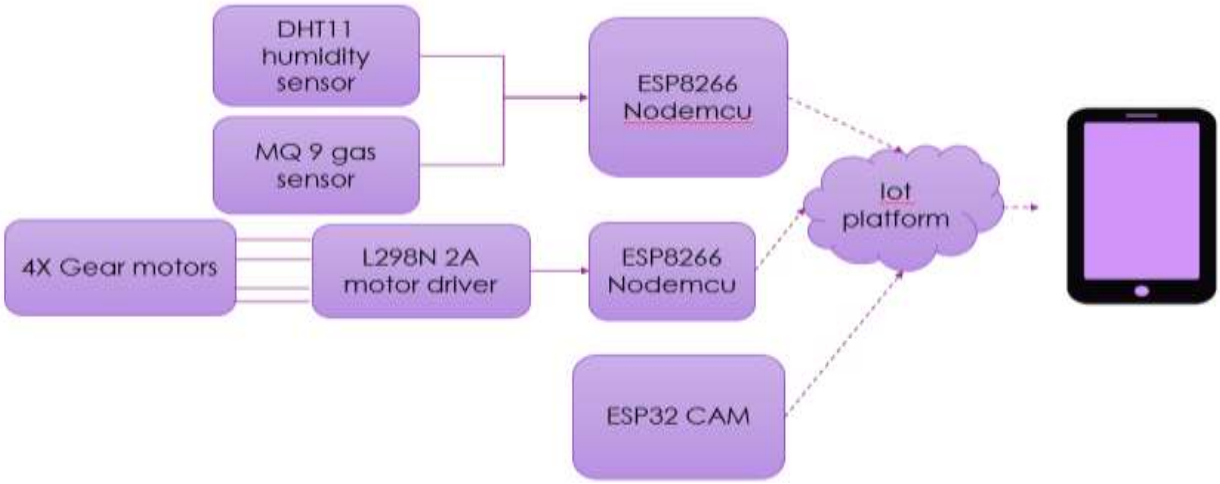

Fig 8. Block Diagram

Fig.8 represents the block diagram of the proposed system. In these system, each sensor will perform their respective working at a time. We use MQ9 gas sensor to measure flammable gases. The Dht11 sensor is temperature and humidity sensor. When system is start first it is connected with wifi if it is not connected with wifi it is not start after wifi connection sensor start their working and all these sensor data goes to the

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Nodemcu ESP8266. Nodemcu ESP8266 module process the code. We write blynk app auth token in code. Using blynk app auth token it connect to blynk server And display on android using blynk app. Blynk is an IoT platform for iOS or Android phones that allows users to remotely control devices like Arduino, Raspberry Pi, and NodeMCU. And we also add one feature is alert Notification. In this feature if dht11 sensor temperature is high and humility is low then alert message is send. That means if temperature is above 37°C and humidity is below 50% then alert Notification send on blynk app. Same as mq9 sensor if detecting range is above 400ppm then flammable gas is there and alert Notification send on blynk.

We have used 4 gear motor and it is been controlled by the L296N 2A motor driver which takes input from the esp8266 node mcu module. The node mcu is connected to the mobile via wifi and the commands to run the robotic car is given by a mobile application.

We have also used an Esp32 CAM module, so that the operator can detect the obstacles by seeing the live broadcasting on the mobile screen, while the robotic car is in the coal mine.

For programming us use Arduino Ide is a cross-platform programme that uses C and C++ functions. With the aid of third-party cores, it may also be used to create and upload applications to other vendor development boards that are compatible with Arduino.

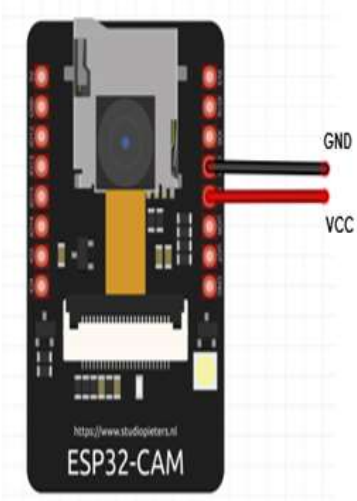

Fig 9. ESP CAM circuit diagram

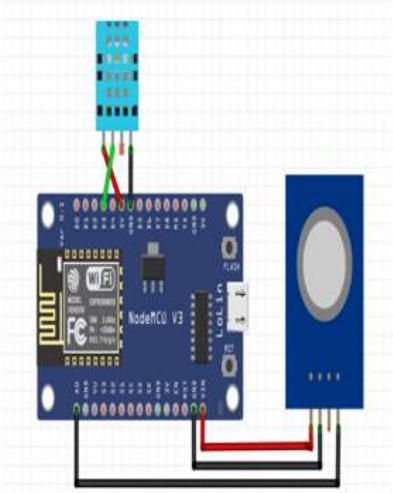

Fig 10. Circuit Diagram of sensor part

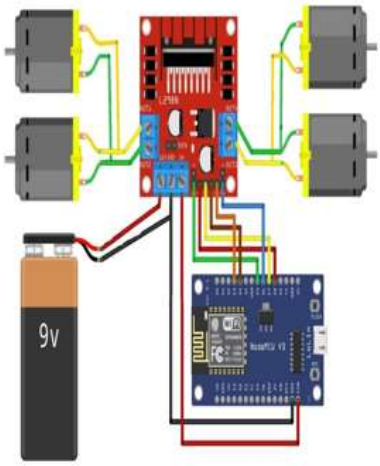

Fig 11. Circuit Diagram of Remote control car

Fig. 9 represent the ESP CAM circuit diagram after upload program. ESP CAM VCC pin is connected to 5volt battery and gnd pin is connected to ground of battery. For program uploading on esp cam we need to connect FTDI cable to TTL and using Arduino ide we upload the code.

Fig. 10 represent the circuit diagram of sensor part. To sensor are connected. First is dht11 sensor. It is operate on 3.3 volt dc. Dht11 sensor data pin is connected to D3 pin of esp8266. And second is mq9 gas sensor. It is operates on 5 volt dc. Gas sensor analog pin is connected to A0 pin of esp8266.

Fig. 11 represent the circuit diagram of remote control car. 4x gear motor is connected to L2982A motor driver. L2982A Motor Driver input and Enable pins is connected to digital pins of esp8266.

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V. RESULT.

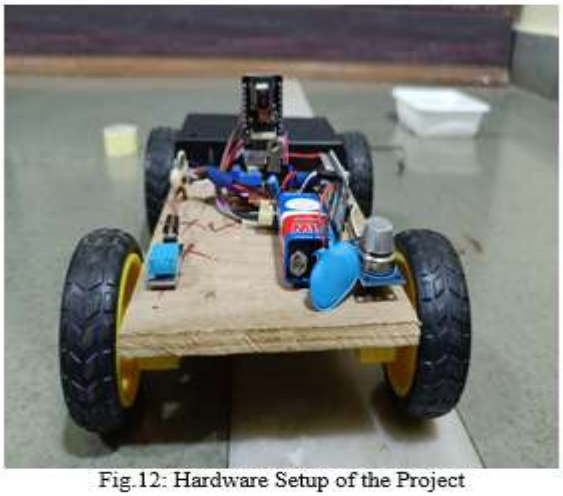

Fig.12: Hardware Setup of the Project

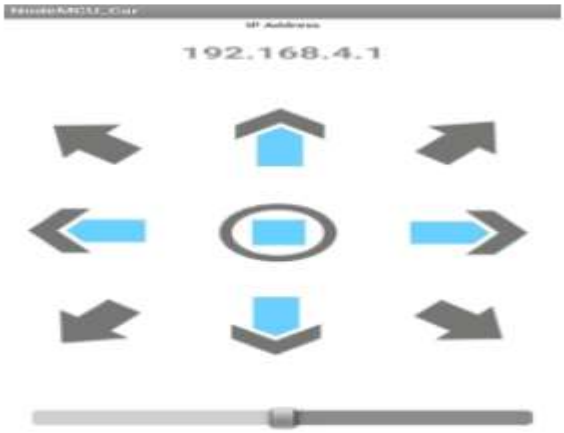

Fig.13: Motor Control Web App

Fig.12 represent the he hardware setup of the project and Fig. 13 is the motor control web app. This app is designed to make it simple for you to construct a straightforward Wifi robot automobile. In addition to allowing you to transfer Arduino sketch/code straight from your Android phone to ESP8266 through USB OTG or Wifi OTA, the software also allows you to drive an ESP8266-based robot vehicle over WiFi. Using this app car move right, left ad other direction as per the instructions.

Fig.14: Sensor Data Displayed

Fig.15: If Flammable Gas is there the Notification Send

Fig.14 represent the sensor data displayed such as temperature is 28.20°C, humidity is 61.0% and flammable gas value is 253ppm. Using the value we know which gas is there like if detecting value range is between 20ppm-2000 then carbon monoxide is there and range vale 500ppm-10000ppm then CH4, LPG gas is there. Fig. 15 represent the alert Notification of flammable gas. In this figure flammable gas is detecting using mq 9 gas detector. This sensor value is goes to above 400pp. That's why alert Notification pop up screen is displayed.

Fig.16: Live Broadcasting

Fig.15 represent the live broadcasting. We have used a web server to display the camera live footage. A particular ip address is assigned by the stm32 cam module which is pasted in the google chrome/browser and we get to the live footage from the camera via the wifi connection.

VI. FUTURESCOPE

- The current project can be further modified by installing fire extinguisher.
- In this project in future we can further implement a system using GPS model to know about location of coal miners.
-

VII. CONCLUSION

The main objective of this Safety Monitoring Robot for Coal Mine is to make it more innovative, user friendly, time saving and more efficient. Measuring three parameters such as gas, temperature, humidity and the system also notify flammable gas, high temperature. It can successfully replace the wired communication between the control room and the mine area by connecting both the mediums wirelessly. It can be assembled within a few minutes and can be brought under application very quickly.

VIII.REFERENCES

[1] Jayant Nivritti Patil, "Advanced Rescue And Monitoring Robot For Coal Mine" presented at International Research Journal of Engineering and Technology (IRJET). Volume: 04 Issue: 07 July 2017.

[2] Madhu Nakirekanti, Dr.Raja Murali Prasad, Eliyaz Mahammad, K.Narsimha Reddy, "Coal Mining Safety Monitoring System" presented at IInternational Journal of Mechanical Engineering and Technology (IJMET) Volume 8, Issue 12, December 2017.

[3] Sachin M. Ledange , S. S. Mathurkar, "Robot based Wireless Monitoring and Safety System for Underground Coal Mines using ZigBee" presented at SSRG International Journal of Electronics and Communication Engineering (SSRG – IJECE) – Volume 3 Issue 10 – October 2016.

[4] T.S. Kumar Reddy; G. Balasiva Krishna; "Hazardous gas detecting rescue robot in coal mines", International Journal of Mechanical and Production Engineering, ISSN:2320-2092, volume2, Issue-5, May-2014.

[5] S. D. Mitragotri , Dr.A. R. Karwankar; "Coal Mine Robot for Detection of Hazardous Gas", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, ISSN : 2278 – 8875, Vol. 5, Issue 4, April 2016.

[6] Deepan A, Jayakrishna S V, Nagha abirami S S , Vanmathi M E , Andril Alagusabai; "Detection of Hazardous gas using Land Rover Robot in Mines First", International Research Journal of Engineering and Technology (IRJET), ISSN: 2395-0072, Volume: 05, Issue: 04, Apr-2018

[7] P. Mansi and L. P. Pratap, "Advancement of a wall climbing robot for various applications," International Journal of Engineering & Technology, vol. 5, pp. 9–11, 2016.

[8] Pritesh Chaudhari, Manas A Dani, Mansi Mhalsakant Gajare, Payal D Deshmukh, "Mine Safety Robot" presented at Conference December 2019.

[9] Marco Schwartz, Discover the aREST Framework: Easily control your Arduino, Raspberry Pi & ESP8266 Projects, 2016

[10] W. Qiao, "Analysis and measurement of multifactor risk in underground coal mine accidents based on coupling theory," Reliability Engineering and System Safety, vol. 208, 2012.

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MAPPING OF KINETIC AND POTENTIAL ENERGIES FOR DIFFERENT RENEWABLE SOURCES

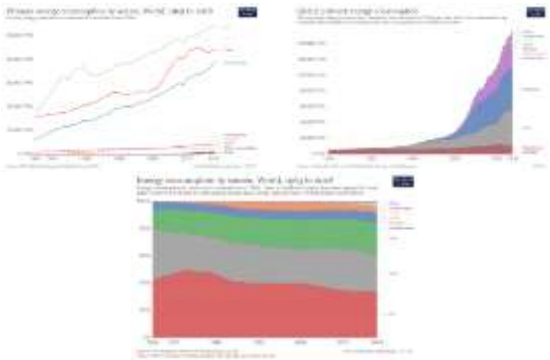
Kshipra R. Pandey Department Of Electrical Engineering Atharva College of Engineering, Mumbai, India kshiprarpandey@gmail.com

Abstract **—** Energy resources, prominently, are non-renewable worldwide and power system managers all over the globe are concerned in this matter. Urbanization and the population explosion have added to the woes of Power System Stake holders. Savior in this regard could be Renewable sources and its rampant usage. Kinetic energy can be a major source of energy if harnessed in a efficient manner. The same thing can be said about potential energy too. In this paper, kinetic and potential energies associated with various renewable sources are discussed**.**

Index terms**—**Potential energy, Kinetic energy, Current Electricity, Static Electricity, Renewable, Solar, Wind, Hydro

I. INTRODUCTION

The transformation of the world to a global home is rapid on the virtue of ever rising demand of energy. The world has seen a boom in the consumption of energy in its various forms to satisfy social and economical development needs of humans. The rise in the demand has led to the several harsh implications on the sustenance of the world environment and hence a different approach has to be adopted on the larger scale to fulfill the energy demands as well as mitigate the climatic adversities. In particular, the catastrophe of Fukushima Daiichi was a threshold in the call for alternative energy sources. Non conventional sources are now considered more reliable and desirable sources of fuel due to the least probabilities of disasters. The following graphs show the comparative rise in the non conventional technologies and the decline in the conventional ones. [2] [3]



Comparison of Utilization of Energy resources across the globe over the time [9]

TABLE I. COMPARISON OF THE RESOURCES [1]

Comparison on several aspects	***Conventional Resources***	***Non - conventional Resources***
Availability	Limited reserves	Abundant in nature
Carbon footprint	Extreme	Zero emission
Environmental implications	Harmful repurcussions	No apparent adversities on the environment
Distribution	Unevenly distributed	Mostly evenly distributed
Transportation	Has to be transported from its extraction source to the processing facility.	Used at the place itself where it is available.

Regeneration	Once drained, then takes billions of years to regenerate.	Regenerates at an extreme rate and hence is inexhaustible.

A. Physics of energy: According to Newtonian mechanics for translational motion, the energy which is present in the object with the mass by rectitude of the motion of the possible mass is known by the term defined by kinetic energy. Also presence of energy which is possessed by the object with mass on the rectitude which is present because of its position (height from a reference point or a surface) is known as potential energy. The general equation to describe the KE or the kinetic energy of an object with the presence effect of mass m and which is moving with a velocity vis K.E. = $\frac{1}{2}mv^2$ and if object is placed at a height which is 'h' from a given reference point then its potential energy is given by P.E. = mgh, where g is acceleration present due to gravity (g = 9.8 $\frac{m}{s^2}$). When the case is for the rigid body performing rotational motion, the mechanics is changed up to an extent, although the form of dynamics remains the same. Considering both the physical quantities, the kinetic energy falls in the category of scalar quantities and can be described for electric current, light, and projectiles. Whereas the potential energy is a vector quantity as it is the energy possessed by an object in a force field of any type as gravitational force field, electric force field, magnetic force field etc. In a nutshell, kinetic energy is doing work and the potential energy is the work which has been done. Now considering electric charge, electric current is the movement (motion) of free electrons and hence electrons have kinetic energy. Although the energy per electron is microscopically small. Also, when the charge is in stationary state (Static Electricity), the energy they possess is potential energy. When the charges of both the polarities are accumulated on the electrodes separated a small distance, the difference in the potential energies of both the electrodes is known as potential difference. When both the electrodes are connected across an electrical circuit, the electrons start drifting through the metal circuit at the drift velocity of about 1 mm per minute and hence they possess kinetic energy then. In different words, the difference between the total energy and the potential energy is kinetic energy. Kinetic energy can never be fully known as it is the work in progress. The movement of charged particles through a conductor is called Current Electricity. Current electricity is a form of Kinetic Energy. The extent of the work to be done and the amount of the total work done entirely depends upon the amount of charge stored on the electrodes. Building up of the adequate charge causes the electrical energy to be discharged in the form of a spark, or it may be in the form of a lightening which has electrical kinetic energy. The presence of the electrica energy goes to travel as waveforms in the medium. These waves are comprised of both kinetic and potential energy moving back and forth in the medium such as transmission lines. The waves can also be considered as a long cascade of swinging pendulums continuously transferring kinetic energy to potential energy and vice versa. Power plants produce kinetic energy by a number of means, mostly in the form of alternating current.

II. Potential Energy and Kinetic Energy in Hydro Power

Availability of water source for the generation of Hydro Electricity is easily accountable as compared to Wind or Solar Energy. The water in the reservoir of the Hydro Power dam is source of the stored potential energy. When water from the reservoir is freed to flow down through the penstock towards the turbine, potential energy is converted to kinetic energy. Turbine in the HE power plant converts kinetic energy of the flowing-falling water into the electrical energy by spinning the alternator connected to it. The entire process follows as this: The running water rushes across turbine and hits the blades of it and consequently spinning the turbine. This converts KE of the running water to the mechanical energy of the spinning wheel. Only a partial amount of running water can be utilized for the generation of Electricity and a huge amount of the energy is released wasted as the water falls. This is noteworthy that higher the altitude of the water reservoir higher will be the potential energy stored in it because of the gravitational force and the altitude velocity of the flowing water is also very much dependent on the mass of the stored water of the reservoir.

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III. MEASUREMENT OF HYDRO ENERGIES

For the measurement of the Hydro Energies, the following parameters are measured:

1. The Electrical Potential Energy

Amount/Voltage of electrical PE or the potential energy is measured at varied heights and with discrete velocities of water, non identical or disparate blade sizes, and the incompatible and inconsistent sized water streams are considered.

2. Power from Dams (Potential Energy)

As mentioned the hydroelectric dam has a reservoir with a massive amount of water stored in it. Therefore the available or stored energy depends on potential head of water which is above the turbine and also the volume of the water falling upon the turbine. In the hydroelectric plants the turbines are generally of reaction type with their blades entirely submerged in the flow of water. Dam reservoir on the other hand provides the facility to control the water flow volume and hence the output of the generator can be controlled.

IV. AVAILABLE POWER (DUE TO POTENTIAL ENERGY OF THE STORED WATER)

Potential energy per unit volume of the stored water is given by:

$$PE = \rho gh \quad (1)$$

Where ρ density of the water (in$\frac{kg}{m^3}$), g = 9.8$\frac{m}{s^2}$ is acceleration due to gravity, h is the altitude at which the volume of the water is stored.

Power P which is from the dam:

$$P = \rho \eta g h Q \quad (2)$$

Q is the volume of water flowing per unit time, this rate of the flow is preferably estimated in$\frac{m}{s^2}$; η is the efficiency of the turbine. It has been apparent from the studies that when conversion efficiency is assumed to be a 100%, an equivalent power of 10 kW is generated for water flowing at the rate of 1$\frac{m^3}{s}$ from a head of 1 metre. It is just over 9 kW with a turbine with efficiency between 90% and 95%.

Power of the Potential is studied mathematically:

1. Power or W = (net head in metre) x flow/second x 9.81x 0.5 (turbine generator efficiency)
2. Potential power or PE is approximated as, Power o/p = (height in metre) x (water flow/ second) x 5 (3)

V. RUN OF RIVER POWER (KINETIC ENERGY)

It is not that the 'Run - of – river' installations require on the flooding of large expanses of land mass to construct. In fact the required constant water supply can also be extracted out from the natural water bodies like lakes, rivers, or other reservoirs. The upstream lakes and reservoirs are typically utilized for the plants which are a tad bit of small scale generating up to 10 MW output power. Whereas the fast flowing water from the river or a steam is taken through the penstock to a turbine, often a Pelton wheel which drives a heavy duty alternator to generate the electrical power of far greater magnitude. Design of the wheel of the turbine is designated in such a manner so as to convert the kinetic energy of the flowing water into the rotational kinetic energy and this rotational kinetic energy which moves the generator and hence the available energy is dependent upon the amount of flowing water through the turbine and is directly proportional to the square of its velocity. The Power can be calculated as:

Power = Height of the Dam x Flow rate of River x (Efficiency)/11.8

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A. *Maximum Available P, Power*: More the kinetic energy ($\frac{1}{2}mv^2$) of the water impinging the blades of the turbine the maximum will be the power output from the turbine used in run of the river application.

Equation for calculating maximum output power is:

$$P_{max} = \frac{1}{2}\eta\rho Q v^2 \quad (4)$$

Here v - velocity of the flowing water
Q- volume of water through turbine/ sec.

Q = Av, where A is area swept of the turbine blades.
Thus,

$$P_{max} = \frac{1}{2}\eta\rho A v^3 \quad (5)$$

The above equation clearly states maximum o/p power is directly proportional to velocity of the running water's cube. Taking inefficacies of the system in account it can be drawn to the conclusion that the water flowing at the rate of one cubic metre per second through a turbine with 100% efficiency (ideal) will generate the power slightly less than or equal to 0.5kW. This accounts to $1/20^{th}$ part of the power which is generated by same volume of water flowing from over dam.
Now generation of same amount of the power having same volume of water from run of the river, the velocity of the flow should have to be $\sqrt{20}$ metre/sec.

VI. An example of Power Generation Calculation for Hydro – Electric Plants

Considering a turbine with an efficiency of 80% and the height of the dam to be 20 feet and the rate of flow to be 500 cubic feet per second. The power generated will be:

P = (20 feet) x (500 cubic feet per second) x 0.80/11.8 = 677.96 kW ~ 678 kW

Now the energy generated in a year will be:

Annually Generated Electrical Energy = (678 kW) x (24 hours per day) x (365 days in the year) = 5,939,280 kWh

In India, the annual residential consumption per person per year is about 3,000 kWh. So the number of persons the mentioned dam can serve a year can be determined as follows: Number of persons served = (5,939,280 kWh)/(3,000 kWh per person per year) = 1979.76 ~ 1980 persons

VII. Wind energy's potential energy and kinetic energy

Wind energy is nothing but a form of sun or solar energy. Wind energy/ power outlines procedure by in which the wind is consumed for the production of the electricity. Turbines of the Wheel change the k.e. in the wind into m.e.. A generator can convert mechanical power into electricity. Wind has both k.e and p.e. Wind moving higher up in the atmosphere has more potential energy than wind moving lower in the atmosphere. Wind that is moving down in the atmosphere will gain kinetic energy from the potential energy it loses. Sun light, Earth light and Cosmic or Galactic light combine in various ways to generate an atmosphere. Energy units [photons] mass in various ways in the atmosphere to become the foundations of all articulated energy centres within the atmosphere and on the surface of Earth. Farmers have used the kinetic energy of the wind to drive wind mills which can also stuff up directions for the migrating bird life. Science defines energy as the strength and vitality to do work and in this case calculating kinetic and potential energy is helpful in making machines. Dark-light energy is infinite and creates infinite possibilities and probabilities that people can tune too. The wind cannot be bound to just potential and kinetic applications. The origin of the wind is potential energy due to changes in atmospheric pressure but it is converted in

kinetic energy, when air hit a blade it changes velocity direction and magnitude applying lateral impulse mechanical energy to the blade. But since gravitational force on gas molecules is negligible so it may not be considered that it has potential energy and about kinetic energy is surely there as every moving object has kinetic energy.

As per the explanation of Prof. Friedrich Aumayr of Institute of Applied Physics at the gathering of TU Wien, "The solar wind consists of charged particles -- mainly hydrogen and helium ions, but heavier atoms up to iron also play a role,". The heavier particles like these smash rocks of the surface at very high speed of 400-800 kilometer/ sec and the further effect emit various other atoms. These massive particles rose enormously before mainly falling back to the exterior area. This will create exosphere around the Mercury or Moon. Also an extremely thin atmosphere of atoms sputters from the surface rocks by the bombardment of solar wind. The exosphere is of great interest for space research because its composition allows scientists to find out the chemical composition of surface of rock. A research scholar Paul Szabo from Friedrich Aumayr's team has said that Up to now it was assumed that the kinetic energy of the fast particles is primarily responsible for atomization of the rock surface, but this is only half the truth: we were able to show that the high electrical charge of the particles plays a decisive role. It is the reason that the particles on the surface can do much more damage than previously thought." When the particles of the solar wind are multiply charged, i.e. when they lack several electrons, they carry a large amount of energy which is released in a flash on impact. Protons make up by far the largest part of the solar wind. [10]

VIII. CALCULATING ENERGIES (WIND POWER GENERATION)

Wind energy is calculated as follows: 1/2 x mass x velocity x velocity
Mass times velocity equals momentum in the wind.
Power per unit area is KE times momentum, or mv2 times mv.
Therefore, the amount of power that may be collected from the wind is equal to velocity cubed (v3). A wind blowing at 60 mph has 27 times more strength than one blowing at 20 mph.Power per square metre equals 0.0006 v3 for typical air conditions with density and moisture constant. metres per second, which represents speed. Kilowatts were then used to measure power. A speed of 2 mph is equal to 1 metre per second. 10 m/s of wind at 20 mph. Power generated is equal to 600 watts per square metre (0.6 Kilowatts per square metre) or 0.0006 x 103 (0.0006 x 1000).

IX. POTENTIAL AND KINETIC ENERGY IN RELATION TO SOLAR ENERGY

All time, solar, the sun energy is being converted into kinetic energy that is available in winds, clouds, ocean waves, and rainfall. This happens by initially converting the radiations from sunshine into thermal energy that raises the temperature of the receiving medium creating a weight/ density unbalance. This unbalance causes the resulting movement of the objects / medium carrying kinetic energy.

In recent years, organic and inorganic halide perovskites-based solar cells have demonstrated rapidly increased power conversion efficiencies. They exhibit and demonstrate behaviours including voltage and current hysteresis as well as a low-frequency large dielectric response. Ion transport has been found to be a significant contributor to these results. Fundamentally, activation energies for ion migration in methylammonium lead iodide (CH3NH3PbI3) are derived from the very beginning. These are contrasted with kinetic information obtained from a perovskite-based solar cell's current and voltage response. The foundations of microscopic transport were identified, and it was discovered that iodide ion migration was easily facilitated by vacancies with an activation energy of 0.6 eV, in good agreement with kinetic studies. When combined with kinetic practicals and experiments that would be performed for the monitoring of the photo-current relaxation of devices,

the initial basic basics and principle approaches were used to investigate the major key point issues linked to intrinsic defect migration in CH3NH3PbI3. [4]

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Mexico has a lot of potential for using renewable energy sources. With regard to solar energy, as an illustration, the nation of Mexico has extremely exceptional superb conditions with a vast geographical extension and ideal climatic conditions, with the average of the sun or solar radiation adding up to and equating to roughly 5.0 kWh/m2/d. For each class of end-use points, the technological, economic, and commercial potential are estimated. To determine the potential of SWH for homes in Mexico, various and end-use potentials are combined and extrapolated. Energy savings range from 29% to 56% of consumption for water heating during the winter, with the built-up area of the Gulf of Mexico having the highest and greatest potential for energy savings. Savings in rural households were 1.3 PJ and in urban households 10.4 PJ for the use of SWH. Given the possibilities assessed in this article, it is obvious that the SWH can play a key part in resolving Mexico's energy issues. The SWH is not just the near future; it is the present of the energy use for heating water. [5]

It is demonstrated that solar wind standoff, an ion-electron kinetic interaction mechanism that locally inhibits weathering by solar wind ions, reproduces and yields the shape of the Reiner Gamma Albedo pattern by linking the completely kinetic simulations with a Surface Vector Mapping model. The importance of a kinetic technique to characterise the solar-wind interaction is expressed by the simultaneous qualitative agreement between optical remote observations and in situ particle measurements of the back-scattered ions. However, due to the fact that magnetic shielding on small scales is an ion-electron kinetic mechanism, it is not possible to assess the veracity of the solar wind standoff model solely by analysing the magnetic topology and the size of the crustal field. A fluid created utilising magnetohydrodynamic or hybrid technology. In order to shield the underlying surface, create Reiner Gamma's three bright lobes, and direct solar wind plasma into its dark lanes, the approach requires surface magnetic fields and/or spatial scales that are at least an order of magnitude larger than what is currently inferred from in-orbit observations. This indicates that even if many protons touch the surface of the moon, differential darkening could still occur owing to solar wind standoff if enough kinetic energy is lost due to the charge-separation electrostatic field before the protons reach the surface. We demonstrate qualitative agreement between in-person measurements of the back-scattered protons simultaneously coupled together by a fully kinetic simulation and optical remote observations for the first time. Up until then, fully kinetic simulation studies are the best option. [6]

Sometimes, the fluid flow in a solar system consists of two phases, including steam and liquid water. The Large Eddy Simulation (LES) technique has been used in this study to create a complete three-dimensional compressible fluid dynamics model of a compressible turbulent temporal mixing layer (steam flow). The primary goal of the current research is to compare the vortices that are produced during mixing at three distinct times. The Navier-Stokes equations have been filtered using a top-hat filtering function to separate the large and sub-grid scales, and the dynamic eddy viscosity model has been used to describe the sub-grid scales. Verman's direct numerical simulation (DNS) and (LES) results have been compared to the numerical result for the momentum thickness.

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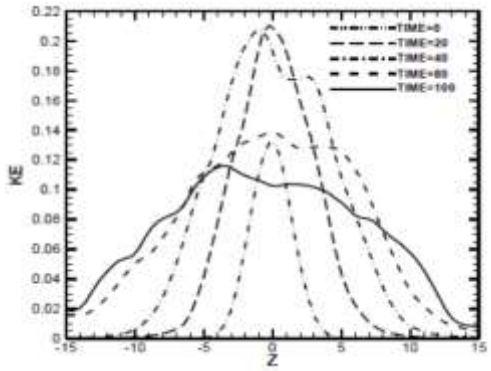

Comparison of kinetic energies at different temperatures

At five distinct intervals (steps), The numerical results showed that the turbulence spread resulting from the mixing of layers in the entire flow field, and its effects on the main flow properties. The sub-grid scale kinetic energy and the flow simulation results, such as vortices, pressure, density, and x-velocity component, have been presented. According to the model, eddy viscosity dissipates flow kinetic energy at sub-grid sizes. On the other hand, the dynamic coefficient, which regulates the degree of flow turbulence, has taken the position of the square of constant coefficient in Smagorinsky's basic model. The order of the eddy viscosity in the flow is determined by local variations in this coefficient. The dynamic coefficient is then continuously adjusted by achieving the new value at any location in the flow field after a time step or numerous time steps by evaluating the flow field. This makes it possible to calculate the precise rate of kinetic energy conversion to heat. In the dynamic eddy viscosity model, test filtering is employed for this purpose with a filter width that is twice that of the original filter. The turbulent stress tensor model at sub-grid scales and the strain field at large scales are related by eddy viscosity. [7]

Scientists at the Los Alamos National Laboratory have constructed magnetically-doped quantum dots that can absorb electron kinetic energy before it is lost as heat. A significant portion of the energy from sunshine is lost as heat in conventional solar cells. Due to the lack of efficient methods for harnessing the kinetic energy of "hot" electrons produced by photons in the green to ultraviolet region of the sun's light spectrum, this waste happens. In the past, hot-carrier energy has been harnessed by stimulating an immobile, low-energy electron to a current-conducting state by transferring kinetic energy from the hot, energetic electron to it. The number of electrons contributing to the photocurrent is doubled as a result of this phenomenon, known as carrier multiplication, which can be employed to improve the efficiency of solar cells.[9]

The material's surface deflects the electrons, causing some of their energy to be lost. This energy loss can be quantified, making it possible to draw conclusions about the material's characteristics, such as its capacity to carry electricity or heat. It needs to be measured from several angles. The energy loss could only be measured for one angle at a time up until this point. As a result, measurements of a single sample took an entire day, often longer. A technique for measuring a sample in a matter of minutes has been developed by François Bocquet and his associates. Their HREELS device has two extra parts that make the measurements easier: The first, according to Bocquet, is a hemispherical electron analyzer that has been used successfully for ten years in angle-resolved photoelectron spectroscopy. The second is a modified electron source tailored to the institute-created electron analyzer. "The second is a modified electron source tailored to the electron analyzer, which was produced here at the institute." By using specifically created software, this is tuned to make sure the electrons in the beam have the correct kinetic energy and can be concentrated on a very tiny area of the sample. The analyzer can be utilised most effectively in this fashion, enabling the simultaneous monitoring of energy losses from various angles. [9]

Researchers from TU Delft have developed a novel method for quickly and precisely determining the solar energy potential of surfaces in non-rural urban settings. The most recent technique can significantly assist architects and urban planners in incorporating the technicalities of PVs or solar power into their architectural process. In metropolitan settings, buildings, trees, and various other structures shade solar panels, which has a significant impact on the efficiency of a PV system. The integration of PV systems into the urban environment will be made easier by an appropriate and accurate judgement and assessment of the specific performance, and the corresponding pricing or performance of PV systems.

The energy yield of PV systems can be simulated using a variety of techniques. All of these instruments essentially rely on mathematical models that calculate the incident sun radiation on solar PV modules. The tools that offer an annual irradiation that is received by the solar PV modules are used repeatedly to calculate the incident irradiance. But the truth is that determining with great accuracy how much electricity a PV system produces in a city environment is not at all straight forward. But the truth is that determining with great accuracy how much electricity a PV system produces in a city environment is not at all straightforward. The new method makes the numerical steps easier and allows for high end accuracy while allowing for speedy verification of the solar energy potential for vast urban areas. The association between the skyline profile and the annual irradiation at a specific urban location is very strong. The study shows that the two parameters that are generated from the skyline profile—the sky view factor and the sun coverage factor—can be used to quantify the total annual solar irradiation that is received by a chosen surface in an urban environment. The second value is indicative of the irradiation from the direct sunlight component, whilst the first parameter is utilised to estimate the irradiation from the diffuse sunlight component. The skyline profile makes it simple and quick to get these two elements. This study demonstrates that the computational complexity of the issue is greatly reduced when these two factors are used. The approach has already been incorporated by the Photovoltaic Materials and Devices department into a software toolkit that can precisely determine the energy yield of PV systems at any location. It will also assist investors in making choices on the installation of PV systems in buildings and other urban areas. [9]

X. MEASUREMENTS

A. Measuring Hydroenergies: This involves taking measurements of the voltage, which is also known as the amount of potential energy in electricity, and doing so at various heights, water speeds, blade sizes, and water stream sizes.

B. Measuring Solar Energies: From a basic solar cell placed in the sun, measure the voltage, which is the amount of potential energy in the electricity between cell connections. The next step would be to position mirrors close to and around the cell so that more and more light would reflect upon it. The measurement is affected by trying out different and multiple places as well as different foil shapes.
C. Measuring Wind Energy: A generator that is typically attached to the turbine shaft by gears that cause the generator to rotate at a different speed than the turbine shaft is used to measure wind energy. The electricity is transformed into the proper voltage and frequency to put into the power grid, which is likely 60 Hertz or 50 Hertz, using fancy power electronic controls.

XI. COMPARISON

1. A turbine modifies each of the portion of power of wind to the power in the form of mechanical it can be asserted that efficiency in that case is full or hundred percent. This is rather impractical concept to ponder. Achievement of as low as fifty percent is also very much questionable. A turbine which is possessing the productivity/efficiency of fifty percent would modify half of the power in the wind to mechanical power.

2. Hydropower depends a lot on landscapes and it is a costly affair to change its kinetic and potential energies.
3. By the cases studied in this paper, we can infer that kinetic energies and potential of Solar can be altered to achieve greater power.

XII. REFERENCES

[1] R. Dhingra, A. Jain, A. Pandey, S. Mahajan, "Assessment of Renewable Energy in India", International Journal of Environmental Science and Development, Vol. 5, No. 5, October 2014, pp. 459
[2] P. A. Owusu, S. A. – Sakodie, "A review of renewable energy sources, sustainability issues and climate change mitigation", Congent Engineering Journal, 2016, pp. 2
[3] S. Abolhosseini, A. Heshmati, J. Latman, "A Review of Renewable Energy Supply and Energy Efficiency Technologies", Discussion Paper No. 8145, April 2014, pp. 2
[4] Christopher Eames1, Jarvist M. Frost1, Piers R.F. Barnes2, Brian C. O'Regan2, Aron Walsh1 & M. Saiful Islam1, "Ionic Transport in Hybrid Lead Iodide Perovskite Solar Cells"
[5] Jorge Alberto Rosas Flores, Dionicio Rosas-Flores, José Luis Fernández Zayas, "Potential energy saving in urban and rural households of Mexico by use of solar water heaters using geographical information system"
[6] Jan Deca 1,2,3, Andrey Divin 4,5, Charles Lue 6,7, Tara Ahmadi 4 & Mihály Horányi, "Reiner Gamma Albedo features reproduced by modeling solar wind standoff"
[7] Mohammad Bagher Sadeghiazad, "Large eddy simulation of vorticity in compressible turbulent mixing layer concentrating on steam flow in solar system"
[8] https://ourworldindata.org/energy
[9] https://www.sciencedaily.com/releases/2019/10/191007164345.htm

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A REVIEW- COMPARISON OF EFFICIENCY AND METHODOLOGY OF 3D SCANNER

Hrigved Suryawanshi, **Shlok Mhaprolkar, Sakshi Mhatre, Tanay Parulekar, Prof. Mahalaxmi Palinje,** Department of Electronics and Telecommunication Atharva College of Engineering Mumbai, India

***Abstract*—** As we glance throughout history, the rich and privileged have had access to useful technologies before the masses. We have attempted to engineer a 3D scanner that is affordable and easy to use while maintaining the same level of accuracy and applicative traits as the current leading scanning technologies. After studying various research papers and learning from other researchers,we, with our collective knowledge, have put together a 3D scanner that uses the best of both worlds.We cover the essential components and their functioning in our design and expand on the workingsof this model.

Keywords – *Scanning, 3D Scanner, 3D Printing, Laser, Distance Scanning, IoT, Industrial design*

I. INTRODUCTION

The first records of 3D printing technology dates back to the early 1980s when a man named Hideo Kodama was developing a rapid prototyping machine. This technology was not patented as it had quite a few drawbacks, but it was followed by a window of strong advancements in this field, in 1986 this technology was patented as SLA printer and the first commercial printer was released in 1988 [1]. As theyears went on, 3D technological advancements were developed and heavily used. It combines the 3D scanning and 3D printing processes.

A 3D scanner is used to evaluate real-world objects and environments, gathering raw data on their appearance and shape. It is a device that uses sensors and or lasers to capture the outline and design of anobject and convert it into CAD (Computer Aided Design) data. This string of data is compiled in softwareand a 3D mask of the entire object is mapped.

This review was done to track the numerous technological breakthroughs in 3D scanning, and it covers the various scanning technologies, methodologies, advantages, disadvantages, and results. This study assesses the use of 3D scanning and looks at the process, overall effectiveness as well as its potential utilityfor use in design and engineering education.

II. SURVEY STUDY

Despite the fact that 3D scanning is not a new technology, it's becoming increasingly popular and growing every day. 3D scanning can be used for inspecting products, which can help reverse engineering them andlower the cost.

Mahesh Parde, Karan Khankal, Thotya S. and R. S . Meshram [2] provide information on 3D scanning technologies, their various types, and their limitations. The model developed had some drawbacks mentioned by the author and was considered less accurate. As it had difficulty in collecting data points ofcomplex shapes.

Mohamed Abdelmomen, F. Ozan Dengiz, and Mart Tamre [3] refer to the surveys of current 3D technologies. The main two focus points were 3D scanning, 3D printing, and software tools as they link these two technologies. It also enlightened about the various parameters to be taken into consideration while 3D scanning

Mr. Aditya Gaykar, Ms. Advyta Jujaray, Ms. Shalmali Mutalik, Ms. Prachi Waghmode, Prof. Sanjay B Matekar [4] introduce a mechanism to construct a 3D scanner that would be easier to use and handle. The3D scanner is mounted on a dolly mechanism to get accurate points from the scanner. The object was heldby a two-point support so that all surfaces are scanned by an Intel SR laser scanner

N Alberto Borghese, Giancarlo Ferrigno, Guido Baroni, Riccardo Savarè, Stefano Ferrari and Antonio Pedotti [5] focus on providing flexibility, reliability, and accuracy for scanning 3D surfaces. Their prototype included a two video cameras, laser pointer, a computer host and a real-time image processor. Their system can distinguish circular objects even in low-light circumstances, such as outdoors, and has great accuracy even employing a very small circular shape. The model's downside is its long scanning time and use of a single laser pointer.

Sampsa Kohtala, Jorgen F. Erichsen, Ole Petter Wullum, and Martin Steinert [6] provide insight into the photogrammetric 3D scanning technology, which utilizes images of the object. Their model demonstratedthe potential for low-cost, straightforward, accurate digitalization and overcoming obstacles such as the limitations of photogrammetry and the frequent need for manual mesh editing.

Siti Asmah Daud and Nasrul Humaimi Mahmood [7] proposed an infrared sensor rig to detect shapes that measure the distance between the sensors and the object placed at the center of the plate. An Arduino microcontroller will completely control the data received. The sensors then communicate this data to the MATLAB software, which reconstructs the picture of the item based on the values acquired. The suggested system makes use of five sensors arranged in the shape of a pentagon. The Arduino microcontroller will control the sensor movement, and the data collected will be saved. It is then used to plot the model within the MATLAB software.

A. Kus, E. Unver, and A. Taylor [8] focuses on a variety of different data from scanned organic 3D shapes to 3D CAD packages for learning and teaching in undergraduate education. They also created and applied repeatable methods for analyzing the laser scanner setup for capturing diverse 3D surfaces.

Joao Braun, Ana I. Pereira, Paulo Costa, Jose Lima, and Claudia Rocha [9] propose a prototype of low- cost 3D scanning system for small objects using a point cloud to stereolithography approach where it was already validated in simulation. The model had drawback that it must have a uniform shape, i.e., without discontinuities

A. Various 3D Scanning Technologies

After surveying different 3D scanners on the market and those used in research & development, the following 5 techniques or methodologies are used for 3D scanners:

1) Laser Triangulation - Rectilinear laser beams are directed toward objects and reflected. A receiving sensor captures the reflected laser and calculates the angle. In most cases, a camera is used to measure thedeformities in reflected laser beams. Simple trigonometric theorems can be used to determine further distance measurements. It is a low-cost method, but its range is relatively limited (a few meters).

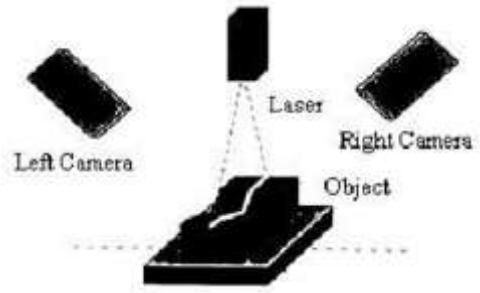

Figure 1. Laser Triangulation 3D Scanner [10]

2) Structured Light 3D Scanning - This technology requires a projector and camera system. A projector projects a specific light pattern onto an object. Patterns are stripes, dots, etc. Deformation is observed by the camera from different viewpoints along with pattern irregularities and calculated accordingly. Differentpatterns can be created by varying the angle between the beams. The observed information is used to reconstruct the object using software geometric calculations. Using this technology, it is possible to produce very fine patterns with infinite depth of field in a precise and

simple manner. The disadvantages are the high implementation costs and the difficulty in supplying the optimal beam geometry.

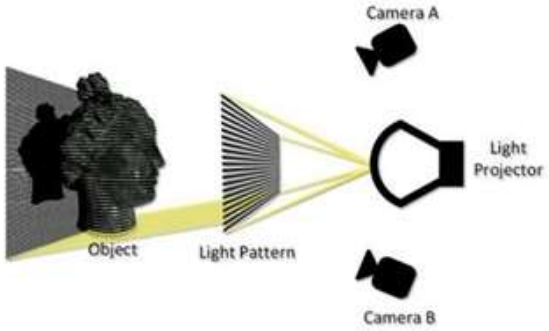

Figure 2. Structured Light 3D Scanner [11]

3) Photogrammetry - It converts two-dimensional data into three-dimensional measures (images). The distance between two points on a plane is then calculated. The co-ordinates are obtained by the cameras from various points of view. We can utilize many cameras to accomplish this. They collect data from various orientations and build a camera model. With all of the variables captured and the data obtained, the software creates a 3D reconstruction.

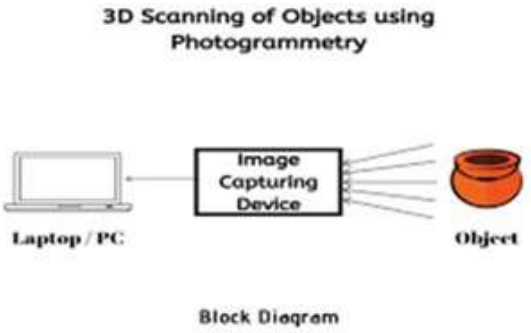

Figure 3. Photogrammetry 3D Scanner [12]

4) Contact Based 3D Scanning - This method uses a probe to collect 3D data. A probe acquires data by physically touching an object. The probe can be physically moved and aimed, but to get data points moreclearly, a mechanical arm is used to facilitate movement and precision. To do this, hold the object firmly,move the probe and place it next to it. The precision and capacity to 3D scan clear or reflecting surfaces are the primary benefits of contact technology for 3D scanning. There are a number of drawbacks associated with contact 3D scanning systems, including slow speeds and the inability to control organic structures in their natural state.

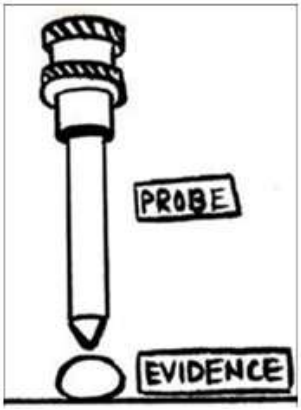

Figure 4. Contact Based 3D Scanner [13]

5) Laser Pulse Based 3D Scanning - It is also called time-of-flight technology because it measures the time it takes for a laser pulsed 3D scanning laser to hit an object and return, accuracy is up to 1 picosecond.Only one point is captured for each measurement. A large number of pulses are projected

onto the object and reflected by the laser. It uses mirrors to rotate the laser and sensor hardware.

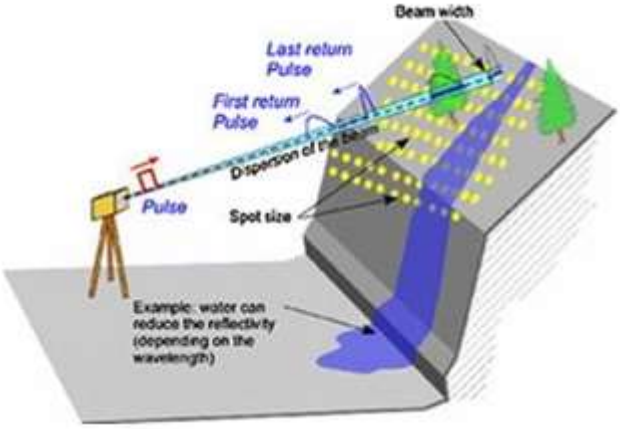

Figure 5. Laser Pulse Based 3D Scanner [14]

Table 1. Comparison between the 3D Scanning Techniques [15-17]

Parameter	1) Laser Triangulation 3D Scanning	2) Structured Light 3D Scanning	3) Photogrammetry	4) Contact Based 3D Scanning	5) Laser Pulse Based 3D Scanning
Advantages	• It's a highly versatile technology • It has high level accuracy • It is capable of scanning objects as well as measuring distances. • Scan objects at high speed at low resolution, measuring only a few points at a time	• It has a very fast scan time compared to other technologies • With the use of commercial scanners, you are usually very likely to get good results in terms of accuracy • This is a model that has a high level of precision	• There is no specialized equipment required, so it is relatively cheap • It is also possible to scan very large objects with this scanner • It properly captures the texture of the object. • It is very precise.	• It requires contact between theprobe and the object • It can collect precise 3D data points • Used to 3D scan transparent or reflective surfaces	• It has the ability to scan big object and anenvironment • Laser beams are measured in time between emission and reception to obtain geometrical information

Disadvantages	• During brightly lit environment, it does not perform well • There is also the possibility of more errors and minimal accuracy when compared to structured light scanning • It isn't ideal forscanning objects with transparent orshiny surface	• Cannot be used outdoor or inbrightly lit environment • We cannot scanvery large objects • Scanners can be expensive	• Due to the lack of specialized scanners, this is difficult. • Computers with high processing power, high resolution cameras, and specialized software are necessary for this method	• Slow speed and inabilityto work with free form shape • Equipment 'sare very expensive	• Does not workwell in brightlit environment and rain • It is a slow method in comparison toother 3D scanning techniques.
Cost	• Low Price	• Most Expensive	• Cost Effective	• Expensive	• Cost Effective

III. PROPOSED SYSTEM

After understanding and analyzing various models we have picked a suitable mechanism. The scanning mechanism (photogrammetry) used in our model entails an object kept on a turntable controlled using a potentiometer and gear mechanism to rotate the object to be scanned at a predefined speed. The ideal speedfor generating a detailed data set is 1 RPM. The data collected is put together to generate a composite 3Dimage.

Advantage: Scans colour of the object, cost effective, portable and easy rotation of the object.

Disadvantage: Since the object is mounted on the turntable, the lower data points of the object cannot be captured. In the bottom part of the object, there might be designs, holes, or cavities that cannot be captured.

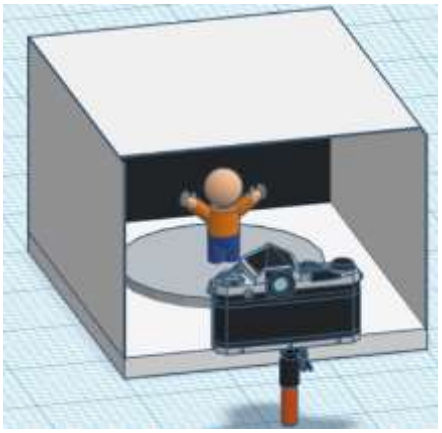

Figure 6. 3D Scanner Proposed System

IV. CONCLUSION

Using simpler cameras in place of a complex sensors while maintaining accuracy and reliability while compromising on some of the data captured and the time required helps us in manufacturing a 3D scanner that is more economical and user-friendly. This model can be used in various industries owing to all the avenues it opensin the design sector and its ease of use.

REFERENCES

[1] Gregurić, Leo. "*History of 3D Printing – When Was 3D Printing Invented?*" All3DP, All3DP, 6 Dec. 2018,https://all3dp.com/2/history-of-3d-printing-when-was-3d-printing-invented/

[2] Parde, Mahesh, et al. "*Implementation of 3D Scanner Using IR Distance Sensor*.", vol. Vol-4 Issue-2 2018, no.2, 2018, jariie.com/AdminUploadPdf/Implementation_of_3D_Scanner_Using_IR_Distance_Sensor_ijariie8280.pdf. Accessed 27 Oct. 2022.

[3] M. Abdelmomen, F. O. Dengiz and M. Tamre, "*Survey on 3D Technologies: Case Study on 3D Scanning, Processing and Printing with a Model*," 2020 21st International Conference on Research and Education inMechatronics (REM), 2020, pp. 1-6, doi: 10.1109/REM49740.2020.9313881.

[4] Gaykar, Mr Aditya, Ms Advyta Jujaray, Ms Shalmali Mutalik, Ms Prachi Waghmode, and Sanjay B. Matekar. "*Design and Analysis of 3D Scanning System for Scanning an Object*."

[5] Borghese, Nunzio Alberto, Giancarlo Ferrigno, Guido Baroni, Antonio Pedotti, Stefano Ferrari, and Riccardo Savare. "Autoscan*: "A flexible and portable 3D scanner"*. IEEE Computer Graphics and Applications 18, no. 3 (1998)

[6] Kohtala, Sampsa, Jørgen F. Erichsen, Ole Petter Wullum, and Martin Steinert. "*Photogrammetry-based 3D scanning for supporting design activities and testing in early stage product development."* Procedia CIRP 100 (2021)

[7] Daud, Siti Asmah, Nasrul Humaimi Mahmood, Pei Ling Leow, and Fauzan Khairi Che Harun. "*Infrared sensorrig in detecting various object shapes*." International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering 2, no. 10 (2013)

[8] Kus, Abdil, Ertu Unver, and Andrew Taylor. *"A comparative study of 3D scanning in engineering, product andtransport design and fashion design education*." Computer Applications in Engineering Education 17, no. 3 (2009)

[9] J. Braun, J. Lima, A. I. Pereira, C. Rocha and P. Costa, "*Three-dimensional scanning system based on a low- cost infrared sensor*," 2021 26th IEEE International Conference on Emerging Technologies and Factory Automation(ETFA), 2021, pp.

[10] Peiravi, Ali & Taabbodi, Behrai. (2010). *A Reliable 3D Laser Triangulation-based Scanner with a New Simplebut Accurate Procedure for Finding Scanner Parameters*. Marsland Press Journal of American Science. 6.

[11] Iyer, Manasa, et al. *"3-Dimensional Scanning Using Photogrammetry*." http://www.iosrjen.org/, IOSR Journal of Engineering (IOSRJEN), 5 May 2020, iosrjen.org/Papers/vol10_issue5/Series-1/G1005014853.pdf. Accessed 28Oct. 2022.

[12] Jani, Gargi & Lavin, Wenona & Ludhwani, Suresh & Johnson, Abraham. (2021). "*An Overview of Three Dimensional (3D) Technologies in Forensic Odontology*." 18-27. 10.18311/jfds/2020/27227.

[13] Baek, Nakhoon & Shin, Woo-seok & Kim, Kuinam. (2017). "*Geometric primitive ex-traction from LiDAR- scanned point clouds. Cluster Computing.*" 20. 10.1007/s10586-017-0759-

[14] Lewis, Alan. "*What Is 3D Scanning? – Definition, Advantages and Uses - 3DSourced." 3dsourced*, 5 Feb. 2021, www.3dsourced.com/guides/what-is-3d-scanning-guide/

[15] Prescient Technologies. "*Types & Benefits of 3D Scanners and 3D Scanning Technologies.*" www.pre-scient.com/knowledge-center/product-development-by-reverse-engineering/scanners-scanning.html#redirect1_6 Accessed 27 Oct. 2022

[16] Bitfab - Online 3D printing service. "*Types of 3D Scanning Technologies: Comparison, Advantages and Applications."* Bitfab.io, 1 June 2020, https://bitfab.io/blog/types-of-3d-scanning/

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A REVIEW ON GRID-CONNECTED SOLAR-WIND HYBRID SYSTEM FOR ELECTRICAL APPLICATION

Priyanka Tripathi, Research Scholar, Department of Electrical Engineering, Sandip University Nashik, India, priyanka.tripathi.phd@gmail.com
Dr. Jagadish B. Helonde, Senior Professor, Department of Electrical Engineering, Sandip University, Nashik, India, jbhelonde60@gmail.com

***Abstract*—**Recently, the smart grid has been paying more and more attention to renewable energy production and electric vehicles (EVs). In order to meet the electrical load demand in India, a grid-connected solar-wind hybrid system is presented in this study. The system also includes a charging station for electric vehicles. The proposed setup is subjected to an economic analysis in order to meet both the retail center's electrical load demand and the demand for EV charging. The cost of the energy that is purchased and then sold to the utility grid is taken into account while designing the suggested system, and the utility grid and other system components are guaranteed to exchange power. By utilising optimization techniques, the component is sized to achieve the lowest levelized cost of electricity (LCOE) while decreasing the probability of a power supply failure (LPSP). The efficient management of renewable energy generation and load needs is determined to be a key to designing a system that is both affordable and dependable. Particularly in poorer nations, the proposed approach would be useful in lessening reliance on the grid's heavy load.

***Keywords*—**Charging station, electric vehicle (EV), optimi- zation, solar photovoltaic (SPV) panels, wind turbine.

I .INTRODUCTION

The microgrid is an intriguing way to use more power, as it increases the efficiency of power supply and the quality of electricity consumed by various users [9][10]. The use of distributed renewable energy sources has expanded to lessen pollution, improve network dependability, and make it easier to electrify remote places [2]. In order to minimise carbon emissions, diversify energy sources, and revitalise local economies, particularly in poor nations, microgrids (MGs) powered by HRERs such solar arrays (PV) and wind turbine generators (WTGs) have recently attracted a lot of attention [11]. In order to improve operation efficiency, hybrid AC/DC MGs integrate the advantages of both AC and DC subgrids [14] and minimise conversion stages [15]

Because of this, hybrid MGs offer a promising alternative for either subpar poor distant populations [16] or even developed load centres that are isolated from primary utilities to meet their electrical needs [17]. In addition, constant population increase and rising load demand spurred aggressive strategies to ensure a sustainable and dependable power supply [18] via hybrid AC/DC autonomous MGs [19] whenever grid connection is not possible or is not cost-effective [20]. Though long-term supplemental energy storage systems (ESSs) can effectively suppress HRER irregularities [22] so that standalone MGs function as conventional power plants [23], MGs are still susceptible to notable voltage and/or frequency deviations due to climatic vagaries, such as changes in solar radiation and wind speed [21]. Hybrid energy storage systems (HESSs), which are distinguished not only by high power density but also by high energy density, are essential to handle rapid power changes and simultaneously ensure MG autonomy [24][3].

In the current electricity grid, EVs and plug-in hybrid EVs have grown significantly in recent years. An exciting and difficult study field is the integration of EVs in terms of economic analysis and power management in the renewable energy-based system. The control and power management of EVs in

microgrid or grid-connected systems are the main research areas. One of the crucial considerations that must be made is an economic analysis that takes the power exchange with the grid into account. The growing use of EVs creates opportunities and difficulties for the current power infrastructure. The reliability, ACS, and a smooth power flow across the components are the three main factors to consider while developing a renewable energy-based system [1].

II. Literature Review

Sr. No.	Author/ citation []	Methodology	Features	Challenges
1.	Shakti Singh *et al.* [1]	Optimized microgrid controller	System that is reliable Affordable helps reduce dependency on the overworked grid	Grid dependency increases
2.	Bhargavi and Jayalakshmi [2]	Novel control strategy	• enticing possibility to boost effectiveness • a PEV charging device and the DC bus voltage can both be regulated	• Might cause the devices to share power improperly.
3	Sayed Abulanwar *et al.* [3]	Adaptive synergistic control strategy	• show a flawless exchange of the desired load power • reduce bus voltage disturbances brought on by large load variations • increases the robustness of the microgrid against parameter uncertainty	• taking into account predetermined parameters, which reduces system performance**.**
4.	Dina Emara *et al.* [4]	Coordinated control	• be functional in both normal and abnormal circumstances. • Greater adaptability and dependability	• Establishes a controlled DC voltage with reliable operation and few voltage spikes**.**
5	Pramod Bhat Nempu and Jayalakshmi [5]	Fuzzy logic and adaptive neuro-fuzzy inference system	• The battery system's voltage and power output transients are reduced	• There has been no discussion of the comparative analysis of FLC and ANFIS with PI regulators under dynamic system conditions.
6	Oladepo Olatunde *et al.* [6]	grid-connected load-following system with EV	• Improved power loss reduction • dynamic energy reserve • voltage regulation	due to the extensive system and high load demand, cannot operate effectively in an

				emergency
7	Asim Datta *et al.* [7]	Coordinated AC frequency vs DC voltage control (CFVC) scheme	• high robustness • capacity to tolerate a wide range of system loading	difficult to balance exploration and exploitation abilities
8	Peng Wang *et al.* [8]	stochastic scheduling approach	• it is conceivable to run hybrid microgrids that incorporate the high uncertainty of renewable energy sources. • dependable and consistent performance	• Plug-in electric vehicle use may have an impact on the security of hybrid microgrids.

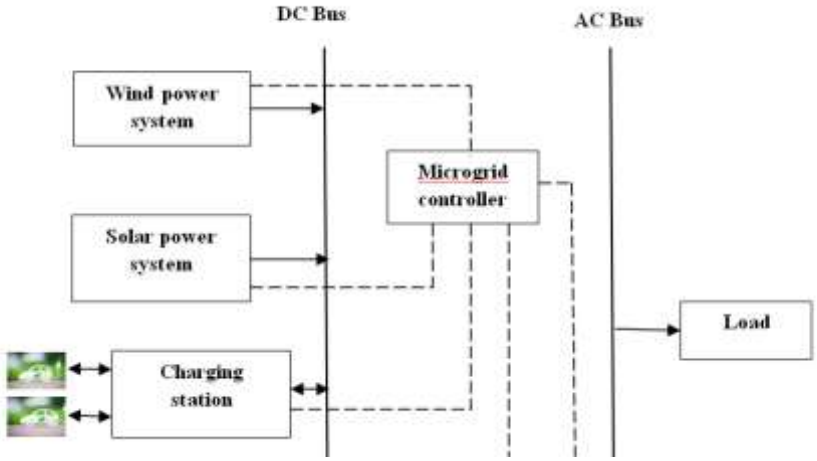
III. Methodology

The final goal of the research that is being presented is to carry out cost minimization when switching between AC and DC power microgrids. The suggested model includes an electric vehicle charging station, a hybrid AC/DC microgrid system, a wind power generation system, and a solar power generation unit. Wind turbines, SPV panels, and a charging station are connected to the DC bus, whilst the electrical load is connected to the AC bus. To convert AC into DC and vice versa, a dual converter is proposed. In a hybrid AC/DC system, as opposed to a single AC or DC system, power management is more important in terms of cost. As a result, the suggested research's goal of cost minimization is combined with a smooth power flow between the system's numerous components. To achieve the lowest levelized cost of electricity (LCOE) while minimising the loss of power supply probability (LPSP), the Aquila Marine optimization (AqMar) Algorithm is suggested [1]. The marine predator optimization algorithm (MPA) [25] and the aquila optimization algorithm (AOA) [26] have been integrated into the development of the proposed AqMar. Multiple energy sources make up the planned hybrid renewable energy system. Due of the numerous decision factors in this subject, complex optimization problems occur. The main goal of the suggested algorithm is to maximise converter, wind, and SPV capacity in order to satisfy the fitness functions of LCOE and LPSP. For the AC load and EV charging station to receive an uninterrupted power supply, this issue necessitates the identification of energy sources. Consequently, the optimization problem includes economic goals. Additionally, to find the best balance between LPSP and LCOE, long-term system performance must be calculated. The suggested AqMar algorithm reduces LCOE by dynamically searching for an ideal system configuration and keeping LPSP within specified bounds. As a result, an ideal power exchange between the utility grid and other system components is guaranteed.

TABLE I : SPECIFICATION AND COST OF SYSTEM COMPONENT

Sr. No.	Component	Parameter	Value
1.	SPV panel	Maximum power Pmax	100 W
		Maximum voltage Vmp	18 V
		Maximum power current Imp	5.56 A
		Open circuit voltage Voc	22.3 V
		Short-circuit current Isc	6.1 A
		Number of cells	36
		Nominal operation cell temperatur	45
		Capital cost and replacement cost	1084 $/kW
		O&M cost	5 $/year

		Life time	20 year
2.	Wind turbine	Rated power	1 kW
		Capital and replacement cost	1098 $/kW
		O&M cost	2 $/kW/year
		Cut-out speed Vco	20 m/s
		Cut-in speed Vcin	5 m/s
		Hub height	50 m
		Life time	20 year
3.	Others	DC bus voltage Vbus	120 V
		Project life N	20 year
		Interest rate i	6 %
4.	Converter	Rated power	1 kW
		Rectifier and invert efficiencies	90 %
		Capital and replacement cost	127 $/kW
		O&M cost	1 $/year
		Life time	20 year
5.	EV battery specification	Battery ampere-hour	210 Ah
		Battery type and variant	Lithiumion
		Number of modules	16
		Number of cells	48
		Battery energy capacity	5 kWh
		Maximum charging rate	0.5 kWh/h
		Maximum number of vehicles/bays	20



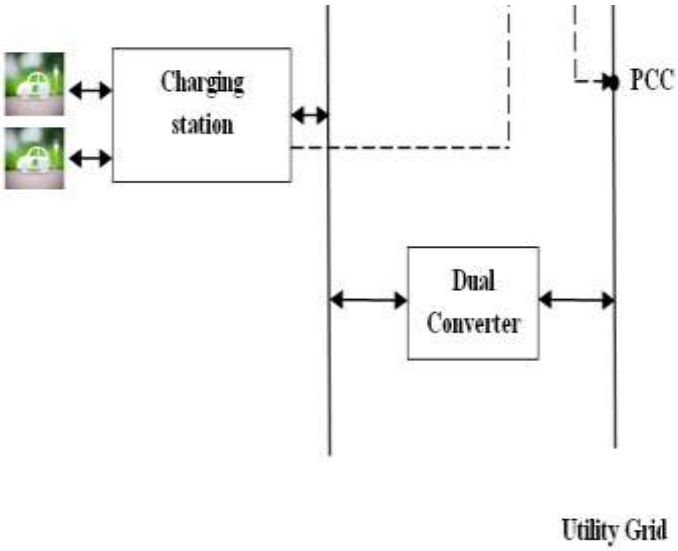


Figure 1. Schematic diagram of proposed system

IV.EXPECTED OUTCOMES

In MATLAB, the suggested model—which employs a hybrid AqMar optimizer—will be simulated before experimental testing and analysis are done. The proposed model is compared to numerous standardised models as part of the performance analysis of the work, and it is discovered to be superior in terms of cost and power loss.

REFERENCES

[1] Singh, Shakti, Prachi Chauhan, and Nirbhow Jap Singh. "Feasibility of grid-connected solar-wind hybrid system with electric vehicle charging station." Journal of Modern Power Systems and Clean Energy 9, no. 2 (2020): 295-306.
[2] Bhargavi, K. M., and N. S. Jayalakshmi. "A new control strategy for plug-in electric vehicle of DC microgrid with PV and wind power integration." Journal of Electrical Engineering & Technology 14, no. 1 (2019): 13-25.
[3] Abulanwar, Sayed, Abdelhady Ghanem, Mohammad EM Rizk, and Weihao Hu. "Adaptive synergistic control strategy for a hybrid AC/DC microgrid during normal operation and contingencies." Applied Energy 304 (2021)
[4] Emara, Dina, Mohamed Ezzat, Almoataz Y. Abdelaziz, Karar Mahmoud, Matti Lehtonen, and Mohamed MF Darwish. "Novel control strategy for enhancing microgrid operation connected to photovoltaic generation and energy storage systems." Electronics 10, no. 11 (2021)
[5] Bhat Nempu, Pramod, and N. S. Jayalakshmi. "Coordinated power management of the subgrids in a hybrid AC–DC microgrid with multiple renewable sources." IETE Journal of Research (2020): 1-11.
[6] Olatunde, Oladepo, Mohammad Yusri Hassan, Md Pauzi Abdullah, and Hasimah Abdul Rahman. "Hybrid photovoltaic/small-hydropower microgrid in smart distribution network with grid isolated electric vehicle charging system." Journal of Energy Storage 31 (2020)
[7] Datta, Asim, Alejandro C. Atoche, Indrajit Koley, Rishiraj Sarker, Javier V. Castillo, Kamalika Datta, and Debasree Saha. "Coordinated AC frequency vs DC voltage control in a photovoltaic-wind-battery-based hybrid AC/DC microgrid." International Transactions on Electrical Energy Systems 31, no. 11 (2021)
[8] Wang, Peng, Dan Wang, Chengliang Zhu, Yan Yang, Heba M. Abdullah, and Mohamed A. Mohamed. "Stochastic management of hybrid AC/DC microgrids considering electric vehicles

charging demands." Energy Reports 6 (2020)
[9] Ding, Ming, Yingyuan Zhang, and Meiqin Mao. "Key technologies for microgrids-a review." In 2009 International Conference on Sustainable Power Generation and Supply, pp. 1-5. IEEE, 2009.
[10] Castilla, Miguel, Jaume Miret, Jorge Luis Sosa, Jose Matas, and Luis García de Vicuña. "Grid-fault control scheme for three-phase photovoltaic inverters with adjustable power quality characteristics." IEEE transactions on power electronics 25, no. 12 (2010)
[11] Kumar, C., and T. Dharma Raj. "A New Nonisolated High-Step-Up DC–DC Converter Topology with High Voltage Gain Using Voltage Multiplier Cell Circuit for Solar Photovoltaic System Applications." Journal of Circuits, Systems and Computers 30, no. 01 (2021)
[12] Jithendranath, J., Debapriya Das, and Josep M. Guerrero. "Probabilistic optimal power flow in islanded microgrids with load, wind and solar uncertainties including intermittent generation spatial correlation." Energy 222 (2021)
[13] Wang, Richard, Shu-Chien Hsu, Saina Zheng, Jieh-Haur Chen, and Xuran Ivan Li. "Renewable energy microgrids: Economic evaluation and decision making for government policies to contribute to affordable and clean energy." Applied Energy 274 (2020)
[14] Li, Xiangke, Chaoyu Dong, Wentao Jiang, and Xiaohua Wu. "An improved coordination control for a novel hybrid AC/DC microgrid architecture with combined energy storage system." Applied Energy 292 (2021)
[15] Xiao, Qian, Yunfei Mu, Hongjie Jia, Yu Jin, Kai Hou, Xiaodan Yu, Remus Teodorescu, and Josep M. Guerrero. "Modular multilevel converter based multi-terminal hybrid AC/DC microgrid with improved energy control method." Applied Energy 282 (2021)
[16] John, Bony, and James Varghese. "Sizing and techno-economic analysis of hydrokinetic turbine based standalone hybrid energy systems." Energy 221 (2021)
[17] Vasudevan, Krishnakumar R., Vigna K. Ramachandaramurthy, Gomathi Venugopal, J. B. Ekanayake, and S. K. Tiong. "Hierarchical frequency control framework for a remote microgrid with pico hydel energy storage and wind turbine." International Journal of Electrical Power & Energy Systems 127 (2021)
[18] Mishra, Sakshi, Kate Anderson, Brian Miller, Kyle Boyer, and Adam Warren. "Microgrid resilience: A holistic approach for assessing threats, identifying vulnerabilities, and designing corresponding mitigation strategies." Applied Energy 264 (2020)
[19] Clarke, Will Challis, Michael John Brear, and Chris Manzie. "Control of an isolated microgrid using hierarchical economic model predictive control." Applied Energy 280 (2020)
[20] Dehghani, Moslem, Abdollah Kavousi-Fard, Taher Niknam, and Omid Avatefipour. "A robust voltage and current controller of parallel inverters in smart island: A novel approach." Energy 214 (2021)
[21] Gargari, Milad Zamani, Mehrdad Tarafdar Hagh, and Saeid Ghassem Zadeh. "Preventive maintenance scheduling of multi energy microgrid to enhance the resiliency of system." Energy 221 (2021)
[22] Mukhopadhyay, Bineeta, and Debapriya Das. "Optimal multi-objective expansion planning of a droop-regulated islanded microgrid." Energy 218 (2021)
[23]Elsisi, Mahmoud, Najmeh Bazmohammadi, Josep M. Guerrero, and Mohamed A. Ebrahim. "Energy management of controllable loads in multi-area power systems with wind power penetration based on new supervisor fuzzy nonlinear sliding mode control." Energy 221 (2021)
[24] Tamalouzt, S., N. Benyahia, T. Rekioua, D. Rekioua, and R. Abdessemed. "Performances analysis of WT-DFIG with PV and fuel cell hybrid power sources system associated with hydrogen storage hybrid energy system." International journal of hydrogen energy 41, no. 45 (2016)
[25] Faramarzi, Afshin, Mohammad Heidarinejad, Seyedali Mirjalili, and Amir H. Gandomi. "Marine Predators Algorithm: A nature-inspired metaheuristic." Expert systems with applications 152 (2020)
[26] Abualigah, Laith, Dalia Yousri, Mohamed Abd Elaziz, Ahmed A. Ewees, Mohammed AA Al-Qaness, and Amir H. Gandomi. "Aquila optimizer: a novel meta-heuristic optimization algorithm." Computers & Industrial Engineering 157 (2021)

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DYNAMIC REAL TIME CRUISE CONTROL SYSTEM (DRT-CCS) WITH ACTIVE ACCIDENT ALERT USING GSM AND SECURED RFID BASED IGNITION SYSTEM

Sayed Mohammed Shafique, Manish Pandit, Avtar Singh Sahota, Krutarth Joshi, Dr. Bhavin Shah, Department of Electronics Engineering Atharva College of Engineering Malad (West), Mumbai-400095

Abstract:
Automotive is a widespread field in the 21st century. Automobiles play an important role as a means of transportation in our daily lives. The term cruise control refers to a concept that assists the driver in the charge of steering the vehicle longitudinally circumventing an accident or collision. As the world's population grows, demand for cars and their daily use soars. This leads to severe traffic congestion, annoyance and risk of accidents.
Automotive Black Box is used to analyze the causes of traffic accidents and prevent personal injury and property damage caused by traffic accidents. This document is constructed on the theme of the Adaptive Cruise Control project.
The proffer system tried implementing DRT-CCS on cheaper devices while improving usability and adding additional features. The purpose of this project is to build a semi-autonomous system. It uses an ultrasonic sensor (HCSR_04) to help the driver steer the vehicle longitudinally while driving. When the ultrasonic sensor's output signal reaches a threshold level, the vehicle speed will first decrease, and if the following distance is too close, the system will stop the vehicle.

Keywords - Dynamic Real Time Cruise Control System (DRT-CCS), Driver Assistance Technology, Sensors, Speed, Distance, Transport Vehicle, Following Distance, Road Safety, Comfort, Rear-end Collision, Manual Speed Adjustment.

I. INTRODUCTION:

In the 1970s, the idea of supporting the driver with a “cruise control device” first appeared in America. The easiest version of CC (cruise control) system shows a linear response in increasing the speed and decreasing it to maintain a constant speed, but not enough to account for all other automobiles present on the road and hence congestion. It was impractical on busy roads. With this in mind, a better version called "Adaptive Cruise Control" (ACC) was soon invented. Controlling of vehicle is done by analyzing the information received from the sensor present in the system. Such systems use ultrasonic sensors, radar, or cameras to allow the vehicle to detect when another vehicle is approaching and brake the vehicle when it exceeds a secure distance set by the owner. Adaptive cruise control does not offer self-determination. This system provides the rider with some assistance and makes the experience smoother and more comfortable. Automotive and computing technologies are creating a new layer of automotive data services. This automotive algorithm is used to predict & analyze the causes of traffic accidents happened earlier so by this is prevent loss of life and property caused by traffic accident. The proposed system uses HC-SR04, IR sensor, RFID, NEO6M, a controller (Atmega328P/Atmega2560) to implement cruise control. Vehicle speed is set according to guidelines set by the developer. This includes breaking the black box state and increasing security.The data received from the sensor is recorded. In addition, in the event of an accident or anomaly, the black box will send his SMS alerts to a predefined mobile number via his GSM module, indicating the vehicle’s location read from the GPS module. [1]

II. LITERATURE SURVEY:

Survey Papers on Automotive Vehicle Accident Detection and Rescue Systems | Springer Link from time to time we read in the newspaper or watch on TV about traffic misfortune around the world. This horrifying news stunned the family of this tragic event. One report said that property damage and such could account for 3% of the world's gross household product. To reduce this percentage,

the suggestion arose to support the driver and assist him on long journeys. States that 90% of road traffic fatalities worldwide occur in low- and middle-income countries, despite only 48% of all registered vehicles (21.5 and 19.5 per 100,000 populations, respectively). Indian statistics are terrifying. A minimum of 13 people die in traffic accidents in every hour, according to the most updated report from the National Criminal Records Bureau (NCRB). [2]

An "ACC (adaptive cruise control) system" helps driver to maintain safe distance from the vehicle present near space of his vehicle. Earlier cruise system was only available on all luxury cars such as Rolls Royce, Land rover and Volvo Trucks. The Transportation department of US and his ACAHSR in Japan are working on to develop "smart vehicles" that can bi-directionally share information among each other with this system called "Cooperative Adaptive Cruise Control."

ACC has been implemented in various new cars abroad, including black boxes. But as you know, these ACC systems have not yet been seen in our cars. Even the working class and ordinary people can't afford cars with adaptive cruise control and black boxes because they have very advanced sensors and security systems so they are very expensive so normal cost sensors and We are trying to implement a system that uses the control system in the car to create a cost-effective ACC and black box system, which can provide accurate and accurate result. [3]

III. ASSOCIATED WORKS:

Present Methods:

Earlier versions of the CC (cruise control) system were actually used when automobile vehicle were first created. Standard CC (cruise control) spontaneously maintains the speed of the car. Driver determines the car's speed by adjusting the position of throttle.

The cruise control system has a speed boundary function that works only at prearranged speeds and stops working beyond that. But as the number of cars on the road increases, traditional cruise control is becoming obsolete.

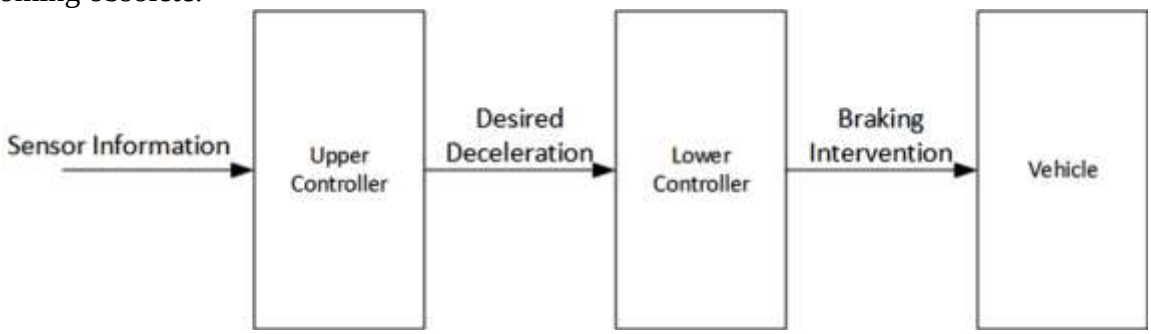

Fig. (1) – General block diagram of Dynamic Real Time Cruise Control System (DRT-CCS)

Proposed Method:

An advanced method of cruise control is the Dynamic Real Time Cruise Control System (DRT-CCS) system. DRT-CCS system not only controls the speed of the car, but it also measures the distance between vehicles ahead and adjusts the speed simultaneously to keep in lane. In the event of an accident, the location of the vehicle is also transmitted. This is an improved feature of the Black Box system. Adaptive cruise control improves fuel economy. Our project is low-cost and user-friendly, meeting the necessary requirements of Dynamic Real Time Cruise Control System (DRT-CCS) (acceleration controlling & distance tracking) and system analyzer and debugger (driver safety by transmitting the driver's location in the form of text message). We aim to implement a system that emergencies. If the driver could have reacted just a few seconds earlier, 60% of head-on collisions would not have occurred," is the result of research and studies to date. To overcome on this problem, researchers have shown that adaptive cruise control considerably improves driver comfort by reducing the driver's tiredness and nervousness and increasing concentration while driving. This will

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make it safer to use and implement DRT-CCS systems in all future vehicles, both electric and manual.[4]

The Figure 1 demonstrates the prototype model of the Dynamic Real Time Cruise Control System (DRT-CCS) system. It tells us about the process of executing CC (cruise control) in a car. Sensing devices (distance sensors, acceleration (speed) sensors and other sensors) collect the information from surroundings. This information is entered to the controller; then controller processes the information and decides to accelerate/decelerate the motor - vehicle and brake accordingly.[9]

IV. BLOCK DIAGRAM:

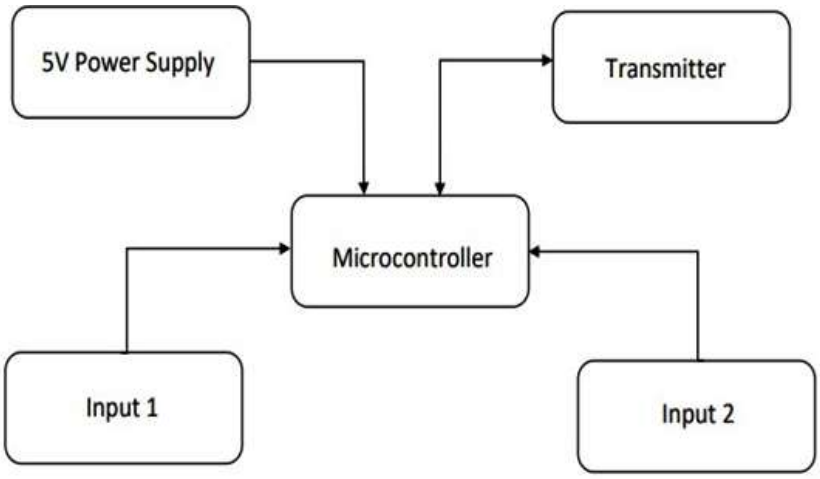

Fig. (2) - Transmitter block diagram

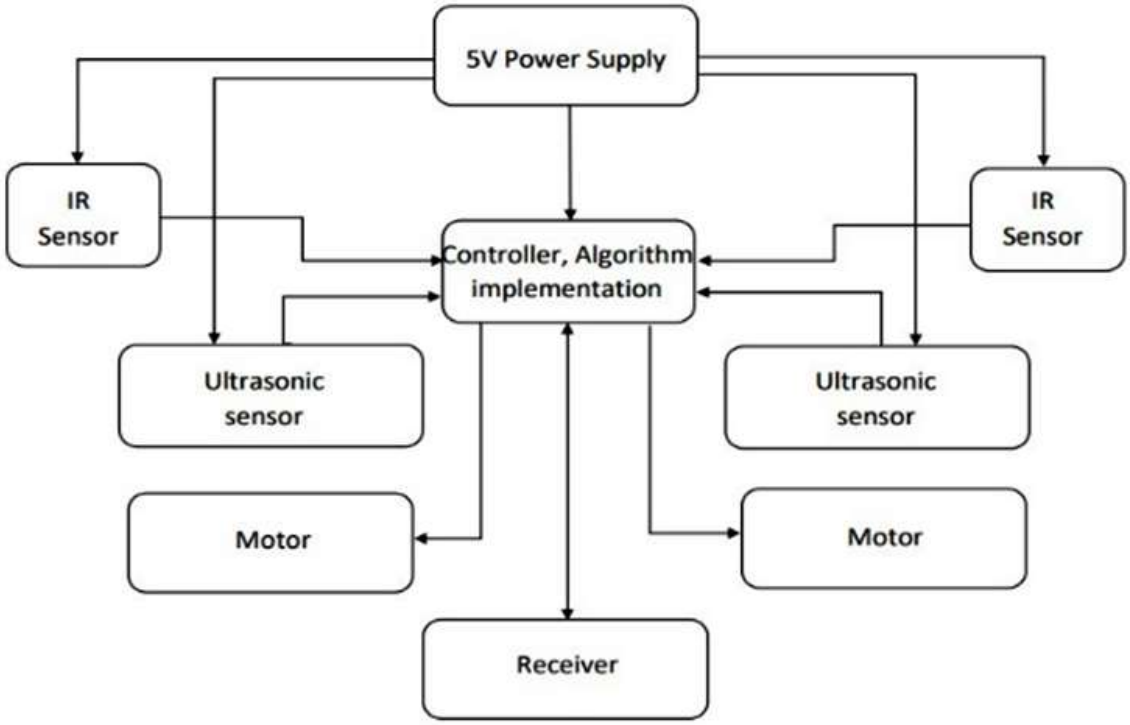

Fig.(3) - Receiver block diagram

V. WORKING:

Dynamic Real Time Cruise Control System (DRT-CCS)is enhanced version of the previously operating cruise control system. With the older system, the vehicle cruises at the rate (speed) set by the controller or in this case driver which allows the driver to keep his feet away from acceleration pedal. Additionally, the Dynamic Real Time Cruise Control System (DRT-CCS) operates on the same

method; it can automatically calculate the rate at which the car in front of you is going by using the data collected from ultrasonic (radars) sensor & accordingly it adjust the rate at which DRT-CCS should drive in order to avoid accident of your vehicle with the vehicle in front of you this also keep look on all the vehicle near you. If the vehicle in front of you is slowing down this vehicle also try to slow down its speed to maintain a safe distance. If the vehicle ahead changes lanes, the system signals to accelerate and reach the correct speed.

Ultrasonic Sensor Value	Motor Speed
1023	255
1020	255
1017	255
1014	255
1011	255
1008	255
1005	255
1002	255
999	255
996	255
993	255
990	255
987	255
984	255
981	255
978	255
975	255
972	255
969	255

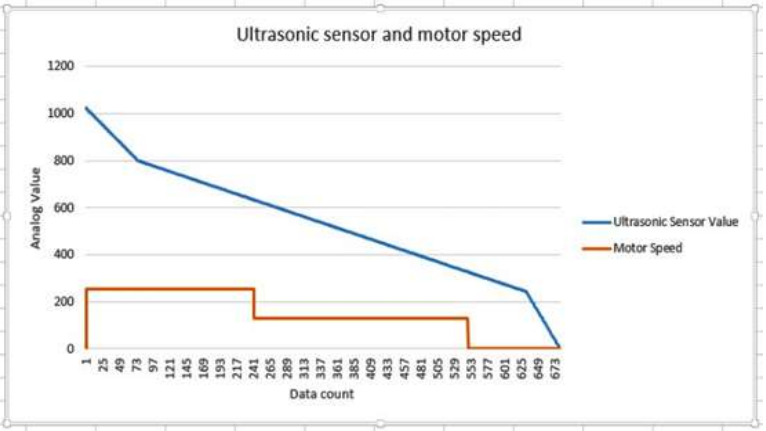

Fig. (6) -Ultrasonic sensor and motor speed

In the above graph illustrate how our motor adjusts its speed based on environment condition. If any vehicle is moving with speed x in front of our vehicle then our vehicle will adjust its speed based on distance sense by ultrasonic sensor and current speed of vehicle in front. Similarly it can implement with the entire surrounding vehicle and not only for front vehicle. In above graph we can see we have set threshold value below which our motor stops automatically this has done to avoid accident.

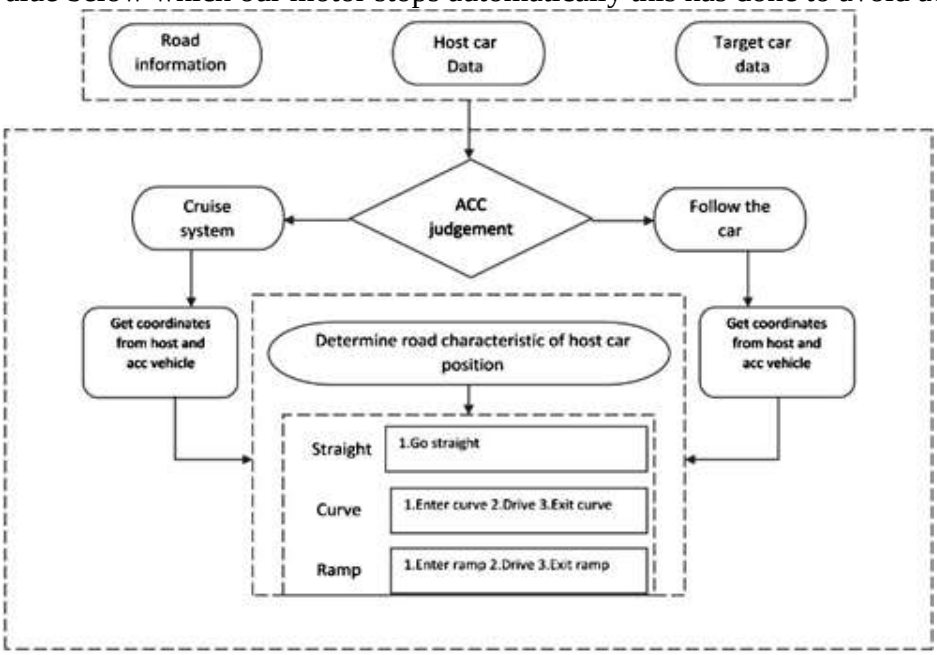

Fig. (7) - Driving condition of vehicle [7]

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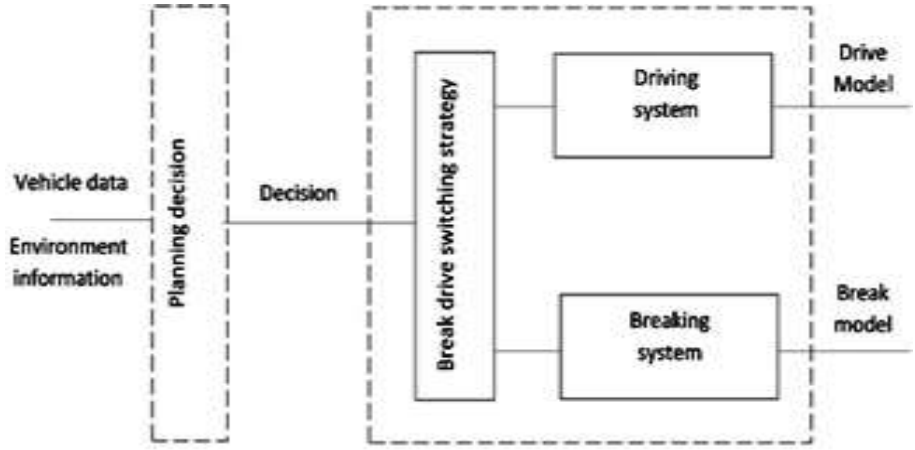

Fig. (8) - Breaking and Driving model

DISTANCE BETWEEN VEHICLE:

The trouble free path to get the distance as centimeters is by using the formula: Centimeters = ((Microsec / 2) / 29). For example, if its taking 100µs (microsec) for the ultrasonic sound to reflect back, then distance is ((100 / 2) / 29) cm or about 1.7 cm.

FOR ROTATION:

1. (Hz x 60 x 2) / number of pole = no-load RPM.
2. ((synchronous speed-rated full-load speed) / (synchronous speed)) * 100 = slip rating.
3. To change SR (slip rating) to Rotation per minute: Rotation per minute x slip rating = Rotation per minute slip
4. To get FL (full-load) Rotation per minute: Rotation per minute - Rotation per minute slip=full-load Rotation per minute.

VI. APPLICATIONS:

1) It can realize automatic cruise control system to avoid accidents and improve user experience.
2) It creates a system with low cost and efficient performance that can be integrated into widely used commuter vehicles.
3) The designed system can be integrated into both cars and bicycles.

VII. ADVANTAGES:

Comfort: On long trips, adaptive cruise control relaxes the driver and allows you to rely on the car for a while without completely taking your eyes off the road. With traffic assistant, ACC makes your daily commute a lot easier.

Speed Consistency: Dynamic Real Time Cruise Control System (DRT-CCS) can move your car at reasonable speeds permitted by national driving authorities. This is especially useful when driving on open highways or other roads where you may hit the accelerator hard for other distractions.

Fuel economy: Driving style is one of the main factors that affect fuel economy. Constantly adjusting speed consumes more fuel. Dynamic Real Time Cruise Control System (DRT-CCS) uses the accelerator and brake system only when absolutely necessary.

VIII. CONCLUSION:

Driver safety and comfort are achieved by the system's adaptive cruise control and black box. An ultrasonic sensor and an LM393 sensor were used to acquire input data, read desired results, and

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control vehicle speed and distance. This also reduces driver braking and shifting. The Thing Speak applet helps you save the data provided by the sensors in graphical form and allows you to view or manipulate the saved data. This reduces stress levels for the driver to drive comfortably, and also ensures the security that the GSM and GPS modules will fortunately and automatically send SMS about your live location in the occurrences of any accident. This system is very viable as a cheap device when used to implement small systems

IX. FUTURE SCOPE:

The Dynamic Real Time Cruise Control System (DRT-CCS) uses LIDAR or radar sensor or in this case ultrasonic sensor technology to determine the distance between two vehicle and speed in order to ensure the safety. Germany is one of the best and the best lucrative market for Dynamic Real Time Cruise Control System (DRT-CCS) in Europe. According to FMI, this growth is due to the high volume of automobile production in the country. Manufacturers of adaptive cruise control systems focus on improving vehicle safety by employing a variety of technologies. According to this study, the Dynamic Real Time Cruise Control System (DRT-CCS) market is expected to grow at a CAGR value of 14.1% to 14.6% in Asia during the predicted period. The addition of advanced Dynamic Real Time Cruise Control System (DRT-CCS) system features in speeding the demand for Dynamic Real Time Cruise Control System (DRT-CCS) system in China.

The rising number of vehicles on country like India and China's roads, along with a increasing population and rising replaceable income, are the factors which influence increasing the demand for Dynamic Real Time Cruise Control System (DRT-CCS). [5]

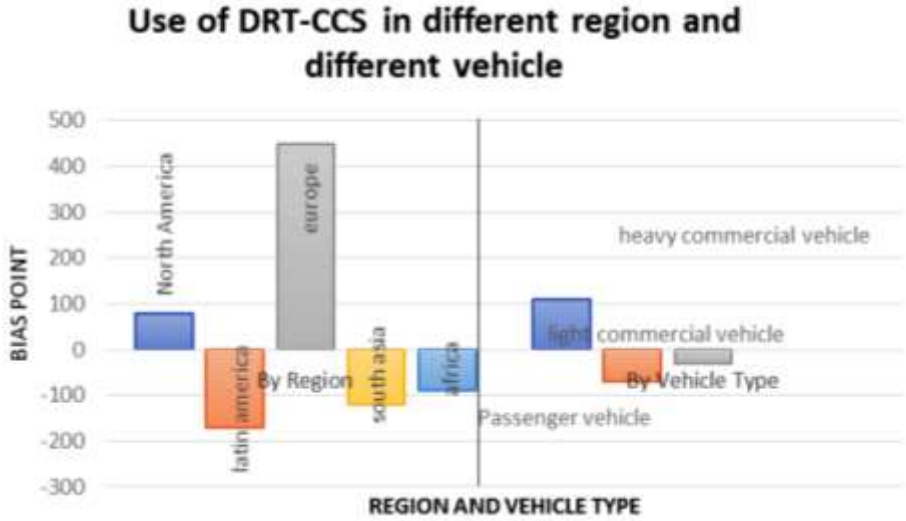

Fig. (9) - Use of DRT-CCS in different region and different vehicle

X. RESULT AND DISCUSSION

Dynamic Real Time Cruise Control System (DRT-CCS) we have tried to make reliable cruse control system with modern feature of lock and safety with this system we can monitor our vehicle performance and location in real time and this was already available in many our advance luxury vehicle we are cutting its cost and making available for low end vehicle so that they can also have so sort of safety.

FEATURES	EXISTING SYSTEM	DRT-CCS
1.LIVE LOCATION	IT'S NOT AVAILABLE IN EXISTING SYSTEM.	WE HAVE MADE IT POSSIBLE IN DRT-CCS
2.ALERT SYSTEM	IT'S NOT AVAILABLE	GET ALERT MESSAGE WHEN SOMETHING HAPPENS WITH VEHICLE
3.RFID	OLD TECHNIQUE ARE USED TILL NOW IN MAY VEHICLE FOR ACCESS	WE HAVE MADE KEYLESS ENTRY TO ACCESS SYSTEM

4.ECONIMOCAL	EXISTING SYSTEM IS PRESENT IN HIGH END VEHICLE	IT CAN BE MADE AVAILABLE TO LOW END VEHICLE TOO.
5.VEHICLE VIEW	ABLE TO GET VEHICLE INFORMATION WHICH ARE PRESENT IN FRONT AND BACK OF THIS VEHICLE	ABLE TO GET VEHICLE INFORMATION IN ALL DIRECTION.

With reference to the result in figure 6 it could be observed that the desired outcome can be achieved with optimum efficiency using DRT-CCS.

XI. REFERENCES

[1] R. Want, "An introduction to RFID technology," in IEEE Pervasive Computing, vol. 5, no. 1, pp. 25-33, Jan.-March 2006, doi: 10.1109/MPRV.2006.2.

[2] Chaudhary, U., Patel, A., Patel, A., & Soni, M. (1970, January 1). *Survey paper on Automatic Vehicle Accident Detection and Rescue System*. SpringerLink. Retrieved January 13, 2023, from https://link.springer.com/chapter/10.1007/978-981-15-4474-3_35

[3] Gulzar, M. M., Sharif, B., Sibtain, D., Akbar, L., & Akhtar, A. (2019). Modelling and controller design of Automotive Cruise Control System using hybrid model predictive controller. *2019 15th International Conference on Emerging Technologies (ICET)*. https://doi.org/10.1109/icet48972.2019.8994444

[4] Edelstein, S. (2021, January 23). *What is adaptive cruise control? Driver-Assistance Tech explained*. Digital Trends. Retrieved January 13, 2023, from https://www.digitaltrends.com/cars/what-is-adaptive-cruise-control/

[5] Reports, V. M. (2022, May 17). *Automotive adaptive cruise control market size and forecast: Robert Bosch, Hitachi, Autoliv, Valeo, Magna International, Mando Corp, Continental, ZF Friedrichshafen, Delphi Automotive, Preco Electronics*. openPR.com. Retrieved January 13, 2023, from https://www.openpr.com/news/2627396/automotive-adaptive-cruise-control-market-size-and-forecast

[6] *Cooperative Adaptive Cruise Control: Human Factors Analysis*. (n.d.). Retrieved January 13, 2023, from https://rosap.ntl.bts.gov/view/dot/36803/dot_36803_DS1.pdf

[7] Howard, B. (2013, June 4). *What is adaptive cruise control, and how does it work?* ExtremeTech. Retrieved January 13, 2023, from https://www.extremetech.com/extreme/157172-what-is-adaptive-cruise-control-and-how-does-it-work

[8] *Prototyping adaptive cruise control on electric motorcycle - researchgate*. (n.d.). Retrieved January 13, 2023, from https://www.researchgate.net/publication/350152028_Prototyping_Adaptive_Cruise_Control_on_Electric_Motorcycle

[9] R. Sundar, S. Hebbar and V. Golla, "Implementing Intelligent Traffic Control System for Congestion Control, Ambulance Clearance, and Stolen Vehicle Detection," in IEEE Sensors Journal, vol. 15, no. 2, pp. 1109-1113, Feb. 2015, doi: 10.1109/JSEN.2014.2360288.

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OH, MY BABY IS CRYING!

Dhanashree Salvi, Poorna Rajesh Pimpale, Suchetadevi Gaikwad, Renuka Nagpure, Assistant Professor Information Technology Department Atharva College of Engineering, Mumbai, India

Abstract:
The paper reviewed research work on comparative analysis of baby crying. N numbers of literature papers are reviewed on cross domain, signal processing technique and machine learning techniques. Crying is one of the forms of communication where infants try to communicate with the surrounding people. The paper depicts comparative analysis between Algorithm CNN, KNN and RNN applied on features of sound collected while the baby is crying on the basis of Body pain, hunger, colic, sleep, Pee and Poop and fake crying of a baby. The existing model monitors the baby crying speech signal and understands the crying signal pattern for Body pain, Hunger, colic, sleep Pee and Poop and Fake crying.

Index Terms – Algorithm

I. INTRODUCTION

Nowadays it has become a very major issue to find what exactly is wrong with the baby when the baby cries. There might be many reasons for crying such as colic, hunger, body pain, pee and poop. These are quite basic reasons of baby crying but there might be major issues when the baby cries such as NRDS i.e Newborn Respiratory Distress Syndrome, vomiting, difficulty in swallowing, due to slow growth of their vital organs, also when the baby is premature as their vital organs are not developed eg: lungs, heart. It becomes very difficult to analyze why exactly the baby is crying. In this paper, the model is proposed to analyze the reason of baby crying using the features such as pitch, amplitude, and frequency of sound of baby cry. These features are trained using the machine learning algorithms such as K-nearest neighbor, Convolutional Neural Network, RNN, Linear Regression, Random Forest, Naive Bayes, Support Vector Machine, Natural Language Processing.

II. OBJECTIVE

System is developed to support and understand the emotion and feeling of an infant baby. System can help to take the required step when the infant cries. It would be a contributing factor in understanding infant feelings and many of the infant lives can be saved and comfort can be provided if the cause is much known on prior basis. For eg. Colic.

III. LITERATURE REVIEW

1. Title: Why is my Baby Crying? An in-depth Analysis of Paralinguistic Features and Classical Machine Learning Algorithms for Baby Cry Classification.
Published year: 2018, 41st International Conference on Telecommunications and Signal Processing. This paper helped to explore baby cry characteristics by looking at different features such as emotion recognition, deception sincerity and native language from speech recognition.
2. In this paper the author has used a classifier which is Deep Neural Network That determines the baby cry considering its fundamental frequency with methods like short time energy linear prediction and also analyzes the baby cry using FFT at initial stages. Title: System for Infant Cry Emotion Recognition using DNN
Published in year: Third International Conference on Smart Systems and Inventive Technology (ICSSIT).
3. Title : Extraction of acoustic features of infant cry for emotion detection based on pitch and formants. In this paper the characteristic feature such as pitch and acoustic formants are considered. K Means algorithm is used on acoustic feature vector to determine the reason of baby cry

and its classes
Published in year: 2019

4. Title : Deep Learning Assisted Neonatal Cry Classification *via* Support Vector Machine Models , 10th June 2021
This article has helped us to understand neonatal cry using Support Vector Machine Models (SVM). In this paper the author has used support vector machine model on the auditory signal from neonatal cry, this signal is transformed using short time fourier transform in to spectrogram image. The images are then trained with Deep CNN and passed
to the Support vector machine classifier .

IV. EXISTING SYSTEM

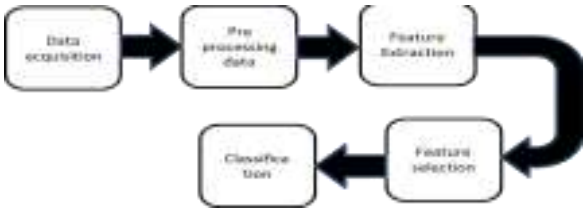

Figure.1. Existing System

A. Data Acquisition
In this module, the dataset is being collected from available resources such as kaggle and the data set is sampled for acquiring the digital numeric values. The sampling techniques that are intended to use in this module are Simple random sampling, cluster sampling, systematic sampling, stratified sampling, probability sampling. Using this method the sound waves i.e the sound of baby cry is converted to digitized value.

B. Pre-Processing Data
In this module the data acquired is pre-processed in order to convert raw data i.e baby cry orsound of baby cry in desired digitized format.

C. Feature Extraction
The data which is pre-processed is trained with the algorithms in order to achieve the features such as pitch, amplitude, frequency of sound of baby cry.

D. Feature Selection
As per the medical studies for detecting the issues in the sound of baby cry, the features are selected to determine the reason why the baby is crying.

E. Classification
Once the desired data is met using the feature selection process, the data is classified using machine learning algorithms.

V. PROPOSED SYSTEM

Baby cry has been proven to be an issue when it becomes difficult to understand why the baby is crying as the cry can be healthy cry and unhealthy cry. The cry has been distinguishedon the basis of medical coefficient value achieved through this proposed system.

A. Speech Signal Acquisition

The baby cry or the analog signals acquired are passed through a sampling module where sampling algorithms such as Simple Random Sampling, Cluster Sampling etc.
Sampling module will produce the required discrete signal which is then passed through the Quantization module. Quantization model converts the discrete signal into the desired digital signal which would be passed to the next model for further processing.

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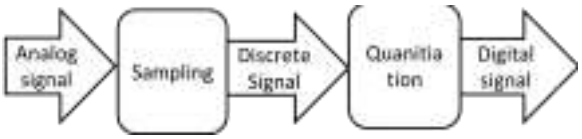

Fig.1 Block Diagram

B. Block diagram for MFCC

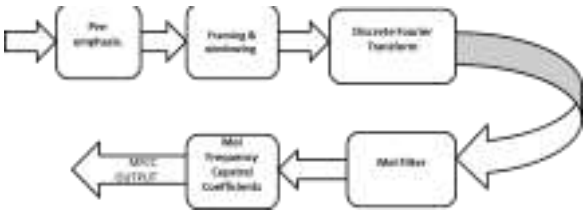

Fig.2 Block Diagram for MFCC

The output acquired from the Speech signal Acquisition model is trained through *Normalisation.*

Pre-emphasis is a process in which the frequencies are trained in order to improve the signal-to noise ratio by minimizing the distortion or saturation of recording media.

Framing and windowing

Once the signal to noise ratio is improved the digitized signal undergoes framing where signal is divided in to frames or blocks.

Windowing

The frames are now trained through windowing where the blocks are splitted into temporal segments by using Discrete Fourier Transform.

Discrete Fourier Transform

The signal acquired or the frames in the form of segments acquired through windowing are trained with DFT in order to achieve the frequency-domain spectral representation of the signal.

Mel Filter

The purpose of Mel filter is to decompose the audio signal using mel frequency scale to separate frequency bands that would mimic the nonlinear human perception of sound. Discrete Cosine Transform

Once the frequency band of the baby cry sound is determined using mel frequency scale it is passed through

Discrete Cosine Transform where a finite sequence of data points in terms of an oscillating cosine functions at various frequencies.

Mel Frequency Cepstral Coef icients

The signal trained with DCT are the compared with the mel frequency cepstral coefficient which would determine the baby cry whether it is healthy or unhealthy. Here using mel frequency the vocal tract is determined which is comparatively smooth as per the source of voice speech which can be modeled as an impulse train. After MFCC model the desired signal with the coefficients is achieved which is being compared to the medical coefficients of the sound in order to conclude that the cry of the baby is healthy or unhealthy.

Feasibility Study

Main concern is about obtaining the real time data set. CNN, RNN etc. have to apply on exciting dataset .Various maternity hospital, pediatrician clinics are approached to acquire the data.

VI.CONCLUSION

This paper aims at proposing a model which determines why exactly the infant is crying using the sound waves acquired from the baby and training the dataset with various machine learning

algorithms to achieve the coefficients that determine healthy and unhealthy cry.

References

[1] Crying Baby - Before 3 Months Old Is this your child's symptom? Last Reviewed:02/06/2023 Last Revised: 12/30/2022Schmitt Pediatric Guidelines

[2] Convolutional Neural Networks for Audio-Based Continuous Infant Cry Monitoring at Home Jiali Xie , Xi Long , Senior Member, IEEE, Renée A. Otte, and Caifeng Shan , Senior Member, IEEE. Published in the Year :IEEE SENSORS JOURNAL, VOL. 21, NO. 24, DECEMBER 15, 2021

[3] Deep Learning Assisted Neonatal Cry Classification via Support Vector Machine Models.RIGINAL RESEARCH article.Front. Public Health, 10 June 2021 Sec. Digital PublicHealth Volume 9 - 2021 |

[4] System for Infant Cry Emotion Recognition using DNN. 2020 Third InternationalConference on Smart Systems and Inventive Technology (ICCSIT).2020

[5]A review of infant cry analysis and classification, Chunyan Ji, ,Thosini Bamunu Mudiyanselage, Yutong Gao & Yi Pan EURASIP Journal on Audio, Speech, and Music Processing. 2021, Article number: 8 (2021)

[6] Infant Cry Language Analysis and Recognition: An Experimental Approach Lichuan Liu, Senior Member, IEEE, Wei Li, Senior Member, IEEE, Xianwen Wu, Member, IEEE and Benjamin X. Zhou Published in the year : IEEE/CAA JOURNAL OF AUTOMATICA SINICA, VOL. 6, NO. 3, MAY 2019

[7] Infant cry classification using CNN – RNN Universitas Indonesia, Indonesia Published in the Year:4th International Seminar on Sensors, Instrumentation, Measurement and Metrology Journal of Physics: Conference Series 1528 (2020)

[8]. Fixed-Frequency MCCF Based Grid Synchronization Technique. Published in the year: 2018 IEEE International Conference on Power Electronics, Drives and Energy Systems (PEDES).2018 [9] Model Reduction of Multivariable Systems by Using New Combined Approach.Published in the year: 2019 IEEE 16th India Council International Conference (INDICON).

[10]Sampling Methods. (2021). Statistical Quality Control, 89–121. Published in the year: 2021 [11] . A Brief Review of Conditions, Circumstances and Applicability of Sampling Techniques in Computer Science Domain. Published in the year: 2020 IEEE 23rd International Multitopic Conference (INMIC). [12]An Infant Cry Recognition based on Convolutional Neural Network Method.Published in the year: 2019 12th Biomedical Engineering International Conference (BMEiCON).

[13] Why is My Baby Crying? An In-Depth Analysis of Paralinguistic Features and Classical Machine Learning Algorithms for Baby Cry Classification. Published in the year: 2018 41st International Conference on Telecommunications and Signal Processing (TSP).

[14] Multiple-Complex Coef icient-Filter-Based PLL for Improving the Performance of Shunt Active Power Filter under Adverse Grid Conditions. Published in the year: 2018 IEEE Power & Energy Society General Meeting [15] The extraction of acoustic features of infant cry for emotion detection based on pitch and formants.Published in the year: International Conference on Instrumentation, Communication, Information Technology, and Biomedical Engineering 2009.

[16]EMOTION DETECTION FROM INFANT FACIAL EXPRESSIONS AND CRIES
Yantorno, Electrical & Computer Engineering Department, Temple University 12th & Norris Streets, Philadelphia,Published in the year 2006 IEEE International Conference on Acoustics Speed and Signal Processing Proceedings.

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REAL TIME CREDIT CARD FRAUD DETECTIONUSING SPARK 2.2

Nakshatra Naik, Omkar Goilkar, Samarth Korgaonkar, Pranav Bhatt Department of Electronics and Telecommunication, Atharva College Of Engineering, Mumbai-095, Maharashtra

Abstract

Abstract The use of computer technology to aid modern fraud transaction problems has revolutionised the banking industry. As there is a tremendous increase in the fraud transac- tions, the study highlights the new technologies help in transforming enterprise into a digital world. The code and server setup is completed using Intellij framework. Project demonstration is done using Intellij Development Environment. Dashboard and real time fraud transaction is demonstrated using Apache Spark Standalone Cluster using Airflow automation.

Keywords: *Apache Spark; Cassandra; Kafka; Intellij; Springboot; Node.js; Airflow Automation.*

Introduction

A credit card allows you to make purchases and pay for them later. In that sense, it's like a short-term loan. When you use a credit card to make a purchase, you're essentially using the credit card company's money. The biggest advantage of a credit card is its easy access to credit. Credit cards function on a deferred payment basis, which means you get to use your card now andpay for your purchases later. The money used does not go out of your account, thus not denting your bank balance every time you swipe. The use of credit cards has replaced cash transactions asthe preferred method of payment.

A large concern on fraud; Credit card fraud is the most common type of identity theft. Credit card fraud is the most common type of identity theft because of the increasing popularity of credit cards. Every year, millions of people fall victim to credit card fraud in INDIA alone due to the estimated 1.5 billion credit cards in the country. Lost or stolen credit cards are sometimes used by criminals to commit fraud. Some people make illegal transactions without ever touching their credit cards. An unauthorised transaction that is carried out with the credit cards, a fraud can take place by physically stealing the card or by stealing the card information via phishing or credit card skimming and using it to make payments, or withdraw cash.

This era of human history where computing has moved from mainframe's PC's to big data and Machine Learning. These technologies contribute significantly in every industry and provideseamless solutions to detect fraud transactions.

1. Related Work

The organisation of the paper is as follows. Section 1 explains the need of automation in banking industry, section 3, 4 and 5 defines the significant concept of Apache Spark framework,Kafka and Apache Cassandra database. Section 6 gives information about the implementation of the study with 5 subsections of Dataset, Experimental Setup, Fraud Detection Architecture, Air Flow Automation and Clean up which comprises information about the main architecture of the study. Section 7 talks about the results and real time fraud alerts displayed on the dashboard.

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2. Apache Spark

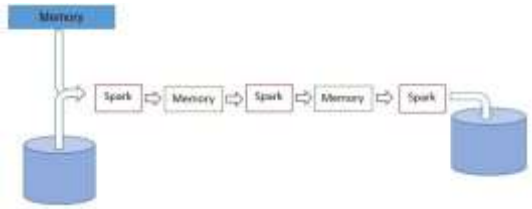

Figure 1. Apache Spark

Spark is an open-source analytics engine for processing large data sets, a distributed processing framework. Apache Spark is an essential component of the Hadoop ecosystem. The framework acts as a single platform for different kinds of data processing techniques such as SQL processing, Machine learning and graph processing. Using a single framework such as Apache Spark, all of these data processing tasks can be accomplished. Data is represented as RD, Data frame or data- set. Spark provides various libraries for data processing. For SQL and ETL processing Spark SQL is used. Real time processing is done by using Spark Streaming library. Machine learning uses Spark ML library. For graph processing Spark GraphX library is used. The framework acts as an in-memory data processing engine, so besides reading the data from the file system, it can also read data from the memory and retain the data in memory.

3. Kafka

Figure 2. kafka

Apache Kafka is primarily used to build real-time streaming data pipelines and applications that adapt to the data streams. It combines messaging, storage, and stream processing to all low storage and analysis of both historical and real-time data. This is a distributed Persistent Circular Message Queue that is not implemented on a single system but instead on a cluster of systems. For durability, messages are stored on the disk, while for faster access, they are stored in memory. Old messages are deleted automatically every week by default. Through its function as a message broker, Kafka facilitates and processes communication between two applications. In the project, the Credit Card App will send messages to Kafka and applications like Samza. Spark Streaming consumes transaction details from Kafka and will process the details in real time. Web application will directly consume the data from Kafka and will display it on the web UI.

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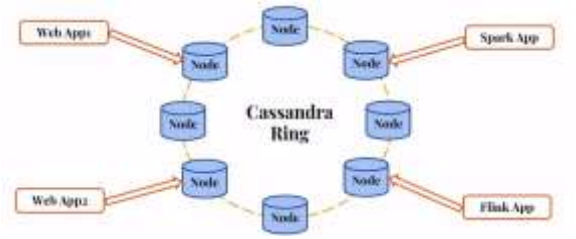

Figure 3. Apache Cassandra

4. Apache Cassandra

The Cassandra database management system is an open source, distributed, NO-SQL database designed to support large amounts of data. Used as a storage layer. Cassandra follows a ring architecture. It is not implemented as a master slave model hence there is no single point of failure. Every node is equal, if any node goes down there is another node to help clients to access the data. Data is directly returned to the memory. Cassandra is linearly scalable and consists of flexible storage. Data must be denormalized through features like 'collections' before storing the data because it does not support joins between column families.

5. Implementation

This section contains an overview of the software installation, code setup and project demon-stration to actively perform the study.

5.1. Data-set

Existing data is present in the resource directory. In this directory there are customer.csv and transactions.csv files. Customer.csv file contains all the details regarding the customer. Transac- tion.csv contains all the transaction details such as credit card number, merchant name, transaction ID and transaction timestamp, etc. These two data sets are imported into the Cassandra database.

5.2. Experimental Setup

The study uses virtual box, Ubuntu and Intellij IDE to run the Spark Jobs. Firstly, connect to Cassandra server through Cassandra console client and create tables and databases in Cassandra. Next we need to start the dashboard server. Whenever there is a fraud transaction it will be displayed here. Zookeeper server is bundled with Kafka, go to kafka and start the zookeeper server. Lastly, start the kafka server and kafka topic, our topic is Credit Card Transaction.

5.3. Fraud Detection Architecture

Figure 4. Fraud Detection Architecture

Figure shows that the existing file systems are imported from file system to cassandra , to import the files we'll run spark jobs. The Spark SQL reads the data and will save the data

into the Cassandra database. Now, run Spark detection training- Spark ML job which reads the data from cassandra and will train the model accordingly. The model will be saved on the file system. After that will start streaming jobs, it will load the model that was created by previous Spark ML jobs, it will also start consuming the credit card transactions from kafka and will predict whether the Transactions are fraud or not. These predictions are saved on the Cassandra database. After Streaming jobs the Kafka Producer will start. Kafka producer takes input arguments. It will randomly generate the credit card transactions and will publish it to kafka. The spark streaming jobs that are waiting for these messages will consume these messages and will predict if the transactions are fraud or not and will save the predictions to cassandra. From Cassandra database fraud transactions are alerted on the dashboard. The spring boot is used to display fraud transactions on the dashboard.

5.4. Apache Airflow Automation

Air flow automation is required to run the spark jobs on a regular basis. To update the model with the new transaction details we need to run the spark jobs on a regular basis. Spark Jobs reads the old and new transaction data and will create a new updated model. In the project Apache Airflow is used for automation.

5.5. Cleanup.

The cleanup is required so the project can be implemented from scratch. In a cleanup process we need to stop the servers. Always stop the Kafka server first and then the zookeeper server.

6. Result and Conclusion

The results obtained are data or facts obtained from research. In this study, we initiated the discussion by describing the current situation of the credit card business with respect to fraud issues. Although new technology is available and widely supported by banks and merchants globally to lessen or perhaps eradicate the repercussions of credit card fraud, some researchers are starting to challenge its design and implementation. This paper suggests building a model based on the spending behaviour of the card holders and using it to detect anomalous transactions. Benefits of implementing such a detection system will lessen the phone and SMS costs shouldered by the banks; instead of sending SMS transaction notifications to all customers, messages will be sent to those customers with detected anomalous transactions.

References

[1] A NoSQL Database Approach for Modeling Heterogeneous and Semi-Structured Information, 2018 9th International Conference on Information, Intelligence, Systems and Applications (IISA).
[2] Credit Card Fraud Detection Using Machine Learning, 2021 International Conference on Advances in Computing, Communication, and Control (ICAC3)
[3] Machine learning and its applications: A review, 2017 International Conference on Big Data Analytics and Computational Intelligence (ICBDAC)
[4] Online Transaction Fraud Detection System, 2021 International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE)
[5] Credit Card Fraud Detection Using Machine Learning, 2021 5th International Conference on Intelligent Computing and Control Systems (ICICCS)

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AN OVERVIEW ON THE ADOPTION OF BLOCKCHAIN TECHNOLOGY IN THE TRADING OF ENERGY

Prof. **Garima Gurjar Unhale, Dr. Yogesh Pahariya** Professor, Department of Electrical Engineering, Sandip University, Nashik, India

Abstract— Blockchain based energy trading have gained popularity in academia and business, this study provides a literature analysis of Energy trading based on Blockchain in the possible areas. The background and development process are presented, and then a review and analysis of block-chain applications in the area of energy trading is done. Final thoughts are summarized, and significant future opportunities in this field are highlighted.

Keywords— *Ethereum, Energy trading, Blockchain, Incentivization, Smart contract*

I. INTRODUCTION

Interconnected micro grids' (IMGs') energy management and trading has lately received attention [1]. To provide local players, including residential, commercial, and industrial clients with sustainable, clean, and affordable energy, a market integration across diverse micro grids is being built [2]. Energy infrastructure is progressively incorporating renewable energy, notably solar energy, thanks in part to financial incentives from the government and the money saved on energy bills as well as growing environmental consciousness [3]. Prosumers are a category of consumers who generate a portion of their energy requirements on-site using microgeneration equipment and supplement that with grid purchases as necessary [4]. Multiple prosumers living close to one another can create prosumer communities or micro grids [5]. Prosumers can either use the solar energy they produce for their own needs or sell any excess to the grid or other consumers. As a result, energy trading is a popular form of practical energy sharing in everyday life [6].

However, in conventional P2P energy trading systems, it is impossible or difficult to ensure participant trust, set the energy trading price, or enforce agreement fulfilment without the help of a reliable third party [7]. Additionally, because RESs are sporadic, some persons struggle to meet their energy needs while others are in excess [8]. Due to DG's efficient energy trading system, small-scale energy providers can now exchange and preserve energy in decentralized manner. The implementation of blockchain, which has been used successfully in many industries due to its well-known advantages, is being used to address the issues that have limited the effectiveness of conventional energy trading methods, such as security, privacy, trust, and the determination of energy pricing [9].

Numerous research has been undertaken on the subject [10], but the usage of blockchain technology in energy trading industry is particularly interesting and promising one. Customers can choose suppliers in a scheme based on the blockchain for energy trading on their own deciding factors, like

dealing with nearby providers or utilization of clean energy, to reduce their electrical energy costs and enhance their distributed renewable energy return on investment. Some experts looked into the viability of using distributed technology to the energy market before formally attempting to integrate blockchain with the energy trading paradigm [11]. The P2P (Peer to peer) framework, which is supported by data, supports the participation of so-called "prosumers" and permits the market for trding of energy to operate in an user centric way, greatly expanding the flexibility of the traditional energy market mode [12–14]. In order to address the issues of users' privacy, security, resource management, and price termination in smart grids, effective and efficient solutions are needed. Sustainable cities and communities depend on the solutions.

II. Literature survey

BEST, a secure platform for trading of energy for EV application using Blockchain, was created by Rajat et al. [15] for their study (EV). In particular, BEST leverages distributed blockchain to validate EV requests, ensuring robustness against single point of concern. The nodes chosen by miner are nominated to authenticate the requests in accordance with the energy requirements, length of stay, dynamic pricing, connectivity history, and additional factors that are significant at the time of operation. Additionally, s/w-defined interaction is used as the backbone of the system to allocate requests from EVs to a worldwide software-based network controller in order to give real-time services. Finally, BEST is evaluated based on the expenses associated with various communications and computation costs between EVs and the smart grid. In order to boost network throughput, it will be necessary to look at the SDN's flow management method in the future.

Esmat et al. developed a novel market and decentralized P2P energy trading platform based on Blockchain [16]. A simultaneous, pool-structured auction for a brief period of time and a ground-breaking, distributed Ant-Colony Optimization clearance mechanism are also included in the market layer. This market structure ensures a close to ideal market outcome, protects players' anonymity, and permits trade of market goods throughout time. The blockchain layer's significant level of automation, security, and efficient real-time settlements are made possible by the usage of smart contracts. The platform's capabilities for energy trading, market clearing, smart contract operations, and blockchain-based settlement are then simulated using real data. One of the limitations of this approach is that it fails to take into account the prosumer's ambiguous commitment and the intermittent nature of RES.

SURVIVOR: Jindal et al. [17] introduced a Blockchain-based on Edge-as-a-Service is basis for safe and Secure Energy Trading in a V2G environment using (SDN) Software Defined Networking. To make energy trading decisions near the EVs, the suggested system employs edge nodes. Additionally, all currently active nodes are used to choose approver nodes, based on a utility function to be in charge of validating transactions, and blockchain is used for safe energy trading. As soon as such nodes have been chosen, a consent-based blockchain technique for secure trading of energy in an S/W Defined Network-permitted V2G environment is next given. Future performance assessments of the proposed work can be made via the consortium blockchain system.

Zhou et al[18] .'s improvements to the decision-making trial and evaluation laboratory (DEMATEL) method include the construction of an obstacle analysis model for the relevant scenario and the use of a hesitant fuzzy linguistic word set and K-mediods clustering algorithm. In comparison to the conventional DEMATEL method, the assessment data collection is more precise and adaptable. Additionally, there may be more than two categories for the severity of an

effect, and the classification of obstruction factors is more precise. Prior to providing an overview and analysis of six specific application cases, thirteen barriers to its implementation in power trading are first mentioned. Following that, each possibility is thoroughly examined, including the causal process, impact degree classification, and quantification of influence among obstacles. In the upcoming work, the design and architecture of the blockchain trading platform in each application scenario will be more thoroughly investigated.

For the autonomous usage of Micro Grids with (PEJ) power electronic jointing based on (M-S) master-slave that is created in the Industrial Internet of Things environment and carried out by a superior array while a inferior array calculates the appropriate control procedures for the Power Electronic Jointing, by Xu et al. presented a brand-new load-sharing method for renewable MGs and a secure energy policy. A superior layer of intelligent control is accomplished via a (DMAS) decentralized multi-agent system on the basis of communication. MAS balance of power control and economic load dispatch are the two different control techniques used by the layer. Many people who work in, manage, or plan to work in the energy sector are very interested in the subject of blockchain technology. A shared and distributed database is made possible by blockchain technology (B.CT), which also delivers secure, transparent, automatic, and reasonable priced operations in power distribution networks. In forthcoming work, the authors will carefully review and discuss recent suggestions for remedies to the blockchain scale problem, like decentralized storage and plasma. Cryptographic system concept for use in scenarios involving the Smart Grid was shown by Skowronski et al. [20]. In addition to handling and encouraging the necessary data transmission and storage, the strategy aims to promote the spread of green field energy. Supply and demand dynamics entirely determine the value of both the cryptocurrency and the energy itself. In the design, Smart Meters are the sole reliable actors. They also emphasize the significance of structures required by a system, such as being regarded secure, dispersed, and in fact, decentralized, with a improved level of safety provided by end-to-end encoding and secrecy provided by unspecified identities. However, owing to the platform's openness, there are numerous ways to ensure legal compliance in every nation.

III. Problem addressing using Optimization technique

A micro grid within the traditional energy trading system will assist buyers and users in trading small expanses of energy during each short-term trading time period. On the basis of this supposition, Prosumers and consumers would find it challenging to inquire or bid in each trade for each period. It is vital to set a single price for each period based on the overall supply and demand offered in order to reduce this difficulty. Since energy is exchanged online, it is critical to prevent the sale of the same energy more than once. As a result, it's required to construct an energy possession structure inside of a smart contract. Unless expensive firewalls are installed, systems based on server are similarly susceptible to hackers and manipulation. The rate and maintenance expenses brought on by the secure implementation may be too expensive for micro grid-based P2P trade on a small scale.

IV. Methodology

In order to create a dynamic rating function to set equilibrium in supply and demand among buyers and users and carry out secure trading within a microgrid, this proposal suggests a novel Smart contract-based block chain framework-based peer-to-peer(P2P) secure trading of energy system. The suggested system is based on a dynamic rating function that balances supply and demand within a micro grid and is based on block chain technology. The ratio of total supply to total demand determines whether prices go up or down each time. Prosumer (consumer) supply and demand will be encouraged or discouraged by the higher or lower price during the necessary

trading period. In order to resolve any disagreements and carry out energy trade processes automatically, a smart contract built on the blockchain is used.

The private block chain linked to the micro grid must first get registration information from each prosumer or consumer planning to trade energy, according to the suggested structure. A digital signature (DG) from the account owner is included in each transaction that includes an externally held account. For the choosing a miners and creation of blocks, this framework uses a proof-of-closeness (PoC) consensus process. The transaction it delivers is the owner's responsibility, and the digital signature ensures validation and nonrepudiation. The transaction gets mined into a block once it has been confirmed to be genuine. Participating nodes transmit transactions that contain information on which functions should be executed, the parameters needed to perform those functions, the smart contract's compiled byte code, and the smart contract with the relevant address. As soon as the transactions of energy are injected into a block, all nodes implement the smart contract (SC) functionalities according to the defined parameters. When a prosumer injects the surplus energy, notification in form of message is employed to create an element with the updated status showing "Injected Energy." Energy transmission between participants is handled by the DSO, a block chain network operator. In addition, it runs the blockchain network and develops or updates smart contracts for the exchange of energy. By avoiding the lengthy consensus process, it enables a node to communicate with other nodes directly rather than through the block chain. Accordingly, only the qualified node's private key(s) can be used to update the states (s). There is no possible method for hackers to alter these conditions without exposing the necessary private key (s). The variations in energy possession that occur while transaction of energy are kept inside a structural arrangement that is included in the smart contract and is therefore secure, which also prevents the double sale issues. The suggested (P2P) secure trading of energy system built via a block chain framework is crucial for creating sustainable cities and societies.

V. Architecture Diagram

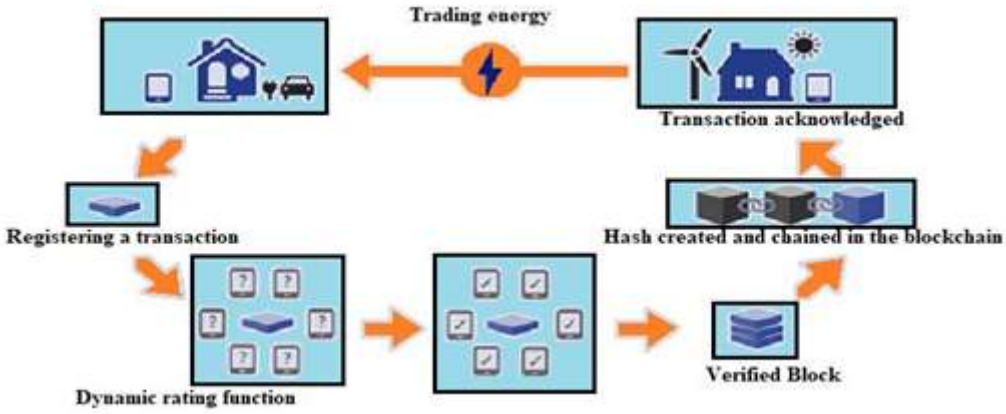

Fig1: Architecture of Authentication by Smart Contract

Conclusion

Many scholars are interested in blockchain-based energy trading as a powerful and developing technology. This essay reviews the main problems into the subsequent four points after reviewing the literature: (1) creation of the trading platform; (2) considerations regarding the operation mechanism's; (3) redundancy, economics, privacy, security and scalability of the trading platform; and (4) use of the novel technology of the platform used for trading. The majority of research are still in the initial stages, the creation of a platform that will be utilized for Energy trading and the application of effective algorithms will be substantial research in the future.

References

1. Hamouda, Mohamed R., Mohammed E. Nassar, and Magdy MA Salama. "Centralized Blockchain-Based Energy Trading Platform for Interconnected Microgrids." *IEEE Access* 9 (2021): 95539-95550.
2. Williams, Nathaniel J., et al. "Enabling private sector investment in microgrid-based rural electrification in developing countries: A review." *Renewable and Sustainable Energy Reviews* 52 (2015): 1268-1281.
3. Shahsavari, Amir, and Morteza Akbari. "Potential of solar energy in developing countries for reducing energy-related emissions." *Renewable and Sustainable Energy Reviews* 90 (2018): 275-291.
4. Oberst, Christian, and Reinhard Madlener. "Prosumer preferences regarding the adoption of micro-generation technologies: Empirical evidence for German homeowners." (2014).
5. Sousa, Tiago, et al. "Peer-to-peer and community-based markets: A comprehensive review." *Renewable and Sustainable Energy Reviews* 104 (2019): 367-378.
6. Okoye, Martin Onyeka, et al. "A blockchain-enhanced transaction model for microgrid energy trading." *IEEE Access* 8 (2020): 143777-143786.
7. Wang, Naiyu, et al. "When energy trading meets blockchain in electrical power system: The state of the art." *Applied Sciences* 9.8 (2019): 1561.
8. Bhandari, Binayak, et al. "Mathematical modeling of hybrid renewable energy system: A review on small hydro-solar-wind power generation." *international journal of precision engineering and manufacturing-green technology* 1.2 (2014): 157-173.
9. Khan, Minhaj Ahmad, and Khaled Salah. "IoT security: Review, blockchain solutions, and open challenges." *Future generation computer systems* 82 (2018): 395-411.
10. Andoni, Merlinda, et al. "Blockchain technology in the energy sector: A systematic review of challenges and opportunities." *Renewable and sustainable energy reviews* 100 (2019): 143-174.
11. Wang, Qiang, and Min Su. "Integrating blockchain technology into the energy sector—from theory of blockchain to research and application of energy blockchain." *Computer Science Review* 37 (2020): 100275.
12. Kahn, M. T. E. "DIGITAL BLOCKCHAIN TECHNOLOGY IN ENERGY: A TECHNICAL REPORT FOR SMART TRANSACTIONS IN THE AGE OF SOCIAL DISTANCING."
13. Mengelkamp, Esther, et al. "Designing microgrid energy markets: A case study: The Brooklyn Microgrid." *Applied Energy* 210 (2018): 870-880.
14. Zhou, Yue, Jianzhong Wu, and Chao Long. "Evaluation of peer-to-peer energy sharing mechanisms based on a multiagent simulation framework." *Applied energy* 222 (2018): 993-1022.
15. Chaudhary, Rajat, et al. "BEST: Blockchain-based secure energy trading in SDN-enabled intelligent transportation system." *Computers & Security* 85 (2019): 288-299.
16. Esmat, Ayman, et al. "A novel decentralized platform for peer-to-peer energy trading market with blockchain technology." *Applied Energy* 282 (2021): 116123.
17. Jindal, Anish, Gagangeet Singh Aujla, and Neeraj Kumar. "SURVIVOR: A blockchain based edge-as-a-service framework for secure energy trading in SDN-enabled vehicle-to-grid environment." *Computer Networks* 153 (2019): 36-48.
18. Zhou, Jianli, et al. "Prospects and obstacles analysis of applying blockchain technology to power trading using a deeply improved model based on the DEMATEL approach." *Sustainable Cities and Society* 70 (2021): 102910.
19. Xu, Weicheng, et al. "Blockchain-based secure energy policy and management of renewable-based smart microgrids." *Sustainable Cities and Society* 72 (2021): 103010.
20. Skowronski, Rafal. "On the applicability of the GRIDNET protocol to Smart Grid environments." *2017 IEEE International Conference on Smart Grid Communications (SmartGridComm)*. IEEE, 2017.

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IMPACT OF LOCKDOWN DUE TO COVID-19 ON HUMAN LIFE AND ENVIRONMENT ININDIA

Manisha Deshpande (Asst Professor – Mathematics, PCCOE&R),
Hemant deshpande

Abstract
The Pandemic COVID-19 is causing lockdown with enormous changes in human life and the Environment. It has an impact on the economy and keeps on giving rise to unemployment. This research paper includes an Analysis of the Statistical Data obtained from the survey to come to a consensus to conclude what is the impact of COVID-19 pandemic lockdown on living being and the environment. The research also compares the results obtained from the statistical survey on Environmental changes, impact on Economy and understanding importance of self and social hygiene due to lockdown. The insight rom article provides an account of the potential impact of COVID-19 in Indian society and helps one to draw measures to mitigate the effects off pandemic.

Keywords :COVID-19, Pandemic, Lockdown, Survey, Hygiene, Skills.

Introduction

The eruption of COVID-19 in Wuhan, China set the whole world in a situation of panic on how tocontrol this Pandemic as there is no vaccine available for overcoming corona virus 2. Social distancing and taking hygiene related precaution was the only option available with all countries.'With more than 1.36 billion population India is highly populated country in the world with population density of 414 people per km2.' **[1]** COVID-19 situation was a sitting time bomb to beexploded had the lockdown not been imposed. In India first a one-day Isolation being declared on21st March 2020 thereafter understanding the situation worldwide extended the lockdown for 21days from 24th of March 2020 and continued the lockdown till 17th May 2020 to keep control on the pandemic in areas of high alerts considering the request from various state governments. Due to this lockdown various difficulties were faced by human beings as it was a period of more than two months. This research has a survey of how this Pandemic has helped human beings to explore the different technological advancement for sustaining daily life and how this has helped them to be more conscious of their own health and wellbeing. This research also studies the changes caused due lockdown on environment especially on Air and Water pollution. This surveyalso tries to explore the thought process of human beings on how the economy would be impacted due to this lock down. It explores the assertiveness of India's fight against COVID-19 comparedto the rest of the world. Another facet of this survey is to look how the mortality rate has changed due this pandemic. This research will also compare the data obtained from the survey with actualresearch done in past and current that will help to take some precautionary steps for reducing the post pandemic effect.

Literature Survey

The study done in UK **[2]** showed that period utilized for employment-related activities had a dropof d by 17–43 minutes on average compared to before the pandemic. Although the trajectory of change was constant throughout population subgroups, the magnitude varies. There was a shift in negative side for time spent on employment activities for employee **[2].** Also our survey results are in line with survey done in China **[3]** where the relationship between parents and children shows a positive trend due to quality time spent during lockdown. Lot of research has already been done on parent and child relationship comparing time spent by mother and father with children in

[4] which also states that quality time spent decreases with the age of child, the survey in paper **[5]** reflect increase in time period given for household work, child care, and family. Organization facedvarious challenges like (a) hiring freezes and layoffs; (b) salary freezes, cancelled bonuses, and pay reductions; (c) the nature of work (teleworking); and (d) an increase in employee stress and burnout. **[6]** The side effect of Pandemic lockdown was work from home which in turn helped theorganization run employee engagement activities successfully**. [7]** In research paper **[8]** study about Knowledge, positive attitude and healthy a preventive practice of Type 1 Diabetes Mellitusyoung adults was carried out which should lack of proper awareness. The solution suggested wascampaigns to be conducted in rural areas to spread correct knowledge about basic hygiene and utility of insulin/needled/syringes.

The paper **[9]** concluded that there is a need for regular educational interventions and training programs on infection control practices for COVID-19 across all healthcare professions. Occupational health and safety are of paramount importance to minimize the risk of transmission to healthcare students and professionals and provide optimal care for patients. The first evidence for this saying holds good is due to the pollution control report by IQAIR, Cities with historically higher levels of PM2.5 pollution witnessed the most substantial drops, including Delhi (-60%) **[10]**. In another research **[12]** among other pollutants, NO2 (−52.68%) and CO (−30.35%) level had also reduced during-lockdown phase. About 40% to 50% improvement in air quality was identified just after four days of commencing lockdown.

Many countries including China, Italy, United Kingdom and Germany experienced falls in carbondioxide and nitrogen dioxide of as much as 40%, greatly improving air quality and reducing the risks of asthma, heart attacks and lung disease **[12]**.

The pandemic demonstrated that pollution lowers our resistance to disease. Research showed that tiny pollutant particles (PM2.5), breathed over many years, sharply increased the chances of dying from the virus. Countries that averaged just one microgram per cubic meter more PM2.5 in the airhad a COVID-19 death rate that was 15 percent higher **[13] [16].**

The particles penetrate the body, promoting hypertension, heart disease, breathing problems, and diabetes, all of which increase complications in corona virus patients. PM2.5 also weakens the immune system and triggers inflammation in the lungs and respiratory tract, adding to the risk both of getting COVID-19 and of having severe symptoms. **[13][16]** This observation confirmed a 2003report that death rates due to SARS in China's most polluted areas were twice as high as in the least polluted ones **[13][16]**. Within the short period of lockdown, we experienced a clearer environment which created the image of real world that human need to maintain after pandemic.For example, people in India reported seeing the Himalayas for the first time from where they live; and in Delhi, levels of both PM2.5 and nitrogen dioxide fell more than 70 percent **[13][16]**.

A noticeable improvement in natural water quality was found by researchers and scientist during lockdown. The longest freshwater lake Vembanad, showed significant improvement in surface water quality in terms of suspended particulate matter (SPM) **[14]**. The SPM concentration duringthe lockdown period decreased by 15.9% on average (range: 10.3% to 36.4%), up to 8 mg/l decrease compared with the pre-lockdown period. **[14]** Time series analysis of satellite image collections (April 2013 – April 2020) showed that the SPM quantified for April 2020 was the lowest for 11 out of 20 zones of the Vembanad lake. When compared with preceding years, the percentage decrease in SPM for April 2020 was up to 34% from the previous minima **[14]**. The water in Venice's canals also became much clearer, with small fish visible swimming around. **[15]** The quality of work life, during pandemic, it is characteristics and various stages along with different factors are explained in **[17]**. The effect of pandemic on the employees of different sectors such as education, software industries, agricultural industries (Farmers) and real estate studied and analyzed by data analysis with mathematical modeling

through rough set theory, probability and graph theory.
There are different mathematical models used to study actual impact of COVID-19. The severity of the pandemic is measured by two pragmatic formulae known as the progressive recovery rate (PRR) and progressive mortality rate (PMR) **[18]**. By reducing dependent symptoms of COVID- 16, the probability of having COVID-19 is studied in **[19]**. All types of viruses and their growth rates are defined through graph theory in work **[20]**.
The article **[21]** makes an effort to evaluate the effect in both the short- and long-term. The fiscal year 2020–2021 has been designated as the short term. Five years, from 2020–2021 to 2024–2025,have been designated as the long term. Operationally, the evaluation of the effects on the economyhas been defined as the effects on the important economic indicators listed below**,**

- GDP
- Unemployment rate
- Inflation rate
- Interest rate
- Industry output

Methodology used
We have used stratified sampling method to collect the sample of data across age group, different professions and geographical zones. A survey through online Google form is conducted on below mentioned questions. 551 responses were studied and analysis of the same ispresented in study area of each question separately. Also, recommendations are suggested to sustain the positive results post lockdown achieved during lockdown period caused due to
Covid-19. We have given 5 options for the participant to rate these answers with 1 beingPoor/No and 5 being excellent/high impact.
Below are the questions included in the google form,
1) The quality time spent with family due to the lockdown caused by COVID-19, Pandemic. (Comparison of survey analysis and research data available)
2) Impact of lockdown in discovering hidden talent/skills of individuals.
3) How lockdown spread the awareness of self and social hygiene in better way? (Comparisonof survey analysis and research data available)
4) Impact of Lockdown on Environment (Pollution control comparison of survey data withdata from research sources).
5) Effect on economy of the country owing to Covid-19 related to difficulties faced by every participant. (Comparison of survey data with data from research sources).

New Findings and Discussions
1. The quality time spent with family due to the lockdown caused by COVID-19, Pandemic. With lockdown imposed by the Government from last week of March to Mid May 2020 the production industry as well as the ITES industry were shut for this period. This forced everyone to stay at home and help break the chain or cycle of corona spread.
With regular working time and combined with travelling time being saved in lockdown the averagetime person spent at home increased dramatically, this in-turn meant time being spent with familyincreased.

This survey studied the impact of lockdown on quality time spent with family. Fig1.1 and Table 1.1 Shows the comparative time spent by different age group. The results were overwhelming withthe

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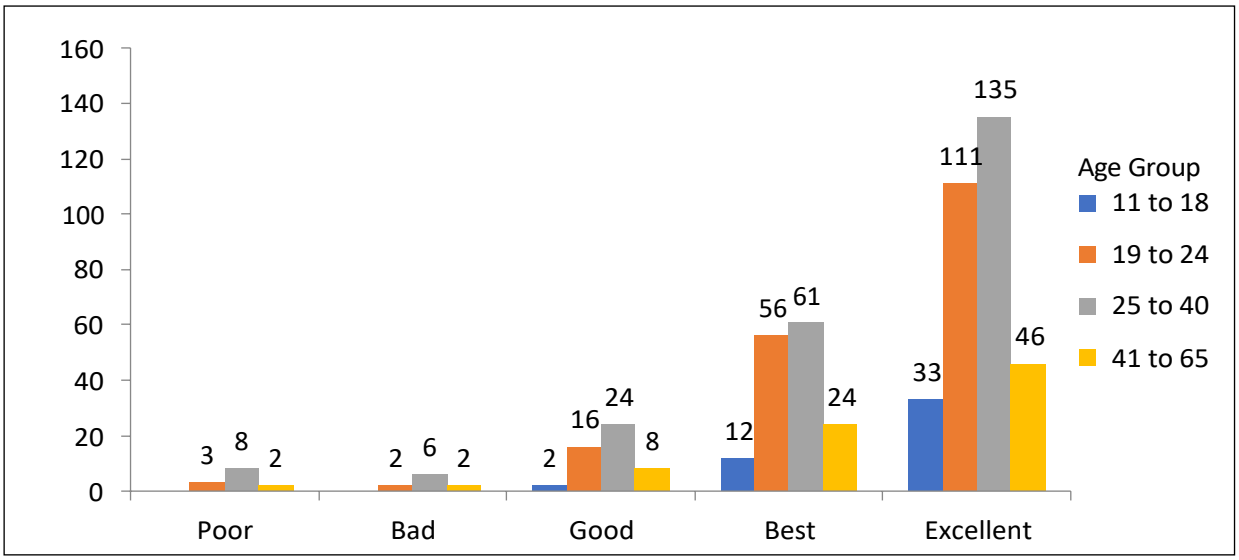
maximum quality time spent by age group 25-40 with respect to number of participants out ofthe whole sample space. If comparison is down among age groups considering the count of participants the

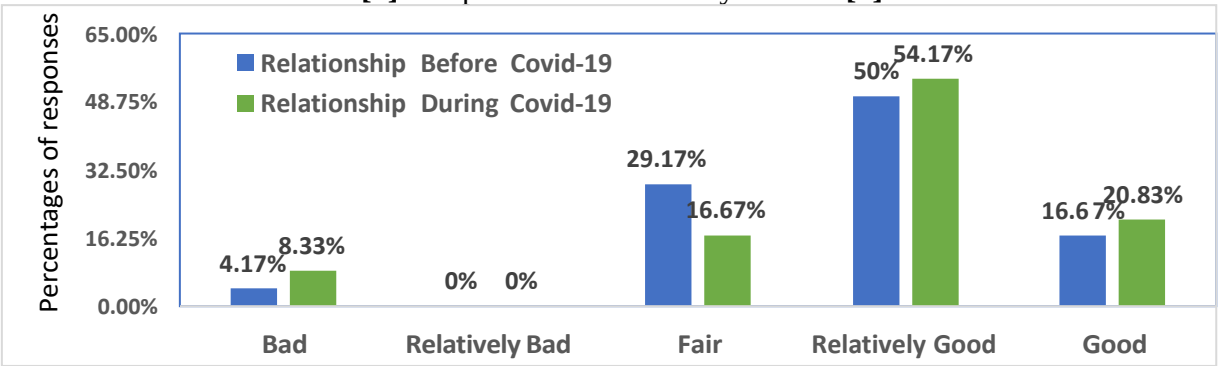


Children between 11-18 have spent excellent time during pandemic. This reflects that time spent by parents with their children is quiet less in daily life. This survey has definitely has helped parents to understand the importance of personal-professional life work balance.

Fig 1.1 Quality time spent age group wise

Quality Time Spent with Family					
Age Group	Poor	Bad	Good	Best	Excellent
11 to 18			2	12	33
19 to 24	3	2	16	56	111
25 to 40	8	6	24	61	135
41 to 65	2	2	8	24	46
Age Group	Percentage wise				
11 to 18	0.00%	0.00%	4.26%	25.53%	70.21%
19 to 24	1.60%	1.06%	8.51%	29.79%	59.04%
25 to 40	3.42%	2.56%	10.26%	26.07%	57.69%
41 to 65	2.44%	2.44%	9.76%	29.27%	56.10%

Table 1.1 :These statistics obtained in (Table 1.1) from our survey agrees with results mentioned in **[2] [3].** Graph below is the analysis from **[3].**



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State of Relationship

Children's view on relationship with their parents before and during COVID-19

2. Impact of lockdown in discovering hidden talent/skills of individuals

Due to increasing cases of the Covid-19 pandemic within the country, colleges and different instructional establishments were closed, that allowed students and lecturers to continue with their learning and teaching activities from the comforts of their homes. Lockdown has given us the possibility to do fascinating things, and learn new skills and gain more knowledge. Experiments are happening to handle the pandemic as necessity is the mother of invention. During the lockdown period, everything came to a standstill which, gave a golden opportunity for people to use this time period more productive way to discover new skills of individuals by exploring new hobbies and talents like skills in art and craft, dance, music, technical ability etc. this will help people to get better opportunity enhancement in employment and reduces stress.

Many individuals generally are unaware about the skill set or talents they have within them, it's only when people spare time on practicing these skills they realize about their own expertise. The current survey of 551 participants shows the percentage variation in identifying the hidden skills across different age groups. The age group 19-24 shows the highest percentage in identifying theirskills in the lockdown period reflected below in Fig 1.2 as well as Table 1.2. This is the student fraternity of undergraduate and postgraduate who could grow technically as well as artistically during the lockdown period.

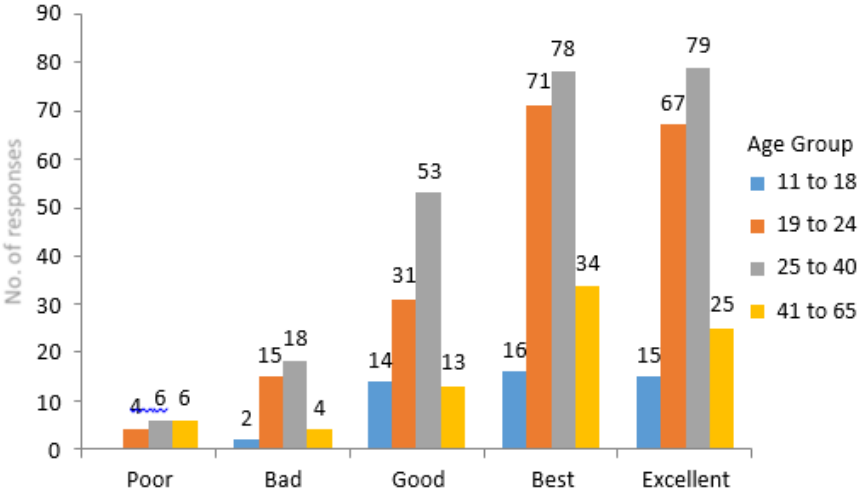

Fig 1.2Discovering hidden talent/skills age group wise

Discovering hidden talent/skills					
Age Group	Poor	Bad	Good	Best	Excellent
11 to 18		2	14	16	15
19 to 24	4	15	31	71	67
25 to 40	6	18	53	78	79
41 to 65	6	4	13	34	25
Age Group	Percentage wise				
11 to 18	0.00%	4.26%	29.79%	34.04%	31.91%
19 to 24	2.13%	7.98%	16.49%	37.77%	35.64%
25 to 40	2.56%	7.69%	22.65%	33.33%	33.76%
41 to 65	7.32%	4.88%	15.85%	41.46%	30.49%

Table 1.2

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3. How lockdown spread the awareness of self and social hygiene in better way?

The awareness of people in India before Covid-19 towards health and hygiene was low. Common man was least bothered about maintaining his health on regular basis by having a proper schedule for exercising, or having a proper diet to boost the immune system. Awareness programs had to be arranged at various levels to spread the importance of Health, Hygiene and diet especially among girl's students in colleges. However due to this pandemic people are now more aware aboutthe importance of maintaining a good diet, regular exercise and having a strong immune system which could protect them against such a life-threatening pandemic.

From the research in **[9]** it was found that the awareness of medical Professional on Infection control practices needs to be improved so a question aroused that what will be the understanding of common man about hygiene maintenance. So, in the current survey we posed a question to all category pupils on how lockdown has helped to spread awareness of self and social hygiene in better way?

The below (Fig 1.3) and Table 1.3 data shows significant improvement in self and social hygiene awareness during Pandemic. This was possible as a huge campaign was undertaken by various government organizations, social welfare organizations, social media crusaders, NGO's and celebrities to spread the awareness during lockdown. "Prevention is better than cure", is understood the best by all during this pandemic lockdown.

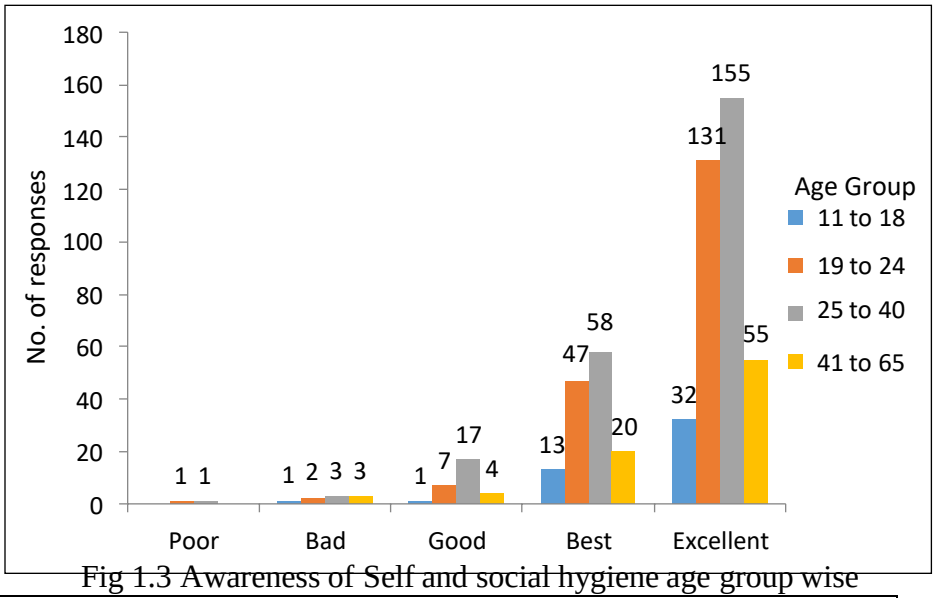

Fig 1.3 Awareness of Self and social hygiene age group wise

Awareness of Self and social hygiene age group wise					
Age Group	Poor	Bad	Good	Best	Excellent
11 to 18		1	1	13	32
19 to 24	1	2	7	47	131
25 to 40	1	3	17	58	155
41 to 65		3	4	20	55
Age Group	Percentage Wise				
11 to 18	0.00%	2.13%	2.13%	27.66%	68.09%

19 to 24	0.53%	1.06%	3.72%	25.00%	69.68%
25 to 40	0.43%	1.28%	7.26%	24.79%	66.24%
41 to 65	0.00%	3.66%	4.88%	24.39%	67.07%

Table 1.3

4. Impact of Lockdown on Environment

During the lockdown declared by many countries due to pandemic COVID-19 people were forced to focus on the saying "Earth is healing", Regular reports of this improve quality have definitely spread the awareness about environment (Pollution control) which is reflected in the survey done. Below Fig 1.4 and Table 1.4 is the analysis geographically Zone wise on effect of Lockdown on pollution control.

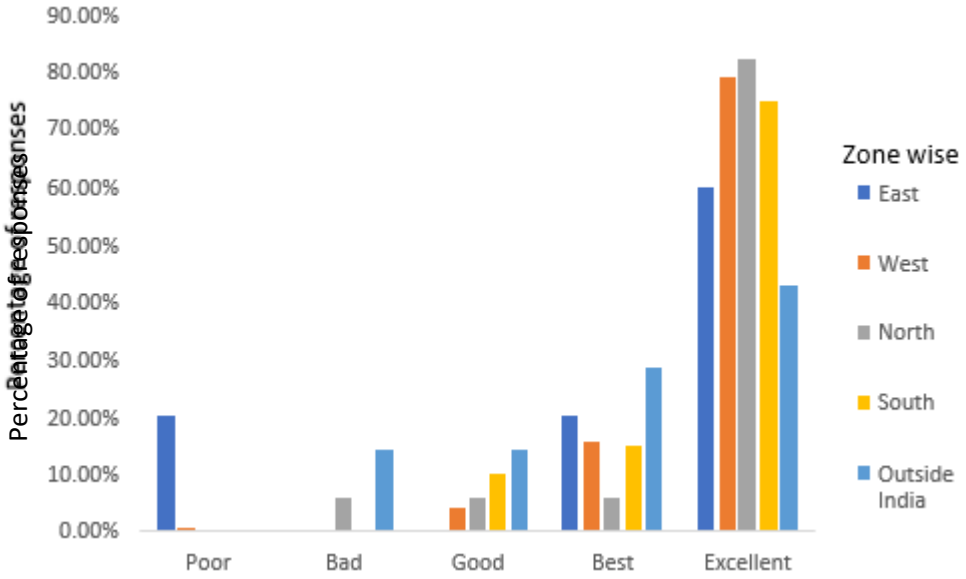

Fig 1.4 Impact of lockdown on environment Zone wise

Effect of Lockdown on Environment (Pollution Control)					
Zone	Poor	Bad	Good	Best	Excellent
East	1	0	0	1	3
West	3	1	21	79	398
North	0	1	1	1	14
South	0	0	2	3	15
Outside India	0	1	1	2	3
Zone	Percentage wise				
East	20.00%	0.00%	0.00%	20.00%	60.00%
West	0.60%	0.20%	4.18%	15.74%	79.28%
North	0.00%	5.88%	5.88%	5.88%	82.35%
South	0.00%	0.00%	10.00%	15.00%	75.00%
Outside India	0.00%	14.29%	14.29%	28.57%	42.86%

Table 1.4

This survey results agree with the research mentioned in **[10] [11]** showing excellent improvementin air pollution control in north zone of India which includes Delhi. Overall, the survey also shows

better and clearer air in all parts of India. The survey also has some participants from outside India that agrees with statistics in literature survey.

5. Effect on economy of the country owing to Covid-19

On March 12, 2020, WHO issued a pandemic declaration for COVID-19. This terrible disease continues to spread throughout the world today. The global community as well as the Indian economy have experienced an unparalleled shock as a result of the Covid-19 epidemic. The multiple global lockdowns effectively put the globe on hold and pressed the pause button for everything.

Of the largest economies in the world. During 4Q, India's real GDP fell to its lowest level in more than six years. Consequently, the numerous flaws in the international system have been shown by the COVID-19 or Corona virus Pandemic. India's growth rate decreased to 3.1 percent as a result of COVID-19, according to the Ministry of Statistics, as indicated by the Chief Economic Government of India advisor. The influence of this epidemic on the major Indian economic sectors is the main topic of the literature study is mentioned below,

Summary of Key Indian economic Indicators Projections **[22]**

Sr No	Economic Indicator	Current (Mar/Apr 2020 Position)	Projection for 2020-21	Projection for 2024-25 on the Basis of 3 Possible Recoveries		
				Strong	Moderate	Weak
1	GDP growth	5%	-0.55%	7.45%	3.45%	1.45%
2	Unemployment	8.76%	20.13%	12.13%	16.13%	18.13%
3	Inflation	2.99%	6%	8%	10%	14%
4	Base lending rate	8.15%	6.65%	8.65%	4.65%	2.65%
5	Industrial production index	0%	-3.96%	4.04%	0.04%	-1.96%

In **Fig: 1 .5.1 shows the impact on how this pandemic has affected various Indian industries [23].**

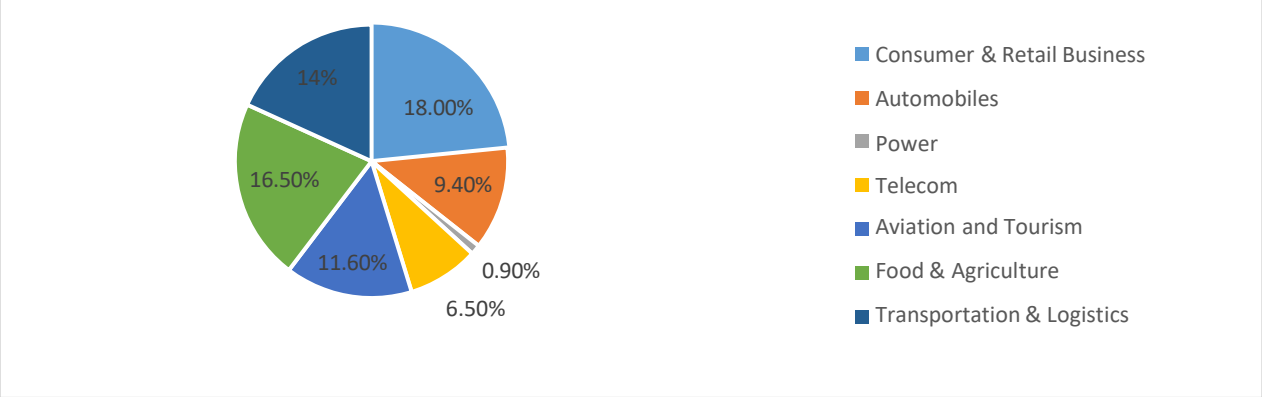

Fig: 1.5.1 Contribution to GDP by Different Sectors

The survey conducted had a question to find impact on economy in different professions due to lockdown caused by Covid19.Results of the same are represented below in Fig 1.5.2 and Table 1.5.2

It shows a very high impact on most of the professions. Information Technology Enabled Services(ITES) with highest percentage followed by Medicine. The daily wagers were highly affected economically,

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this fact is supported by the survey results. In Sample size of 6,5 participants said they had high impact on their monthly wages. This survey also shows the awareness of economic impact on the nation due to such pandemic.

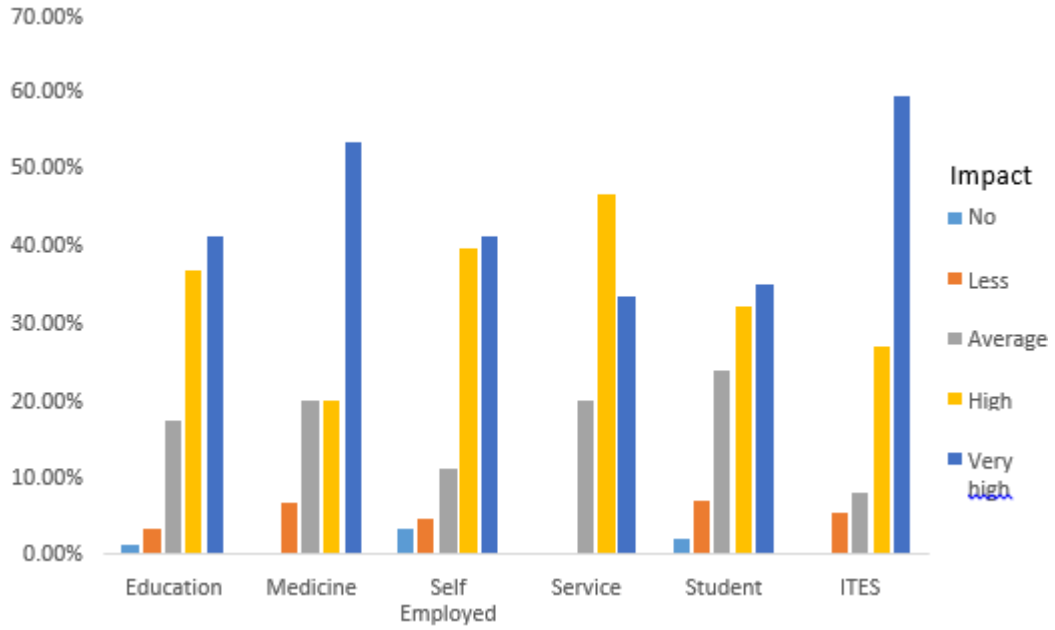

Fig 1.5.2 **Impact on Economy on various professions due to lockdown.**

Sector	No	Less	Average	High	Veryhigh
Education	2	6	31	66	74
Medicine		1	3	3	8
Self Employed	2	3	7	25	26
Service			6	14	10
Student	4	14	48	65	71
ITES		2	3	10	22
Sector	Percentage wise				
Education	1.12%	3.35%	17.32%	36.87%	41.34%
Medicine	0.00%	6.67%	20.00%	20.00%	53.33%
Self Employed	3.17%	4.76%	11.11%	39.68%	41.27%
Service	0.00%	0.00%	20.00%	46.67%	33.33%
Student	1.98%	6.93%	23.76%	32.18%	35.15%
ITES	0.00%	5.41%	8.11%	27.03%	59.46%

Table 1.5.2

Conclusion

From the survey and literature study it is clearly visible that family bonding and relation have enhanced by spending quality time with Children and Senior citizens in the family. Post lockdown parents have been able to manage their work and family time then that will help all members in the family including themselves in stress management. This survey has studied the impact of lockdown in discovering hidden talent/skills of individuals which has provided an improvement of opportunity in employment, exploring new skills and reduction in anxiety.

This survey has posed a question on awareness of people about Health and Hygiene due to this pandemic situation and more than 90% have agreed on its improvement in huge amount. To sustain this awareness post Covid it is important that regular counseling through sessions by doctors have to be conducted in schools. Initiatives by government should be taken in reference to this for introducing a separate time slot for such activities. Also, to inculcate the understanding in these young children, teachers and students should follow these practices in schools. We can explore platforms like NSS for wider reach of awareness as well as activities by students can be conducted.

As all the means of transportation air, road and water have been almost shutdown due to lockdown, a noticeable reduction in Pollution has been measured. The work however of certain industries such as ITES, Education, Medical has still continued to work efficiently. So, from the survey and literature study it has been suggested to continue with hybrid working model for ITES or compulsory use the pool transportation option for less usage of road transport. This has definitely reduced the air pollution to certain extent in west zone of India which has maximum ITES sector.

The survey on impact of Covid-19 on economy concludes that there has been significant impact on every individual not only socially but also economically. The economic impact has been seen across all professionals. For the first time it has been seen both central and state level governments extending their support to all daily wagers and hawkers by providing direct cash transfers as part of relief fund to their bank accounts. The government schemes have to be strengthened to help the needy in such pandemic situations.

References

1. Resource data from
https://en.wikipedia.org/wiki/List_of_countries_and_dependencies_by_population_density
Lee I, Tipoe E (2021) Changes in the quantity and quality of time use during the COVID-19 lockdowns in the UK: Who is the most affected? PLoS ONE 16(11): e0258917.
https://doi.org/10.1371/journal.pone.0258917
3. Spending Time with Family Members: How COVID-19 has Changed the Family Member Relationship Ye Zhang https://www.researchgate.net/publication/347915052_Spending_Time_with_Family_Members_How_COVID-19_has_Changed_the_Family_Member_Relationship
Parents' Assessments of How Much Time They Spend with Their Children at DifferentAges Article in Psychological Reports · July 2004 DOI: 10.2466/PR0.94.3.1025-1030
https://search.proquest.com/openview/7cce020af91345aa8f0e79778ce0d54f/1?pq-origsite=gscholar&cbl=18750&diss=y
Changes in Family Life and Relationships during the COVID-19 Pandemic and theirAssociations with Perceived Stress August 2020 Family and Environment Research 58(3):447-461 DOI:10.6115/fer.2020.032
Herman Aguinis, Jing Burgi-Tian Talent management challenges during COVID-19 andbeyond: Performance management to the rescue https://doi.org/10.1177/23409444211009528
Chanana N, Sangeeta. Employee engagement practices during COVID-19 lockdown. JPublic Affairs. 22020; e508 10.1002/pa.2508
8. RimeshPalaUrmilaYadavbSandeepGrovercBanshiSaboodAnmolVermaaSanjay K.Bhadadaa Knowledge, attitudes and practices towards COVID-19 among young adultswith Type 1 Diabetes Mellitus amid the nationwide lockdown in India: A cross-sectionalsurvey
https://doi.org/10.1016/j.diabres.2020.108344
9. Modi P D, Nair G, Uppe A, et al. (April 02, 2020) COVID-19 Awareness Among Healthcare Students and Professionals in Mumbai Metropolitan Region: A Questionnaire-Based Survey. Cureus 12(4): e7514. doi:10.7759/cureus.7514 https://www.cureus.com/articles/29822-covid-19-awareness-among-

healthcare-students-and-professionals-in-mumbai-metropolitan-region-a-questionnaire-based-survey
10. Resource data from https://www2.iqair.com/sites/default/files/documents/REPORT-COVID-19-Impact-on-Air-Quality-in-10-Major-Cities_V6.pdf?_ga=2.77158165.1495375760.1588989254- 743641501.1588989254
11. Effect of lockdown amid COVID-19 pandemic on air quality of the megacity Delhi, IndiaSusanta Mahato, Swades Pal, and Krishna Gopal Ghosh∗10.1016/j.scitotenv.2020.139086https://www.ncbi.nlm.nih.gov/pmc/articles/PMC71 89867/
12. Watts, J. Climate crisis: in coronavirus lockdown, nature bounces back – but for how long? Available from: https://www.theguardian.com/world/2020/apr/09/climate-crisis-amid-coronavirus-lockdown-nature-bounces-back-but-for-how-long
13. Impact of COVID-19 lockdown on the environment John O. Chikwem1, Uzoma J. Chikwem2 and Susan D. Chikwem3 https://www.researchgate.net/publication/358791143_Impact_of_COVID19_lockdown_o n_the_environment
14. Yunus AP, Masago Y, Hijioka Y. COVID-19 and surface water quality: Improved Lakewater quality during the lockdown. Science of the Total Environment. 2020; 731: 13901. Available from: https://www.sciencedirect.com/science/article/pii/S0048969720325298?via%3Dihub
15. Shawn L.The virus brought something ... beautiful: Clear water flows through Venice amid coronavirus lockdown. Available from: https://www.marketwatch.com/story/the-virus-brought-something-beautiful-clear-water-flows-through-the-venice-canals-amid-coronavirus-lockdown-2020-03-18
16. Gardiner B. Pollution made COVID-19 worse. Now, lockdowns are clearing the air. Available from: https://www.nationalgeographic.com/science/2020/04/pollution-made-the-pandemic-worse-but-lockdowns-clean-the-sky
17. Shinde G.R., Majumder S., Bhapkar H.R., Mahalle P.N. (2022) Impact of COVID-19 Pandemic on Agriculture Sector. In: Quality of Work-Life During Pandemic. Studies inBig Data, vol 100. Springer, Singapore. https://doi.org/10.1007/978-981-16-7523-2_6.
18. Bhapkar, H. R., Mahalle, P. N., Dey, N., & Santosh, K. C. (2020). Revisited COVID-19 Mortality and Recovery Rates: Are we Missing Recovery Time Period?. Journal of medical systems, 44(12), 202. https://doi.org/10.1007/s10916-020-01668-6.
19. BHAPKAR, H.R., MAHALLE, P.N., SHINDE, G.R. and MAHMUD, M. , 2021. Rough sets in COVID-19 to predict symptomatic cases. In: K.C. SANTOSH and A. JOSHI, eds., COVID-19: prediction, decision-making, and its impacts. Lecture notes on data engineering and communications technologies (60). Singapore: Springer, Singapore, pp. 57-68. ISBN 9789811596810.
20. Bhapkar H.R., Mahalle P.N., Dhotre P.S. (2020) Virus Graph and COVID-19 Pandemic: A Graph Theory Approach. In: Hassanien AE., Dey N., Elghamrawy S. (eds) Big Data Analytics and Artificial Intelligence Against COVID-19: Innovation Vision and Approach. Studies in Big Data, vol 78. Springer, Cham. https://doi.org/10.1007/978-3-030-55258- 9_2.
21. COVID-19 and Its Impact on the Indian Economy; Vikas Barbate, Rajesh N. Gade, Shirish S. Raibagkar First Published February 1,2021 Research Article Volume: 25issues: 1, page(s): 23-35 Article first published online: February 1, 2021; Issue published: March 1, 2021 https://doi.org/10.1177/0972262921989126
22. Impact of COVID-19 on Indian Economy; Article in SSRN Electronic Journal · March 2021, EPRA International Journal of Economic Growth and Environmental Issues- PeerReviewed Journal ISSN: 2321-6247 Volume: 9 | Issue: 4 | April 2021 | Journal DOI: 10.36713/epra0713 | SJIF Impact Factor (2021): 8.047

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A REVIEW ON RESOLVING TRAFFIC CONGESTION USING IMAGE PROCESSING TECHNIQUES AND DEVELOPMENT OF AN ANDROID APPLICATION

Sowmya Kini Prabhu, Assistant Professor, Department of Electrical Engineering
Atharva College of Engineering : sowmyakini@atharvacoe.ac.in

***Abstract*—** Our current situation makes this a severe issue. Traffic congestion on both major and minor routes is constant. A strong traffic control system is necessary in order to address these problems. Human and material resources are lost as a result of poor traffic management.

Due to these recurring issues, interest is growing in finding new ways to address the congestion issue. Inadequate capacity, unrestrained demand, and protracted delays caused by traffic signals are only a few of the factors that contribute to traffic congestion. Magnetic loop detectors, infrared sensors, wireless sensor networks, and other devices are all used in modern technology. As opposed to

These frequently occurring problems are generating interest in solving the congestion problem through various methods and methods. Traffic congestion occurs for a variety of reasons, including insufficient capacity, unrestricted demand, and long delays due to traffic signals. Modern technology uses wireless sensor network systems, magnetic loop detectors, infrared sensors and more. On the other hand, video and image processing methods offer many advantages over traditional systems. This article summarizes an overview of all available existing methods compared to those used in this field of research.

We summarize all the various research papers based on different methods for the development of intelligent traffic detection systems using image and video processing methods. A comparison and overview of all methods is presented in this overview document.

***Keywords*—** Image processing, Video Processing, Traffic congestion.

I. INTRODUCTION

Traffic congestion has been a major problem in this scenario and has persisted in recent years, resulting in poor traffic management. From small roads to highways, traffic jams often waste time and manpower.

The main reason behind the increase of traffic congestion is due to the increase of population and increase of vehicles in larger metro cities. This paper reviews different techniques of traffic density calculation and intelligent detection systems using sensors, wireless networks, microcontrollers which were used earlier and thus a review of all the techniques and hence advantages of image processing over the different techniques have been discussed. Some approaches go over how to use image processing to calculate the traffic density on highways in a real-time context. Using cameras placed at traffic intersections to record real-time recordings of the state of the roads, all image processing algorithms require cameras. In order to determine the amount of traffic using a specific lane at a specific moment, frames from those videos are recorded and further analysed.

All the five methods can be summed up into four general modules – Image acquisition, Preprocessing, Density calculation and Traffic control. Since image processing is gaining a lot of popularity in terms of tracking and detection of the vehicles the area of proposed research work makes use of cameras that shoot the videos or capture images on which motion and vehicle detection algorithms would be applied to get a count of the vehicles. Based on the count of the vehicle a user interface will be established via an android application that helps the user to get an idea of the density of the traffic at any particular location which helps in diverting the route and avoiding traffic jams.

II. Literature survey

Traffic system is at the heart of the civilized world and development in many aspects of life is totally relying on it. Excessive number of traffic on the road and improper traffic management systems has led to hampering or stagnating routine lives of civilians.Therefore, an automatic traffic analysis system

is required for smooth and safe operation of the road system. When automated traffic systems are implemented, they provide better traffic control, correct control signal distribution, and improved traffic control systems.

[1] Georgios Vigos, Markos Papageorgioua, Yibing Wangb proposed An infrared sensor, an AVR-32 microcontroller with configurable flash memory, and an integrated 8-channel analogue to digital converter are used in the system that has been presented. The microcontroller is set up so that it will give a red light to all lanes but the one with the emergency vehicle when an infrared sensor detects a car that needs to be stopped. This system's fundamental flaw or restriction is that it relies on infrared sensors, which must be stored safely because they are impacted by changing weather and climatic conditions. Due to the limitation of this system it makes it a slightly lesser reliable technique to achieve the desired results.

[2] Ahmed S. Salama, Bahaa K. Saleh, Mohamad M.Eassa introduced a new model using a wireless sensor network system used as communication infrastructure in the proposed traffic light controller. The system uses fuzzy logic methods to determine the direction of the ambulance. The main monitoring system collects all necessary information and provides the necessary responses. A limitation of this system is that communication using a wireless sensor network system is still a research area. Communication between sensors is not a reliable method.

In addition, the sensor must be robust to respond to all climatic conditions.

[3] Celil Ozkurt and Fatih Camci propose a method using active RFID and a global system for mobile communication technology. The system includes RFID tags, wireless routers and coordinators, GSM modems and monitoring station software. The wireless device collects data from active RFID tags installed on the side of the road. The monitoring station collects all data from GSM and responds to corresponding traffic signals.

The main limitation of this system is that it contains many communication systems, making the device very expensive. Wireless communication systems have their drawbacks, which also require the installation of a monitoring station.

[4] Zhou J., Gao D., and Zhang D. presented an optical flow approximation method, which can independently detect moving objects and is highly sensitive to changing environments even in the absence of prior information about the background. It's very good because it does it well.

Real-time applications are challenging to implement due to the high processing expense. Additionally, interference from things like car headlights is very likely to affect the device.

[5] S. Zeadally, R.Hunt, Y. Chen, A. Irwin, and A. Hassan proposed the development of a vehicle peer-to-peer network (VANET). This is a very important and exciting new type of network emerging in wireless technology. A feature of VANET is the provision of communication between the vehicle itself and between the vehicle and the road block.

VANETs also play an important role in concepts such as smart cities. This document builds on the framework of a smart city that transmits information about road conditions and helps drivers make voluntary and intelligent decisions to avoid traffic jams, which will ultimately help reduce overall traffic congestion. will. . Limitations include routing protocols that rely heavily on GPS. Also, location servers may not always be within reach. It's also a very unfortunate system in environments with low vehicle density.

[6] Ye Li, Bo Li, Bin Tian, and Qingming Yao an other approach, known as the AOG method, that uses the AND OR graph was proposed. By building an AND OR graph and focusing on the easily accessible and highly apparent aspects while ignoring the lesser vehicle features, this strategy complicates the detection of vehicle features. A decomposition of the vehicle representation is proposed during AOG construction and thus it helps in further reduction of the vehicle congestion or

occlusion using this method. A quantitative experiment was also conducted under several traffic conditions especially during the congested conditions. This method was used to effectively deal with vehicle shape, vehicle motion, vehicle pose and the climatic or weather conditions over the time of day.
A limitation of this method was that it was limited to automobiles and had to be developed for vehicles such as buses. Also, this method cannot be applied to real-time traffic processing and monitoring. Also, for a red vehicle, the system cannot determine whether it is a rear vehicle or a front vehicle, which reduces the system's accuracy and makes the system unreliable for real-time applications.

[7] Salama A.S. Saleh B.K. and Eassa M.M. The use of photoelectric sensors to ensure the design of an integrated intelligent control and monitoring system for traffic lights.
The installation of the sensors is a crucial component of this system because the traffic management department needs to keep track of the number of vehicles moving at a certain rate before sending this information to the traffic control cabinet, which can then use an algorithm based on the relative importance of each road to control the traffic lights in accordance with the sensor readings. The system will then calculate the relative weight of each road and open traffic on the road with the most traffic and give it more time than the other routes with less traffic. The system's ability to make decisions in real time stands out very strongly. Due to the sensors the system is expensive and also the sensors need to be kept in safe to prevent them from weather conditions. It also needs precision in the installation of sensors very accurately for efficient results.

[8]Porter presented aerial wide area motion imagery method for accurately registering the roadmap to wide aerial motion imagery by making use of locations of the vehicles detected and determining a transform for aligning these locations with network of the roads on the roadmap. The registration of the vehicle is calculated using expectation maximization algorithm. This method overcomes the challenges of feature estimation and can be applied easily to different imaging modalities. Three wide aerial motion imagery data sets will be used and the results of the three wide aerial motion imagery data sets will be captured by infrared sensors. A limitation of this method is that it uses sensors which are robust and affected to changes in the climatic or surrounding conditions.It is also an expensive method because it uses multiple sensors for each large set of air traffic images.

[9]Ms. PM Daigawane proposed a software-based system for counting and classifying vehicles.This method relies heavily on algorithms rather than sensors. Vehicle classification and counting can be performed using image or video processing techniques. This method uses the Scale Invariant Feature transform. This algorithm is used to detect key points. This method is widely used to rotate, align, and transform images.
A limitation of this method is that it uses only one specific algorithm which reduces accuracy and efficiency. Additionally, because it is completely algorithm-dependent and does not use sensors, minor errors in the algorithm can affect the system output, reducing efficiency.

[10]Badura S., Leskovsky A. presented a new model of an intelligent transportation system that includes surveillance using cameras installed at intersections and allows users to access this data with the help of a data delivery system.
Data transmission across a mobile Ad-hoc network will make up the data delivery portion of the overall system. Image analysis and foreground/background modelling techniques would be the key components of surveillance. In the course of the project, a number of experiments have been carried out, and they show a lot of promise in terms of effectiveness and real-time implementation. A limitation of this system is that it lacks the detection of emergency vehicles and methods of reducing congestion when an emergency vehicle is detected.

Conclusion

In comparison to all the existing methods mentioned in the literature survey we propose a method that makes use of Image processing techniques for better efficient systems. The system aims at having an Android application that helps the user to get interfaced with the actual system.

The system basically involves cameras that are installed at every signal from smaller roadways to highways. These cameras continuously capture the images and shoot the videos which are later enhanced by extracting its features using image processing techniques.

Vehicle detection and Motion detection techniques will be used along with a feedback controller that gives the count of number of vehicles which is taken into account to decide if the congestion in the traffic is minimal to moderate to heavy. The status of the traffic is then updated in the Android application which provides an interface for the user. Based on the status of the traffic that is updated in the application the user can login to find out the traffic conditions at various roadways and hence divert or avoid that particular route when the traffic is heavily congested. This method aims to achieve better results as it employs image processing and feedback control techniques along with a user interface which eventually leads to an efficient system.

REFERENCES

1. Georgios Vigos, Markos Papageorgioua, Yibing Wangb, “Real-time estimation of vehicle-count within signalized links”, Journal of Transportation Research Part C: Emerging Technologies, Volume 16, Issue 1, pp.18–35, February 2008.
2. Ahmed S. Salama, Bahaa K. Saleh, Mohamad M. Eassa,” Intelligent Cross Road Traffic Management System (ICRTMS),”Proceedings of 2nd International Conference on Computer Technology and Development, pp. 27-31, Nov 2010.
3. Celil Ozkurt and Fatih Camci, “Automatic Traffic Density Estimation and Vehicle Classification for Traffic Survillance Systems Using Neural Networks”, Journal of Mathematical and Computational Applications, Vol. 14, No. 3, pp. 187-196, 2009.
4. Zhou J., Gao D., Zhang D., “Moving Vehicle Detection for Automatic Traffic Monitoring,” Vehicular Technology, pp.51-59, Jan 2007.
5. S.Zeadally,R.Hunt,Y.Chen,A.Irwin and A.Hassan “Vehicular Ad Hoc Networks:status,results,and challenges” Telecommunication Systems Volume 50,Issue 4,pp 217-241.
6. Ye Li, Bo Li, Bin Tian, and Qingming Yao,Vehicle detection based on AND OR Graph for congested traffic condition, Volume 14, Isuue 2,June 2013.
7. Salama A.S, Saleh B K, Eassa M M, Intelligent cross roadtraffic management systems,Computer Technology and Development, 2010 First International Conference,pp.119,123,5-7 August,2010
8. R Porter,A.M.Fraser, and D.Hush,”Wide Area Motion Imagery,”Volume 27,no Ahmed Elliethy, Automatic registration of wide area motion imagery to vector road maps by exploiting vehicle detections, Volume 25, Isuue 11,November 2016.
9. Mrs.P.M.Daigavane and Dr.P.R.Bajaj “Real Time Vehicle Detection and Counting method for unsupervised traffic video on Highways” IJCSNS, International Journal of Computer Science and Network Security,Vol 10, No 8, August 2010.
10. Badura.S:Lieskovsky,A.,”Intelligent Traffic System Cooperation of MANET and Image Processing” ,2010 First International Conference, Volume 22,pp.27.31,2-4 November 2010

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A REVIEW ON CERTAINTY OF LOAD MONITORING AND ANALYSIS FOR HOME ENERGY SYSTEMS

Ms. Deepshikha Shrivastava, Assistant Professor , Applied Science Department , Pimpri Chinchwad College Of Engineering and Research ,Pune
Dr. P. Goswami, Associate Professor, General Engineering Department , Institute Of Chemical Technology, Mumbai

Abstract
One important aspect of energy management is energy monitoring. Consequently, before planning some technical measures to reduce energy use, premises must be monitored for power consumption. Through Load Monitoring (LM), the most recent advancements in appliance energy management is presented in this paper. Various methods of Home Energy Management (HEM) using LM have been analyzed and categorized in an effort to investigate the most recent trend in energy management for researchers in the field. The researchers' various contributions have been highlighted, as have some methods for lowering a building's power consumption to save money and improve the environment. According to the findings of this study, there are problems with load management and monitoring that require attention; issues like the need for a surveillance system capable of that can recognize as many different types of loads as possible and more accurate recognition. Additionally, additional efforts are required to implement LM in appliance energy management. Last but not least, it is necessary to promote a culture of energy management among those who use electricity, whether in businesses, offices, or homes. The study will assist local researchers in gaining a clear understanding of the area's most recent trends.

I. INTRODUCTION

In India, commercial buildings account for nearly 26% of energy consumption. Additionally, commercial building energy consumption in India is rising at a rate of 2.7% annually, according to the US energy information agency. The majority of energy used in buildings is wasted as a result of inadequate energy monitoring systems. In this regard, this paper reviews a building energy monitoring solution and conducts an analysis of the data gathered from the monitoring. Multi Functional Meters, which measure electrical qualities like voltage, current, and power, among others, are used to obtain the data for energy monitoring. The various communication systems that the meter supports are analyzed in order to obtain data from the meter. First, an alert message is sent to the appropriate employee to prevent power cable overload by monitoring the collected data. Second, the obtained data are the subject of data analysis. The obtained load curve is used in the data analysis to calculate load factor, imbalance factor, rising time, and period of high load.. These parameters will assist the manager or operator of a commercial building in optimizing its energy use. Thirdly, in order to fully control the meter, it is suggested to interface the multifunctional meter with Arduino.

The price of electrical energy has gone up as a result of the decreasing supply of fossil fuels and the rising demand for electrical energy. so that the community must cultivate a culture of conserving electrical energy as a habit. On the other hand, without a controllable auxiliary system that can control how much energy is used, energy-saving behavior cannot be implemented on a large scale. Given these concerns, a strategy that encourages a culture of energy conservation must be developed. An energy-efficient culture-supporting system is proposed in this paper to facilitate active energy efficiency methods. This system combines a smart electrical panel with an electric power monitoring system. It can automatically regulate electrical loads, track power use, produce detailed data, and conduct energy analysis. It also monitors the use of electrical energy continuously. This research was carried out using the research and development approach. By using a raspberry PI 3 and a smart panel and a PZEM-004t power energy meter have been used in this research to create an electrical power control and monitoring system prototype. Electrical loads are automatically controlled by the

monitoring system. Additionally, the system can provide daily, weekly, monthly, or annual data monitoring reports. The results of the tests indicate that the system can function effectively. It is anticipated that this research will aid in the development of a system that can assist the government in its efforts to conserve energy.

Every day, energy consumption rises in tandem with urbanization. Particularly in industries, hospitals, commercial buildings, and other locations, energy consumption is higher. As a result, there is an imbalance in supply and demand. The primary challenges facing the Indian government are energy conservation and CO2 reduction. The fundamental step toward accomplishing this goal is the implementation of information and communication technology (ICT). The implementation of ICT technology for the purpose of monitoring the energy consumption of buildings is crucial because Commercial structures are among the primary contributors to CO2 emissions [1]. A low-cost option for energy tracking and information analysis on a commercial building's energy consumption is offered in [2]. The fact that load current monitoring does not disrupt the existing infrastructure is a benefit of this solution. The proposed solution can be implemented without cutting a line, cutting a cable, or shutting down the power. Also, some of the benefits of energy tracking in a commercial structure are explained by showing how to calculate things like the load factor, the current unbalance factor, the rise time, the fall time, and the high load duration. For the purpose of evaluating the voltage imbalances in the industrial building, the voltage unbalance factor is defined in [3]. Additionally, the effects of imbalances, such as malfunctioning relays and equipment voltage regulation, are explained. [4] Examines the functional characteristics of both top-down and bottom-up approaches to residential load curve analysis. The authors came to the conclusion that the most effective strategy for analyzing load curves in residential buildings is the bottom-up strategy. Figure 1 shows how to use load curve data to detect peaks and troughs according to the authors' reasoning [5].

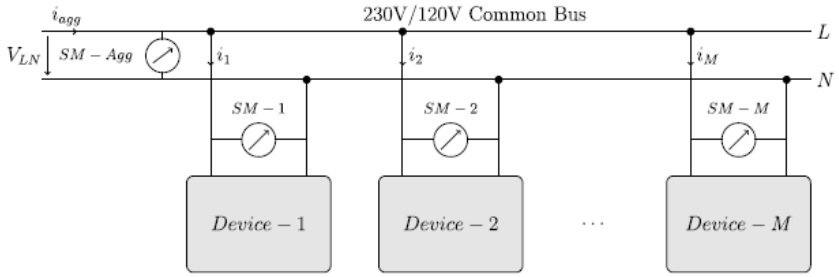

Fig. 1. Load monitoring N devices

I. DATASETS AND DATA ACQUISITION

To objectively assess the disaggregation architectures presented in the literature and to compare LM solutions, publicly available benchmark datasets that are measured using smart metres similar to actual circumstances have been established.

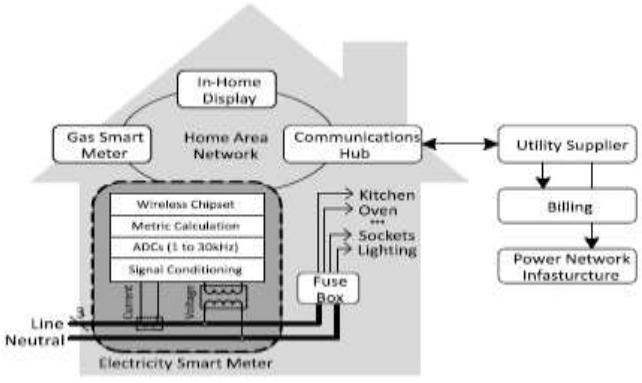

Fig .2. smart energy monitor for load scheduling

A. A Smart Meter

Household energy consumption disaggregation involves the acquisition of data at high sample rates in the range of seconds [7] in order to train and assess the disaggregation architectures depicted in fig. 2. These sorts of data are often collected by so-called smart metres. Using a communication link, a smart metre may monitor the energy usage of a building or a residence and transmit the data it collects to the customer's utility provider or other energy monitoring and management services. Simple smart metres can sample energy use once every minute, whereas more complex ones can sample up to 30 kHz [8]. Higher sample rates are typically preferable since they offer more thorough data on energy use. But these frequencies can have a side effect.

2.

Fig. 2 shows the location of the home's installation and the resulting aggregated power measurement as an example of a smart metering setup. Analogue electronics, analogue signal conditioning, and high-speed In order to compute the different properties, analogue to digital converters (ADCs) are required to measure the voltage of the mains supply and the current being pulled from it [10]. A transformer can be used to just change the mains voltage into a low voltage for the purpose of measuring voltage. Non-isolating direct voltage division is a further choice [6], [11]. To isolate current to low signal voltage conversion for current measurement, utilise a current transformer, Hall effect sensor, or Rogowski coil [6, 12]. Following ADC, the data are processed to produce assessment metrics, such as maximum energy, minimal energy, and so forth. subsequently provide them to a service provider, such as an energy company. The transmission mechanism is determined by the nation where the installation is placed. For instance, mobile cellular networks are frequently used in the UK for transmission, however ZigBee and wireless ad hoc networks are also used. Installation and use of smart metres in the United States are subject to user contracts residential settings [13]–[15]. The transmission, storage, and access to data are heavily regulated by law.

Publicly Available Datasets

The use of public datasets and the definition of standardized performance metrics are crucial in order to guarantee uniform comparison, standardization, and comparability among various LM methods [16]. In addition, the combination of public datasets and performance metrics enables cross-comparison of proposed approaches to advance the LM task, such as filtering methods, selected features, and classifiers. The monitoring of energy consumption for the purpose of creating publicly available datasets was only initiated within the last ten years, despite the growing interest in NILM techniques over the past two decades [17]. Therefore, new NILM methods can be developed and evaluated using the majority of existing datasets, which provide a good representation of existing housing structures or, less frequently, non-residential buildings. However, there have been shifts in electrical household appliances, such as the increasing prevalence of devices that are either strongly non-linear or more continuous (such as controlled air conditioning and switched power supplies) [18]. As a result, the housing structures of the coming years may not be accurately represented by the datasets that are currently available [18], which offers the most popular datasets with aggregated signal measurements and the related ground truth to give the reader an overview of the available datasets that are suitable for LM, is an updated and enlarged version [19]. The detailed summary of the year and nation in which the database was created, the number of households and target devices, the duration of the monitoring, the measuring strategy, the attributes monitored, and the sampling resolution for the target devices and aggregated data. The dataprovides a list of 29 databases with energy and power recordings from eleven different countries, as well as information about sampling frequencies, the number and types of devices, and monitoring period durations. 18 of these 29 databases (REDD [20], BLUED [21], ECO [22], UKDALE [23], Data port [24], Smart [25], RAE [26], iAWE [27], IHEPCDC [28], REFIT [29], AMPds [30], [31], COMBED [32], DRED [33], SustDataED [34], EEUD [35], SysD [36], LIFTED [37], and BLOND [In addition, there is a collection of six additional databases (PLAID [38], WHITED [39-40]) that contain the signatures of transient appliances. These databases can only

be used for the design of edge detectors, the creation of transient appliance models, and the extraction of features. In particular, CREAM enables the extraction of internal operation states that may be utilised to improve complicated device modelling. In addition, five of the databases—REDD, UK-DALE, BLUED, BLOND, and Sust Data ED—offer high-frequency measurements of raw current and voltage for the combined data. The databases may now be divided into high- and low-frequency groups as a result. The BLOND database is the only one, according to the authors, that offers high frequency consumption metrics (above line frequency) for each device. This makes it appropriate for testing disaggregation algorithms with varied sampling frequencies since it offers high frequency ground truth data. All databases have active power, with the exception of the BLOND database, which records voltage and current at a high sampling frequency as their primary measured feature.

II. OBJECTIVE

An employee will receive an alert email to take necessary action if a phase becomes overloaded during a specific time period. Continuous energy consumption data are required to accomplish this. Through RS485 communication, this data is obtained from the Multi Functional Meters. There are six sections in this chapter. The Multi Functional Meter is described in the first section, along with its Slave ID settings and Baud rate settings. The second section explains how to retrieve data from the meter. The third section discusses the pre-processing of the meter-collected data and the creation of the data base for its storage. Fifthly, the procedure of sending an email notification to the employee is explained. Sixth, experiments are carried out with the data that has been collected.

B. Multi Functional Meter

A 3-phase, 4-wire Multi-Function NOVA L&T Meter is used to measure all electrical parameters, including voltage, current, active power, energy, frequency, and power factor. As seen in the illustration, this metre contains three buttons: the choose key, the scroll UP key, and the scroll DOWN key. 2.2.1 Details Regarding the Communication Interface To obtain the meter's measured readings, RS485 connection is supported by the Multi-Function Meter. The meter's pin diagram shows that RS485 communication takes place on pins 7 and 8. To communicate with the meter, the configuration details are

- The half-duplex RS485 standard is used.
- The Baud Rate can be changed from 19200 to 4800 to 2400 to 1200. But 9600 is the default.
- Parity (None, Odd, or Even) can be selected. But even is the default.
- The MODBUS Protocol is used for the RS485 interface in RTU mode. In this case, communicating with the meter entails sending the meter commands to read and write to a specific register. From 1 to 247, a user-defined meter address (Slave ID) can be used to address the meter.

C. COMMUNICATION PARAMETERS SETTING

It is necessary to configure the meter's communication parameters, such as Baud Rate, Slave ID, and Parity, in order to communicate with it. Change the meter to programming mode to set these parameters. By holding down the Multi Functional Meter's SELECT and scroll UP keys, you can accomplish this.

The steps that need to be taken to set the Baud Rate are

1. Press and hold the scroll UP key in the Programming Menu to access "Set Port," then press the SELECT key.
2. Selecting the Baud Rate (1200 to 19200): Press the SELECT key to set the desired baud rate using the UP key.

The steps to take to set the parity are as follows: Press and hold the scroll UP key in the Programming Menu to access "Set Port," then press the SELECT key.

2. Parity(Even/Odd/None): Press the SELECT key to set the desired parity, then use the UP key to select it.

The first step in setting the Slave ID is Press and hold the scroll UP button in the Programming Menu to access "Set SL Id," and then press the SELECT key.
2. Increase the SL Id value by pressing the UP key. To go to the next digit, press the UP and SELECT keys simultaneously.
3. To set the ID, press the select key. The range of the slave id is from 1 to 247.

Data Retrieval
The first difficult task is obtaining the building's energy consumption data once the meter's communication parameters are set. [6] Provides an explanation of the problem's solution. This meter serves as a slave, collecting data from it. Because the Raspberry Pi can be mounted anywhere rather than the computer, it is used as the Master. The meter is connected to the Raspberry Pi through an FTDI-based USB to RS485 converter cable. Devices having an RS485 interface may be quickly and easily connected to USB with this connection. For RS485 connection, 5 Pins 7 and 8 are utilised. The required hardware for gathering the meter's data is listed in [38]. The connection between the metre and the FTDI-based USB to RS485 converter is shown [8]. Once the connection is complete, attach the FTDI-based USB to RS485 converter to the Raspberry Pi.
RaspberryPi uses the meter's Slave ID and communication parameters like baud rate and parity to access the meter. The registers of the meter store information about energy consumption. Some functions can access the registers that hold the necessary data by providing the register addresses and function code as input parameters as an example. To read data from the metre, use the function "read registers (R1, R2, function code)". The start and end registers are R1 and R2, and the function code identifies whether they are read-only or writable. After the data is gathered from read registers, time and date are added to make it easier to separate it from the data that was previously gathered. Since the data monitoring is ongoing, the acquired data are kept on a computer. Cloud storage can be introduced later. SSH is used by the RaspberryPi to connect to the PC. As a result, the data is transferred to a computer as a text or csv file for storage.

Data Pre process
Line by line, the data is stored in. The data, along with the date and time it was collected, are on each line of the file. In reality, the integer format is used to store the data measured by the meter. Using the function code of 4, the read registers read a total of 16 instantaneous parameters from each line. Each parameter is made up of two words, each of which is 8 bits long. 32 registers must be accessed since the parameters are kept at odd locations. where 0 represents fifty percent. as an example. Function code 04 at address 01 can access the phase 1 voltage, and function code 04 at address 03 can access the phase 2 voltage. The preprocessing procedure is divided into three steps.

III. Conclusions
This paper's energy monitoring and data analytics component is divided into three sections. The first is alerting the employee to the overload on the phase-specific cable. To support the solution, a case study of a commercial IITH building is provided. Once all the metres are connected, there will be no need to constantly shut off the Raspberry Pi's power for the experiment. Additionally, by explaining the calculations of different parameters like the load factor, the imbalance factor, the rising time, and the high load duration period, the advantages of energy monitoring in a commercial building are discussed. Another demonstration demonstrates how to connect the metre to an Arduino, which can be upgraded to give you total control over the meter

References .

1. "Lighting control and monitoring for energy efficiency:" by V. R. L. Verso, L. Blaso, A. Acquaviva, E. Patti, and A. Osello, a case study on building management system interoperability," IEEE Transactions on Industry Applications, vol. 52, no. 3, pp. 2627 2637, 2016.Load Curve Monitoring and Data Analytics: Case Study on a Campus Building Charan Teja S Student Member , IEEE , Sandhya CSR Student Member , IEEE , Pradeep Kumar Yemula MIEEE
2. Comparison of voltage unbalance factor by line and phase voltage, by J-G Kim, E-W Lee, D-J Lee, and J-H Lee, published in Electrical Machines and Systems in 2005. ICEMS 2005. Volume 8 of the Proceedings of the Eighth International Conference on 3. 2005, IEEE, pages 19982001. A. Grandjean, J. Adnot, and G. Binet, "A review and an analysis of the residential electric load curve models," Renewable and Sustainable Energy Reviews, vol. 16, no. 9, pp. 65396565, 2012.
3. Trend based periodicity detection for load curve data was presented at the 2013 IEEE Power and Energy Society General Meeting (PES) by Z. Guo, W. Li, A. Lau, T. Inga-Rojas, and K. Wang. IEEE (2013).
4. "CLEAR A circuit level electric appliance radar for the electric cabinet," by A. U. Haq, T. Kriechbaumer, M. Kahl, and H.-A. Jacobsen, in Proc. Int. IEEE Conf. Technol. Ind. Pages (ICIT), 2017. 1130–1135.
5. "A feasibility study of automated plug-load identification from high-frequency measurements," by J. Gao, E. C. Kara, S. Giri, and M. Bergés, in Proc. Global Conf. of IEEE Inf. Signal The procedure GlobalSIP), Orlando, FL, United States, 2015, pages 220–224.
6. "Low cost disaggregation of smart meter sensor data," by G. C. Koutitas and L. Tassiulas, IEEE Sensors J., vol. 16, no. 6, pp. 1665–1673, Mar. 2016.
7. "Embedded edge computing for real-time smart meter data analytics," by T. Sirojan, S. Lu, B. T. Phung, and E. Ambikairajah, in Proc. Int. Conf. Syst. for Smart Energy Technique (Pages (SEST), 2019, 1–5
8. "BLOND, a building-level office environment dataset of typical electrical appliances," by T. Kriechbaumer and H.-A. Jacobsen, Sci. Vol. of data May 5, 2018, Art.no.180048.[Online]. Available: https://www.nature.com/articles/sdata201848.pdf
9. "Privacy protection scheme based on remote anonymous attestation for trusted smart meters," IEEE Trans., by J. Zhao, J. Liu, Z. Qin, and K. Ren. Vol. Smart Grid 9, no. 4, pp. 3313–3320, Jul. 2018.
10. Privacy preserving in nonintrusive load monitoring: H. Wang, C. Lu, and C. Wu, A perspective on differential privacy," IEEE Trans. Vol. Smart Grid 12, no. 3, pp. 2529–2543, May 2021.
11. "Intrusion detection for cybersecurity of smart meters," IEEE Trans., by C.-C. Sun, D. J. S. Cardenas, A. Hahn, and C.-C. Liu. Vol. Smart Grid 12, no. 1, pp. 612–622, Jan. 2021.
12. N. Batra and others, NILMTK, "Proc. 5th ACM International Conf. System for Future Energy (e-Energy), Cambridge, United Kingdom, June 2014, pages 265–276
13. "A non-intrusive identification of home appliances using active power and harmonic current," Electron, by D. Srdjan, D. Marko, and L. Vanco. Vol. of Energetics, 30, no. 2, pp. 199–208, 2017, doi: 10.2298/FUEE1702199D.
14. Eds., J. Z. Kolter and M. J. Johnson, REDD: A public data set for the study of energy disaggregation," in Artificial Intelligence. Michigan, USA: 2011, Greenhaven Press
15. 15. "Event detection for non intrusive load monitoring," by K. D. Anderson, M. E. Bergés, A. Ocneanu, D. Benitez, and J. M. F. Moura, in Proc. 38th Year Conf. Ind. Electron, IEEE Soc. (IECON), 2012, Montreal, Quebec, Canada, pp. 3312–3317.
16. "The ECO data set and the performance of non-intrusive load monitoring algorithms," in Proc., C. Beckel, W. Kleiminger, R. Cicchetti, T. Staake, and S. Santini. First ACM Conf. Integrated System Energy-Efficient Construction Pages (BuildSys), 2014 80–89.
17. "The U.K.-DALE dataset, domestic appliance-level electricity demand and whole-house demand from five U.K. homes," Science, by J. Kelly and W. Knottenbelt Vol. of data Art. 2, March 2015 no. 150007.C. Holcomb, Ed., *A Test-Bed for NILM*. Pittsburgh, PA, USA, 2012.
18. S. Barker and others, Smart*: An open data set and tools to make it possible to study sustainable homes," in Proc. Vol. of ACM SustKDD 111, Aug. 2012, p. 108.
19. C. Tumpach, Z. Wang, and S. Makonin, "RAE: The rainforest automation energy dataset for the analysis of smart grid meter data," Data, vol. 3, no. 1, p. 8, 2018.
20. "It's different," by N. Batra, M. Gulati, A. Singh, and M. B. Sri vastava in Proc. Embedded Systems, Fifth ACM Workshop Energy-Saving Construction, 2013, pp. 1–8.

21. A. Berard and G. Hebrail. Data Set on Individual Household Electric Power ConsumptionOnline].Available:https://archive.ics.uci.(Accessed:edu/ml/datasets/individual-household-electricity-power-consumption#) Jul. 12, 2022).
22. An electrical load measurements dataset of UK households from a two-year longitudinal study, D. Murray, L. Stankovic, and V. Stankovic, Sci. Vol. of data 4, no. 1, pp. 1–12, 2017.
23. "Electricity, water, and natural gas consumption of a residential house in Canada from 2012 to 2014," Sci., S. Makonin, B. Ellert, I. V. Baji c, and F. Popowich. Vol. of data 3, no. 1, pp. 1–12, 2016.
24. "A comparison of non-intrusive load monitoring methods for commercial and residential buildings," 2014, arXiv:1408.6595, by N. Batra, O. Parson, M. Berges, A. Singh, and A. Rogers.
25. "LocED," in Proc., by A. R. Lua, V. R. Prasad, and S. U. Nambi Second International Conference of the ACM Conf. Integrated System Energy-Efficient Construction BuildSys), Seoul, Korea, November 2015, pages 45–54.
26. "SustDataED:" by M. Ribeiro, L. Pereira, F. Quintal, and N. Nunes. A public dataset for the study of electric energy disaggregation," in Proc. ICT Support, 2016, pp. 244–245.
27. "Electrical-end-use data from 23 houses sampled every minute for simulating micro-generation systems," by G. Johnson and I. Beausoleil-Morrison, Appl. Thermal Engineering, vol. 114, pp. 1449–1456, Mar. 2017.
28. for non-intrusive household load monitoring," according to Sci. Vol. of data 7, no. 1, pp. 1–17, 2020. A synthetic energy dataset, by C. Klemenjak, C. Kovatsch, M. Herold, and W. Elmenreich
29. "LIFTED:" by L. Yan, J. Han, R. Xu, and Z. Li Data compression at the appliance level and lossless coding with precision in mind, household appliance-level load dataset," in Proc. IEEE Energy Society 2020 Annual General Meeting (PESGM), pages 1–5.
30. "Residential building stock assessment:" N. E. E. Alliance Metering study," Ecotope Inc., Seattle, Washington, United States, Rep. No. E14-283, 2014.
31. Zimmermann, J.-P., et al., Survey on Household Electricity: Intertek Test, Leatherhead, United Kingdom: A Study of Domestic Electrical Product Use 2012: Certification Ltd.
32. A. Reinhardt and others, on the reliability of appliance identification using data from distributed load metering," in Proc. Sustain. ICT Support the Internet. (Maintain IT), 2012,pages19.[Online].Available:http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6388037
33. S.D'Alessandro, A. Monacchi, D. Egarter, W. Elmenreich, and A. M. Tonello, "GREEND: An Italian and Austrian household energy consumption dataset," in Proc. Int. IEEE Conf. Comm. Smart Grid (SmartGridComm), November 2014, Venice, Italy, pages 511–516.
34. "PLAID:" by J. Gao, S. Giri, E. C. Kara, and M. Bergés A public dataset of electrical appliance measurements with high resistance for load identification research, as published in Proc. First ACM Conf. Integrated System Energy-Efficient Construction Pages (BuildSys), 2014 198–199.
35. "Whited A worldwide household and industry transient energy data set," by M. Kahl, A. U. Haq, T. Kriechbaumer, and H.-A. Jacobsen, in Proc. 3rd Int. Non-Intrusive Workshop Load Monitor, 2016, pp. 1–4.
36. M. Kahl and others, Measurement system and dataset for in-depth analysis of industrial appliance energy consumption," Technisches Messen, vol. 86, no. 1, pp. 1–13, 2019.
37. "CREAM, a component level coffeemaker electrical activity measurement dataset," Sci., by D. Jorde, T. Kriechbaumer, T. Berger, S. Zitzlsperger, and H.-A. Jacobsen. Vol. of data 7, no. 1, pp. 1–13, 2020.
38. "An in-depth study into using EMI signatures for appliance identification," by M. Gulati, S. S. Ram, and A. Singh, in Proc. First ACM Conf. Integrated System Energy-Efficient Construction Pages (BuildSys), 2014 70–79.
39. T. Picon and others, COOLL: A public dataset of high-sampled electrical signals for appliance identification is the Controlled On/Off Loads Library.," 2016, arXiv:1611.05803.
40. "Unsupervised disaggregation of low frequency power measurements," by H. Kim, M. Marwah, M. Arlitt, G. Lyon, and J. Han, in Proc. Global SIAM Conf. Min. of Data, 2011, pages, Philadelphia, PA, USA 747–758.

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IMPORTANCE OF SUSTAINABILITY IN THE VUCA WORLD FOR GENERATION NEXT

Dr Sudhir M. Purohit, Assistant Professor, Atharva Institute of Management Studies

Abstract : The Research paper discusses about the importance of sustainability in the VUCA world for the coming generation in future . The research paper discusses about the continuous changes which are happening in the world with reference to survival and growth and how to combat them by following the principles of Volatility, Uncertainty, Complexity and Ambiguity. Carbon emission calls for the concern to the whole world. This problem of sustainability which may be solvable with the principles of VUCA is being discussed here.

Key words : Need and Greed Theory , Voluntary or Innocent Activities , Irrational or Deliberate Activities

1.Introduction

Let there be peace in the heavens the earth, the atmosphere, the water the herbs, the vegetation, among the divine beings and in Brahman, the absolute reality. Let everything be at peace and in peace. Only then will be find peace". Atharava Veda

Life is all about Decisions. And decisions are all about choices! Life gives us a choice. If we choose one path to move on in the life, the another path is automatically rejected. However , it is very important that if we choose a wrong path, is it possible to revert back and change the path ? if not then what ? This is a matter of concern !

With the advent of a Human Being as creation of Nature , it took a long time to make this Earth habitable but with a very small passage of time, the Humans made this earth inhabitable by emitting carbon and other elements and thus created a huge problem of survival and sustainability.

2. Importance of Sustainability VUCA World for Generation Next : An Introduction

The individual has power to tackle those tough problems while they are still . The impact of the daily routine activities which are undertaken for the survival of the human being which has created Carbon emission and this has made a sudden unexpected change. Every human being on this earth is striving for its very survival and growth. And to survive they do such activities which so many times are harming the nature and the natural resources termed here as Green Assets. It is human nature that what we have is not enough even though it is fare enough for our survival but the theory of NEED when gets converted to the theory of GREED nobody knows. Here the volatility in the behavior of human towards the Need to Greed leads to the uncertainty of the Future of next Generation! This leads to increase in the Complexities of the problems since one problem is interviewed with another and the whole thread gets interlocked and creates confusion and becomes Ambiguous . The Human nature is first they create problem and then they interconnect one problem with another and gets confused at the end between finding solution to all of them together.

3.Analysis of data and Conclusion

The continues changes which are happening in the world with reference to survival and continuous growth and how to combat them by following the principles of Volatility, Uncertainty, Complexity and Ambiguity

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Chart: The following chart shows the daily routine activities of the individuals for their survival and sustainability and growth. These activities are classified on the basis of their age group based on their daily routine and how these necessary and habitual activates affect the environment through soil erosion, water contamination , noise pollution ,air pollution and environment pollution. The activities are classified as 1. Rational or voluntary activities (which are necessary for survival)and 2. Irrational or Deliberate (Which will harm the Mother Nature.

Classification of individual activities based on age group affecting the environment

Activity/ Age group	0-10	11-20	21-30	31-40	41-50	51-60	61-70
1. Medicine (soil, atmosphere, water, air)	✓	✓	✓	✓	✓	✓	✓
2. Toilet (water, soil, atmosphere, air)	✓	✓	✓	✓	✓	✓	✓
3. Stool(water, soil, atmosphere, air)	✓	✓	✓	✓	✓	✓	✓
4. Diaper atmosphere, soil	✓						✓
5. Cry (loudly) noise, air	✓	?	?	?	?	?	?
6. School/college/ education Books, trees, paper, pen, pencil, rubber	✓	✓	✓	✓	✓ ?	?	?
7. Cracker festival/games atmosphere, air, soil, water	✓	✓	✓	✓	✓	?	?
8. Water balloon/color water, soil, atmosphere	✓	✓	✓	✓	✓	✓	✓
9. Shaving water, soil, atmosphere		✓	✓	✓	✓	✓	✓
10. Watching TV Electricity, noise	✓	✓	✓	✓	✓	✓	✓
11. Traveling air, atmosphere, natural, reasonable, noise	✓	✓	✓	✓	✓	✓	✓
12. Gossiping Noise	?	✓	✓	✓	✓?	✓?	✓?
13. Listening Music, noise, electricity	?	✓	✓	✓	✓	✓	✓
14. Playing outdoor soil, noise	✓	✓	✓	✓	✓	✓	?
15. Going to gym noise, electricity		✓	✓	✓	✓	?	?
16. Driving car air, atmosphere, natural resource		✓	✓	✓	✓	✓	✓?
17. Riding bike air, atmosphere, natural resource		✓	✓	✓	✓	✓	?
18. Sex atmosphere by contraceptives		✓?	✓	✓	✓	✓?	?
19. Sociality Marriage (all type of pollution)	✓	✓?	✓	✓	✓	✓	✓?
20. Funeral (all type of pollution			✓	✓	✓	✓	✓
21. Fart/ sneezes air, atmosphere, noise	✓	✓	✓	✓	✓	✓	✓?
22. Perfume air, atmosphere		✓	✓	✓	✓	✓	✓

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Activity/ Age group	0-10	11-20	21-30	31-40	41-50	51-60	61-70
23. Going office water, soil, atmosphere		✓?	✓	✓	✓	✓	✓?
24. Jogging air, soil				✓	✓	✓	✓
25. Reading newspaper → trees		?	✓	✓?	✓	✓	✓?
26. Hospitalized air, soil, atmosphere	✓	✓	✓	✓	✓	✓	✓
27. Bathing water, soil	✓	✓	✓	✓	✓	✓	✓?
28. Brush	✓	✓	✓	✓	✓	✓	✓
29. Using electronic gadgets energy, atmosphere	✓	✓	✓	✓	✓	✓	✓
30. Reading books paper(cutting trees)	✓	✓	✓	✓	✓	✓	✓
31. Chewing pan/Gutka Chewing gum Smoking(Soil, atmosphere)	✓?	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓? ✓	✓? ✓
32. Washing clothes water, soil, atmosphere		✓	✓	✓	✓	✓	✓
33. Drinking soft. drink Hard drink (water, soil, atmosphere)	✓	✓?	✓ ✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓?
34. Hair Cut, Nail cut (Soil, water, atmosphere)	✓	✓	✓	✓	✓	✓	✓

The tick mark (✓)in the above chart shows the affirmation of the activity by the age group, where as the question mark (?) represent the doubt whether that particular activity is performed by a particular age group.

The above chart shows nearly all routine activities, which a human being exercises during his Life cycle. There are so many other activities which can also be added over here. The above activities are inclusive activities and not exhaustive activities. The activities relating job specification like mining, hunting, fishing, etc. of an individual which does affect the environment, are not noted down purposely as it involves earning lively hood and as a research topic, the professional activities are not covered here.

The above activities presented in the chart are more or less connected with the Human survival, hence these survival activities does have an impact on the environment.

The impact of the daily routine activities which are undertaken for the survival of the human being which has created Carbon emission and this has made a sudden unexpected change.

Activity/ Age group	**0-10**	**011-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**Total**
1. Medicine (soil, atmosphere, water, air)	10	10	10	10	10	10	10	70
2. Toilet (water, soil, atmosphere, air)	10	10	10	10	10	10	10	70
3. Stool(water, soil, atmosphere, air)	10	10	10	10	10	10	10	70

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Activity/ Age group	**0-10**	**011-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**Total**
4. Diaper atmosphere, soil	10	5	5	5	5	5	10	45
5. Cry (loudly) 0ise, air	10	0	0	0	0	0	0	10
6. School/college/ education Books, trees, paper, pen, pencil, rubber	10	10	10	10	5	0	0	45
7. Cracker festival/games atmosphere, air, soil, water	10	10	10	10	10	0	0	50
8. Water balloon/color water, soil, atmosphere	10	10	10	10	10	10	10	70
Activity/ Age group	**0-10**	**011-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**Total**
9. Shaving water, soil, atmosphere	5	10	10	10	10	10	10	65
10. Watching TV Electricity, 0ise	10	10	10	10	10	10	10	70
11. Traveling air, atmosphere, natural, reasonable, 0ise	10	10	10	10	10	10	10	70
12. Gossiping 0ise	0	10	10	10	5	5	5	45
Activity/ Age group	**0-10**	**011-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**Total**
13. Listening Music, 0ise, electricity	0	10	10	10	10	10	10	60
14. Playing outdoor soil, 0ise	10	10	10	10	10	10	0	60
15. Going to gym 0ise, electricity	5	10	10	10	10	0	0	45
16. Driving car air, atmosphere, natural resource	5	10	10	10	10	10	5	60
Activity/ Age group	**0-10**	**011-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**Total**

17. Riding bike air, atmosphere, natural resource	5	10	10	10	10	10	0	55
18. Sex atmosphere by contraceptives	5	5	10	10	10	5	0	45
19. Sociality Marriage (all type of pollution)	10	5	10	10	10	10	5	60
20. Funeral (all type of pollution	5	5	10	10	10	10	10	60
Activity/ Age group	**0-10**	**011-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**Total**
21. Fart/ sneezes air, atmosphere, 0ise	10	10	10	10	10	10	5	65
22. Perfume air, atmosphere	5	10	10	10	10	10	10	65
23. Going office water, soil, atmosphere	5	5	10	10	10	10	5	55
24. Jogging air, soil	5	5	5	10	10	10	10	55
Activity/ Age group	**0-10**	**011-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**Total**
25. Reading newspaper □ trees	5	0	10	5	10	10	5	45
26. Hospitalized air, soil, atmosphere	10	10	10	10	10	10	10	70
27. Bathing water, soil	10	10	10	10	10	10	5	65
28. Brush	10	10	10	10	10	10	10	70
Activity/ Age group	**0-10**	**011-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**Total**
29. Using electronic gadgets energy, atmosphere	10	10	10	10	10	10	10	70
30. Reading books paper(cutting trees)	10	10	10	10	10	10	10	70
31. Chewing pan/Gutka	5	10	10	10	10	5	5	55
32. Chewing gum	5	10	10	10	10	10	10	65

Activity/ Age group	**0-10**	**011-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**Total**

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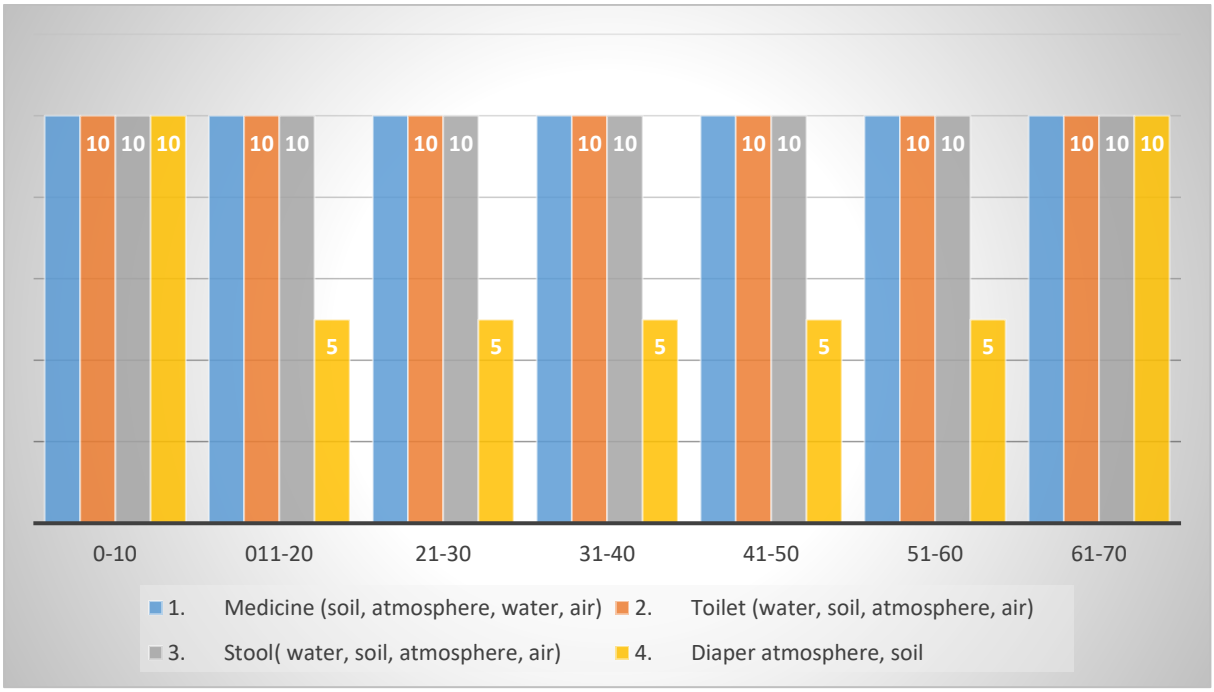
33. Smoking(Soil, atmosphere)	5	10	10	10	10	5	5	55
34. Washing clothes water, soil, atmosphere	5	10	10	10	10	10	10	65
35. Drinking soft. drink	10	5	10	10	10	10	10	65
36. Hard drink (water, soil, atmosphere)	10	5	10	10	10	10	5	60
37. Hair Cut, Nail cut (Soil, water, atmosphere)	10	10	10	10	10	10	10	70



The above activities are broadly classified into :

1.Voluntary or Innocent Activities: These are these activities which an individual does rationally and voluntarily. These activities knowingly or unknowingly affects the environment. But the intention behind these activities is neither bad nor malicious. The intention is growth or satisfaction.

It makes a difference to the environment at a particular level, undoubtedly but the pollution caused is reversible and the Natural Assets can be reinstalled if we want to talk in e-language .i.e. electronic or computer language.

Since an individual fun loving, entertainment lover, kind of person, he by his fun loving nature, makes a mockery and sometimes crosses his limitations and afterwards apologizes for his doings.

These all activities are termed as Curable i.e. Reversible, Rectifiable, and Sound, unconsciously done without a bad intention and done negligently.

Where an individual throws color in the Air and enjoys the festival of colors, the color may go into others eyes.

These activities are undoubtedly constructive but somewhere or the other he will have to pay a price for exploring the environment.

2.Irrational or Deliberate Activities: These kind of are those activities are which an individual does to prove his Almightiness, his strength, his power, his existence and his greed to acquire more. Here starts tug of war between the Nature and the individual.

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Where on one side of the rope the Human Being is holding and the other side he deliberately give to the Nature. This game of "Death" is being participated by the Human Being voluntarily but the Nature is being dragged into. Nature never wanted to participate in such Life threatening game, however the Individual deliberately, induces the Nature to participate. It's like playing with a deadly "sword" and that too with your own Mother?

The Irrecoverable activities by an individual, makes him stand against his own Mother Nature. The Nature which has supported him to be born, grow and survive is now helpless, is retaliating against him. Whoever wins the war between the mother and the son, ultimately the mother only is wounded and defeated.

But one thing to be noticed here is, the war starts only when one person challenges the other. Here an individual because of his reckless behavior challenges Mother Nature and she is bound to retaliate. The Roar of the Mother Nature takes in its Trap , innocent kids also along with the mischievous ones."

This problem of sustainability which may be solvable with the principles of VUCA the individual's power to tackle those tough problems while they are still doable. This concept can further be explained with help of Contribution and Contamination Account similar like Income and Expenditure Account and also by drawing a Green Balance sheet connecting an individual with the environment which is cakculated in Green points of ***Harrit Aank***

Contribution and Contamination A/c for the life span ended

Particulars	Carbon dioxide CO_2	Particulars	Oxygen O_2
To Soil पृथ्वी Use : xx Waste: xx	XXX	By Soil Irrigated or erosion saved e.g. value of soil per kg	XXX
To Water जल Use xx Waste: xx	XXX	By Water conserved or saved during the year e.g. value of water per gallon	XXX
To Air वायु Use : xx Waste: xx	XXX	By Air pollution controlled or contributed to fresh air by saving trees e.g. value of oxygen cylinder	XXX
To Fire अग्नि Use : xx Waste: xx	XXX	By Energy generated Or conserved e.g. value of electricity per unit	XXX
To Space or Atmosphere आकाश Use : xx Waste: xx	XXX	By Trees planted (Nos.) x age of the tree x value per year e.g. Rs. 75,000 per year per tree	XXX
To Addition to environmental capital(if any)	XXX	By Loss to Environmental Capital (if any)	
Total		Total	

Further an individual's Green Balance sheet if drawn connected with environment will look something like shown below

Green Balance Sheet of Mr. …. as on……

Green liabilities	Green Point	Green Assets	Green Point O_2 Rs.

	CO_2 Rs.		
Addition to Environmental capital X	xxx	Trees planted or Natural Assets saved	Xxx
Soil पृथ्वी Use ie irrigated: xx Waste: ie Erosion xx Water जल Use xx Waste: xx Air वायु Use : xx Waste: xx Fire अग्नि Use : xx Waste: xx Space or Atmosphere आकाश (in the form of noise pollution) Use : xx Waste: xx	xxx xxx xxx xxx	Investment in environment protection fund (if any) Amount Spent for Soil Irrigated or erosion saved e.g. value of soil per kg Water conserved or saved during the year e.g. value of water per gallon Air pollution controlled or contributed to fresh air by saving trees e.g. value of oxygen cylinder Energy generated Or conserved e.g. value of electricity per unit Trees planted (Nos.) x age of the tree x value per year e.g. Rs. 75,000 per year per tree Loss to Environmental Capital (if any)	xxx xxx xxx xxx xxx xxx
	xxx	Total	Xxx

Green Balance Sheet of Mr. …. as on……

Green liabilities	Green Point CO_2 Rs.	Green Assets	Green Point O_2 Rs.
Addition to Environmental capital	xxx	Trees planted or Natural Assets	Xxx
Contamination emitting CO_2 in (foot prints) by polluting or using Soil xx Water xx Air xx Fire xx Atmosphere xx		Investment in environment protection fund (if any) Amount Spent for Soil Irrigation xx Water Conservation xx Air Pollution Control xx Energy Conservation xx Others(if any) xx	xxx xxx

	xxx		
Total	xxx	Total	Xxx

Let there be peace in the heavens the earth, the atmosphere, the water the herbs, the vegetation, among the divine beings and in Brahman, the absolute reality. Let everything be at peace and in peace. Only then will be find peace". *Atharava V*eda

4.References

1. www.indiatimes.com/life-style/vedic-perspective-environment/articleshow/4613346.coms
2. www.timesofindia.indiatimes.com/life-style/redic-perspective-onenvironment/articles K.N. Sharma/June 30, 2009, 08:00 AM IST
3. Indiatimes.com/life-style/vedic-perspective-on-environment/articleshow/4613346.coms
4. Indiatimes.com/life-style/vedic-perspective-on-environment/articleshow/4613346.coms
5. http://www.greenfaith.org/religious_teaching/hindu_statements_on_the_environment Hindu Statement on the Environment:
6. N. Das Gupta Environmental Accounting, S. Chand & Company 2005 New Delhi 2005 p. 1
7. Development, U. N. (June, 2012). *the future we want.* Rio de Janeiro, , Brazil: The Indian Astrobiology Research Centre(IARC).
8. www.nationalgeographic.com/earthpulse/ecosystem_and_conservation.html
9. Earth will not remain habitable for long, time to find another planet, says new research.: By Sebastian Anthony an September 20, 2013
10. An Introduction, Edited by S. Vijay Laxkshmi Aparns Bellur, Icfai Books The Icfai University Press, Environmental Accounting By Prodeepta Kumar Samanta and Ashok Kumar Mohanty
11. Green Accounting and Sustainability: Past, Present and Future
12. By Jenni Gandhi LEED IEQ 3.2 Test Meter www.wolfsence.com
13. Fanger, O.P.: Introduction of the olf and the Decibal units to Quantify Air Pollution Perceived by Human Indoors. In: Energy and Buildings. 12, 1988, 1-6. 14What is noise pollution and why it is considered a source of pollution?
14. http://www.teachengineering.org/view_activity.php
15. www.humansandnature.org/humans_nature_the_right_relationship_article_38.php By Peter G Grown & Geoffrey Garver
16. www.sustainablebadystep
17. www.en.on.wikipedia.org/wiki/Decipol
18. www.en.m.wikipedia.org/wiki/radioactive_contamination
19. Calculate y. (2012, september). *to Going Green Fast Track , 07* (09), pp. 19-21.
20. Choudhary Arup (2008) Environmental Accounting Concepts and Practices the ICFAI Univesity Press.
21. Parikh, K.S. and Parikh J. (1997) Accounting and Valuation of Environment: Volume I: A premier for developing countries, Volume II: Case studies from the ESCAP Region, United Nations, New York.
22. Haripriya, G. S. (1998) Forest resource accounting for the state of Maharashtra in India, Development Policy Review
23. Haripriya, G. S. (2001) "Accounting for the forest Resources into the System of National Accounts in India" Environmental and Development Economics.
24. Atkinson and Gundimeda (2004)
25. S. Vijayalaxmi,Aparna Bellur. *Environmental accounting,Importance of Green accounting* . Hyderabad: The Icfai uiversity press.
26. J K Nandi (2008). Environmental Accounting. S. Vijaylakshmi and Aparna Bellur (Eds.) Environmental Accounting: *An Introduction.* Hyderabad, India : Icfai University Press, 2008. pp 3-11.
27. Mohanty, A. K. (2008). Environmental Accounting as a Management Tool. S. Vijaylakshmi and Aparna Bellur (Eds.) Environmental Accounting: *An Introduction.* Hyderabad, India : Icfai University Press, 2008. pp 12-26.
28. Dutta, B. (2008). Corporate Responsibility to Society with Special Reference to Environmental Protection- A Legal Perspective. S. Vijaylakshmi and Aparna Bellur (Eds.) Environmental Accounting: *An Introduction.* Hyderabad, India : Icfai University Press, 2008. pp 27-36.