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2. CONFERENCE

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Parkinson's Prediction Techniques: A Comparison

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ABSTRACT-- Abstract--Parkinson's disease is a medical condition of the central nervous system that affects motion, often including quivering. Nerve cell damage in the brain causes dopamine levels to drop, leading to the symptoms of Parkinson's. Which include Tremor in the hands, limbs, stiff muscles, difficulty standing, difficulty walking, difficulty with bodily movements, unintentional movements, muscle become unbending, problems with integration, throbbing muscle contractions, gently bodily movement, or slow shuffling gait early awakening, nightmares, restless sleep, fatigue, dementia, or difficulty thinking and small handwriting, trembling, unintentional writhing, or weight loss. It may also be symptoms of other disease. Thus, we aim to use comparison Techniques (Decision Tree, SVM, NB) with some preprocessing techniques to predict the Parkinson's disease

Keywords—SVM—Support Vector Machine -NB-Naive Baye

I. INTRODUCTION

Parkinson's disease is a medical condition in which central nervous system that affects the motion, often including quivering. Nerve cell damage in the brain causes dopamine levels to drop, leading to the symptoms of Parkinson's. Which include Tremor in the hands, limbs, stiff muscles, difficulty standing, difficulty walking, difficulty with bodily mov

ements, involuntary movements, muscle rigidity, problems with coordination, rhythmic muscle contractions, slow bodily movement, or slow shuffling gait early awakening, nightmares, restless sleep, fatigue, dementia, or difficulty thinking and understanding, difficulty speaking, soft speech, or voice box spasms fear of falling, loss in contrast sensitivity, neck tightness, small handwriting, trembling, unintentional writhing, or weight loss. Advancements in science and technology has made the process of accessing and understanding datasets much easier. Multiple datasets based on Parkinson's disease are also openly available. This paper deals with mainly three PD datasets which are voice

PD, hand PD and speech PD dataset. A number of feature sets are taken into consideration for categorizing the people into affected or healthy. The dataset related to the different features can contribute to increase the accuracy level of the detection process. But in the past few decades it was observed that the volume of the datasets has been increasing drastically and has led to the drop in performance of various models, thereby degrading the results. Thus, it is essential to process the data by choosing only a subset of the relevant features. Recently, the power of optimization algorithms is being used in advanced feature selection methods, to produce results with higher accuracy by removing not pertinent and needless attributes from datasets, which does not make a big handout to the accuracy of a model. Grey Wolf Optimization is one such optimization technique

which is used for feature selection. The reduced subset of features obtained after feature selection is further processed by a machine learning algorithm for producing a final prediction on diagnosis of Parkinson's disease. Here in this paper deals with a deeper study on the different type of prediction techniques like SVM, Naive Bayes, and decision tree. The process of disease prediction is divided into two steps feature selection and disease prediction. The process of selecting features is a very important task as it plays a crucial role in determining good time complexity as well as producing better accuracy for the model thereby increasing the performance. The total set of features are examined closely for selecting a reduced subset of features, this paper uses GWO for the same. The next major step is disease prediction. The reduced subset of features is further provided as input to various machine learning algorithms like svm, naive Bayes, Decision tree etc to produce an accurate and concrete result. It also focuses on comparing the methods of predictions in the coming sections.

II. LITERATURE SURVEY

For disease prediction we used different types of classification algorithms, these are most common in many health cares. Many of these show high classification accuracy;

- 1) Dr. Anupam Bhatia and Raunak Sulekh, "Predictive Model for Parkinson's Disease through Naive Bayes Classification" In this study, Naive Bayes was applied to predict the performance of the dataset. Rapid miner 7.6.001 is a tool, which is used to explore, statistically analyze, and the data. The Naive Bayes model performs with 98.5% accuracy, and 99.75% of precision.
- 2) Mehrbakhsh Nilashi et al., "A hybrid intelligent system for the prediction of Parkinson's Disease progression using Machine Learning techniques" In this system a method was proposed for the UPDRS (Total-UPDRS and Motor-UPDRS) prediction using machine learning. ISVR is used to predict the Total-UPDRS and Motor-UPDRS. SOM and NIPALS were used for clustering and data dimensionality reduction. The results show that the method combining SOM, NIPALS, and ISVR techniques was effective in predicting the Total-UPDRS and Motor-UPDRS.
- 3) M. Abdar and M. Zomorodi-Moghadam, "Impact of Patients' Gender on Parkinson's disease using Classification Algorithms" In this system, SVM and Bayesian

- Networks were used for classification of data based on the gender of the patient. The accuracy for SVM was 90.98% and Bayesian network was 88.62%. This test proved that the SVM algorithm had a great ability to identify a patient's gender suffering from PD.
- 6) Dragana Miljkovic et al., "Machine Learning and Data Mining Methods for Managing Parkinson's Disease" In this system, based on the initial patient examination and medication status, the Predictor part was able to predict each Parkinson's Disease symptom separately covering 15 different Parkinson's Disease symptoms in total. The accuracy of prediction ranges from 57.1% to 77.4% depending on the symptom where the highest accuracy is achieved from tremor detection.
- 4) Md. Redone Hassan et al., "A Knowledge Base Data Mining based on Parkinson's Disease" In this system, the results and output of the vector support machine (SVM), K nearest neighbor and the output figures for the decision tree algorithms were shown in the output section of the train data. The decision tree offered the highest precision of 78.2%
 - 5) Satish Srinivasan, Michael Martin & Abhishek Tripathi, "ANN based Data Mining Analysis of Parkinson's Disease" In this study, it was intended to understand how the different types of pre-processing steps could affect the prediction accuracy of the classifier. In the process of classifying the Parkinson's Disease dataset using the ANN based MLP classifier as significantly high prediction accuracy was observed when the dataset was preprocessed using both the Discretization and Resample technique, both in the case of 10 fold cross validation and 80:20 split. Whereas in the 70:30 split it was found that the combination of the pre-processing steps namely Resampling and SMOTE on the dataset resulted toward the higher prediction accuracy using the MLP classifier. On an 80:20 split of the preprocessed (Discretized and Resampled) dataset the ANN based MLP classifier achieved a 100% classification accuracy with F1-score and MCC being 100%.
 - 6) Ramzi M. Sadek et al., "Parkinson's Disease Prediction using Artificial Neural Network" In this system, 195 samples in the dataset were divided into 170 training samples and 25 validating samples. Then importing the dataset in the Just Neural Network (JNN) environment, we trained, validated the Artificial Neural Network

model. The most important attributes contributing to the ANN model were made known. The ANN model was 100% accurate.

III. METHODOLOGY

Data Mining is a process of extracting usable data from a much larger set of any raw data. It means studying data patterns in large batches of data using one or more software. Data mining has implementation fields of science and research. As an implementation of data mining, medical science can learn more about the diseases and develop more effective Master plans to combat those diseases and in turn Support resources in a more optimal and insightful manner. Data mining necessitated data collection and warehousing as well as computer processing. For segmenting the data and evaluating the probability of future events, data mining uses sophisticated mathematical algorithms.

3.1 DATAMINING TECHNIQUES

A) Association

Association is used to make an association between items and is often used to study sales transactions. The attempts of association data mining to establish a relationship between an item that occurs sort out in a given dataset. In data mining, association rules are used for studying and guessing the medical health prediction to get a better diagnosis.

B) Classification

Classification is a model used to predict the future behaviour of the data through classifying the records into predefined classes. The classification algorithm is measured in terms of exactness and recall metric to estimate the performance of classification algorithm.

There are various data mining classifiers some of them are listed below:

- Naive Bayes

Naive Bayes in the huge dataset presented acceptable speed and accuracy, but the effect is extremely unfortunate in the case of a small dataset. The Naive Bayes classifier is the probabilistic algorithm that calculates a set of probabilities by counting the frequency and groupings of values in a given record.

- Support Vector Machine

The Support Vector Machine (SVM) was first formed by Vapnik and has since involved a high grade of concentration in machine learning. Support Vector Machine is a constant algorithm compared to other algorithms that are neural networks, decision trees.

- Decision Tree

Decision trees are the most forcible and popular tool for classification and prediction. A Decision tree is a flow chart like tree structure, where each internal node denotes a test on an attribute, each branch represents an outcome of the test, and each leaf node holds a class label.

3.2 PROPOSED SYSTEM

The proposed system includes a training and testing prediction model through following steps;

A) Data Collection

A data set (or dataset) is a collection of data. In the case of tabular data, a dataset corresponds to one or more data tables, where every column of a table represents a particular variable, and each row corresponds to a given record of the data set in question. The dataset can be collected from Kaggle, Google data search etc.

B) Pre-processing

Done by numpy, NumPy is a Python library used for working with arrays. It also has functions for working in domain of linear algebra, Fourier transform, and matrices. It is an open-source project and you can use it freely.

C) Feature extraction

Features are extracted from the dataset by following ways:

The fit() method takes the training data as arguments, which can be one array in the case of unsupervised learning, or two arrays in the case of supervised learning. Note that the model is fitted using X and y, and one includes X and y.

The features of each segmented region are extracted by taking visual content of image. System works well on the most relevant statistical parameters or texture features computed by using Gray Level Co-occurrence Matrix (GLCM). Then construct a feature vector to represent all feature values include contrast, velocity, and entropy, energy etc.

D) Output

Predictive modelling uses scientifically proved mathematical statistics to predict event outcomes. Most often one event that a mathematician wants to predict or apply predictive analysis on it is in the future (also here physics and mathematical notion of future can be applied), but predictive modelling can be applied to any type of mathematically stated as "unknown" event, (almost) regardless of when it occurred.

		PREDICTIVE VALUES	
		POSITIVE (1)	NEGATIVE (0)
ACTUAL VALUES	POSITIVE (1)	TP	FN
	NEGATIVE (0)	FP	TN

Fig3.1 Shows confusion matrix

And compared the output to find the accuracy, using confusion matrix. A confusion matrix is a table that is often used to describe the performance of a classification model (or "classifier") on a set of test data for which the true values are known. The confusion matrix itself is relatively simple to understand, but the related terminology can be confusing.

IV. RESULT AND DISCUSSION

Parkinson's Disease is a very grave disease and has no cure till now. Following it affects the gesticulation of the parts of the body, the speech also be found affected. Here, the system strives to provide a way to discover Parkinson's Disease which will result in a quick action to minimize or even delay it from affecting the complete body. This system intends to make this process of apprehension a case of Parkinson's at the earliest by both the patient as well as medical professionals. Hence, the aim is to use various data mining techniques like SVM, Decision Tree, Naive Bayes for getting the most accurate result. Here using the techniques accuracy is improved.

$$A = \pi r^2$$

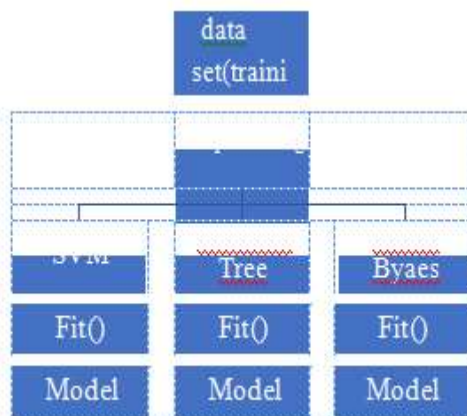


Fig3.2 show training model of PD prediction



Fig3.3 Testing model for PD prediction

SIFT Enhanced Multiple Biometric Authentication System Integrated With Temperature Sensor

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ABSTRACT

Biometric authentication is a security procedure used to verify a person's identity, based on his or her unique physical characteristics. It is used to control access to both physical and digital resources, such as organizations, rooms, and different gadgets. Multiple biometric authentication systems use more than one physiological feature of an individual for the purpose of identification and verification and they are a superior solution for every industry that demands higher accuracy as well as security. This method proposes a contact less multiple biometric authentication system which uses palm print and hand geometry features. A temperature sensor is integrated in this system for detecting elevated body temperatures. A high body temperature or fever is related to many diseases and can be a first indicator whether a person is healthy or not. Using the SIFT (Scale Invariant Feature Transform) algorithm, this design achieves robust local feature detection and extraction in an image.

Keywords- Biometric, Handgeometry, Palmprint, SIFT, Security

INTRODUCTION

Biometric devices are used for security identification and authentication. These devices can identify a user and then verify that the identified user has the identity they claim. In the current epidemic scenario biometric authentication devices must be more vigilant to prevent the spread of diseases. So, as part of ensuring security, biometric systems also need to identify the users expected to be covid infected

and ensure the safety of other users too. Biometric identification systems with integrated thermal measurements are used to make processes contact less while supporting new antivirus policies.

Multiple biometric identification system combines two or more biometric technologies to make the authentication and identification process more accurate and safe. When compared to other biometrics such as fingerprint, iris, retina etc. hand recognition is considered as the most easily accessible biometric and highly accepted by the users. So, the combination of hand geometry and palm print features can result in a biometric authentication system with high performance and accuracy.

In a palm print, many characteristics like wrinkles, epidermal ridges and principal lines can be used to determine or establish identity. A person's identity can be determined with high certainty using the principal lines of their palm. Hand geometry measurements determined for this purpose may be the lengths and proportions of fingers, the area of palm, the height and width of hand, and other such features. Hand measurements and palm characteristics can be located in a single image with the help of a high resolution image [1].

To extend the palm print verification innovation, a unique feature extraction and matching approach for palm print integrating SIFT (Scale Invariant Feature Transformation) is proposed. SIFT has already been extensively utilized in common object detection problems. A rectangular ROI (Region of Interest) of palm is determined with the help of detected points, using the coordinates and distances among finger valleys. Palm image processing is done by means of changing the RGB picture to grayscale, resizing and making use of a smoothing filter. The palm print principal lines are magnified with

four averaging filters in different directions. The principal lines are detected in four smoothed images and consolidated into one single image. Then, the noise is removed. The palm image that contains enhanced principle lines is a grayscale image with high intensity pixels representing sharply defined lines and low intensity pixels representing shallow wrinkles.

The temperature sensor added to the system can measure the body temperature of the user. This technology has become more common and integrated in access control systems for health and safety as they can detect elevated temperatures. LM35 sensor is used here to sense the body temperature. Body temperature is a basic parameter for monitoring and diagnosing human health. The verification decision from the authentication system provides instruction for body temperature sensing. The access is granted only if the user meets both the requirements of authentication and body temperature.

LITERATURE REVIEW

Chih-Lung Lin et al., proposed a strong biometric authentication technique primarily based totally at the palm-print and palm-dorsum vein patterns. In this technique, the palm or palm-dorsum images are first adjusted and trimmed automatically. It then combines palm-print and vein sample images with the aid of digital wavelet remodel and inverse wavelet transform and extract the line-like features (LLFs) from the combined image. It obtains multiresolution representations of the line-like features utilizing a multi resolution filter and makes use of a support vector machine to confirm the multiresolution representations of the LLFs [2].

By merging the images of the left and right palm prints, Yong Xu et al. introduced a multi biometrics system to accomplish personal identification [3]. The first two scores in this framework are derived from images of the left and right palms, and the third score is determined by flipping the right training palm print over and contrasting it with the left palm print to perform matching score-level fusion. When compared to other identification approaches, a weighted fusion scheme is applied, and it works well.

For authentication using iris and palm print features, Zhenan Sun et al. developed ordinal feature representation. This suggests an

ordinal feature selection strategy to assess misclassification error in samples matching samples from within and between classes. Additionally, the process of feature selection is presented as a problem of linear programming. For iris recognition, an ordinal feature set is chosen, and the intensity measurements between the regions of the palm print are used to create descriptors [4]. Linear programming feature selection is a viable option for iris photometric variations that are acute and modest geometric differences in palm print patterns.

Yong Xu et al. recommended a biometrics system that uses infrared face images and palm images. It calculates the matching score for the first and second trait and then it performs a cross matching score. The first, second and the cross matching score are combined by a weighted score level fusion scheme for authentication [5].

A multi-modal biometric system integrating fingerprint and palm-print was presented by Yong Jian Chin et al. in [6]. The palm print and finger print images are improved with the use of Short Time Fourier Transform analysis. Images are broken down into several frequency components using the Wavelet Transform (WT). Images of palm-prints and fingerprints are extracted and filtered using a bank of 2D Gabor filters. Each image has a feature vector that is retrieved, and feature level fusion is used for matching.

A precise and reliable multi-modal authentication system using samples of palm and knuckle prints was proposed by Aditya Nigam and Phalguni Gupta [7]. Images used for biometric identification are transformed using the suggested sign of local gradient (SLG). With the help of the geometrically and statistically constrained Lucas and Kanade tracking method, corner characteristics are retrieved from v code and h code and tracked. To match two query images, the suggested Highly Uncorrelated Features (HUF) measure is applied. The suggested approach is tested using the publicly accessible palm print databases from PolyU, CASIA, and PolyU Knuckle. A key conclusion from this experimental study is that it is exceedingly challenging to attain perfect ROC behavior using only one attribute, but that it is possible to do so with two or more.

METHODOLOGY

Preprocessing

The process of getting the hand image ready for characteristic point detection is called preprocessing. It includes edge detection, noise reduction, grey scaling, and image segmentation. The Hand Segmentation texture is used by default with an Orthographic camera because it separates off the area of the camera feed where the hand is located. With the aid of morphological techniques, the segmentation of the hand is followed by edge detection and noise reduction.

Feature Extraction

The process of transforming the source data into numerical features that may be analyzed while keeping the information from the original data set safe is referred to as feature extraction. It yields higher results than applying machine learning on to the information. It will increase the accuracy of learned models by extracting options from the input file. This part of the overall framework reduces the spatial property of data by removing the redundant data.

To find local features that are independent of image rotation, translation and scaling the SIFT (Scale Invariant Feature Transform) algorithm was created. This can be done by picking key locations at the local maxima and minima of a Gaussian difference operation applied in scale space, which is constructed by sequentially down sampling the input image. This scale space's maximum and minimum values are established by comparing each element to its neighbors. To create a histogram of gradient orientation, a 16x16 window is used around each local maxima or minima that are discovered. The hand geometry features to be extracted are,

- Finger tip
- Wrist point
- Finger valley

Finding the fingertips is the initial stage in characteristic point detection because the remaining processes depend on these points being recognized. The top-most edge points that first appear in the image with the contour lines are extracted. Since fewer points are used, better performance is guaranteed.

In order to accurately determine the hand area, wrist point detection is crucial in hand geometry

point detection. The first edge point to appear on the left and right side of each row, only the points below the thumb, is extracted to begin the detecting process. The points are classified and two categories (left and right) are produced during this process. The wrist points are regarded as the locations where the groupings are closest to one another as shown in Fig. 1 [8].

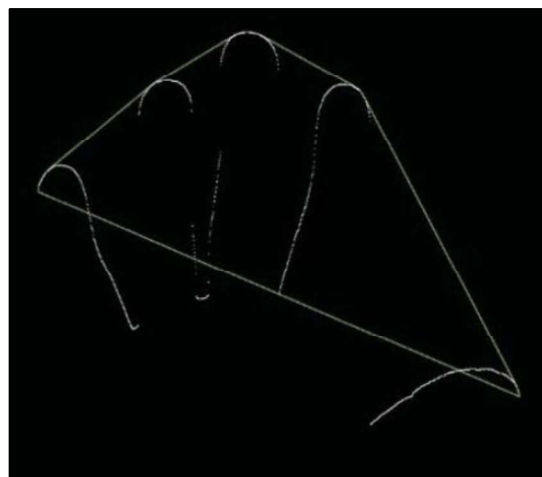


Figure 1: Fingertip extraction.

Finger valley detection is fundamental for finger length calculation and palm image extraction. The finger valley is detected by eliminating the first occurring point from left and right side in each row in the image containing the edges. The further reduction of points can be done by defining a Centre of mass and eliminating points outside it. The thumb valley is determined by calculating the global value of the reduced point set. The remaining valleys are found to be identified by the convex hull of the reduced point set as shown in Fig. 2 and 3.

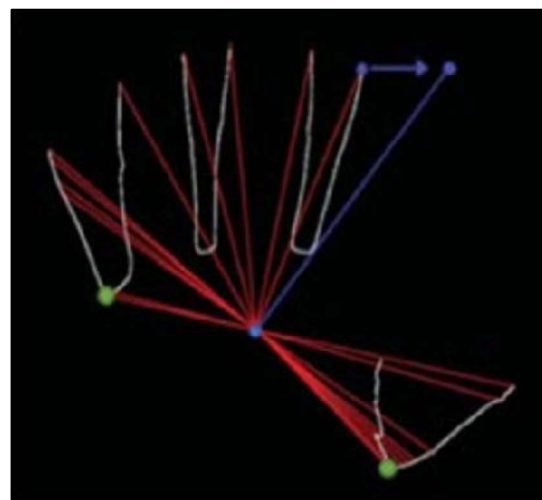


Figure 2: Finger valley detection.

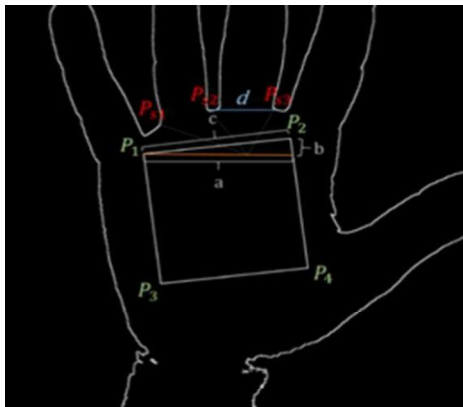


Figure 3: Points of ROI extraction.

The palm print feature extraction include,

- Region of Interest (ROI) extraction
- Palm line extraction

For palm-print analysis, an image section is decided, where the principal palm lines should be analyzed. The projected approach selects a square ROI because determining the whole square requires two points (P1 and P2) [9]. P3 and P4 are the final two points calculated from P1 and P2, and they are shown on Fig. 3.

SIFT feature extraction includes,

Scale Extreme Point Recognition

Key-points in SIFT are found in this preliminary stage. The key points are designed to be resistant to changes in scale and multiple views of the same object.

Customizing Key Points

The earlier step yields a number of weak key-point alternatives with poor edge alignment and low contrast. These are removed at this point.

Key-Points with Low Contrast are Eliminated

Low distinctiveness key points are discovered using the aforementioned methods and are removed in this phase.

Getting Rid of Edge Responses

The DOG function has robust responses along edges even if the candidate key-point is weak to very small quantities of noise. Therefore, key points with poorly established locations but high edge responses are removed in order to increase stability.

Assigning orientations

Based on the local image gradient directions, each key-point is given one or more orientations in this step. As the key-point descriptor is recorded in relation to the current orientation in this step, in-variance with rotation is achieved, leading to changeless to image rotation.

Key Point Descriptors

Key-point locations at explicit scales were discovered in earlier steps, and they were given orientations. This insured that the image's position, scale, and rotation would not change. We are currently trying to figure out a descriptor vector for each key-point that has been specified. This descriptor is very unique and only partially affected by the remaining variations, such as lighting, 3D viewpoint, etc.

Matching

Hand geometry feature matching is done based on the finger length proportion, length of the middle finger and palm area.

The process of point-wise SIFT feature key point matching is employed to match palm-prints. For SIFT feature extraction, the pre-processed palm-print ROIs are used. Several samples of SIFT palm-print extraction results are shown in Fig. 4. The point-wise SIFT feature key point matching technique described above is used to match palm-prints [10].

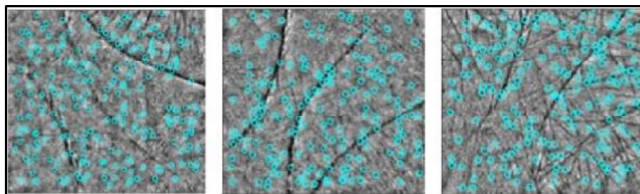


Figure 4: Sample palm-print SIFT features.

is subsequently supplied to the microcontroller. The microcontroller contains an ADC, which performs additional processing before sending the measured data via Bluetooth to the remote

end. The microcontroller processes and displays the received data after being sent to it for processing as shown in Fig. 7.

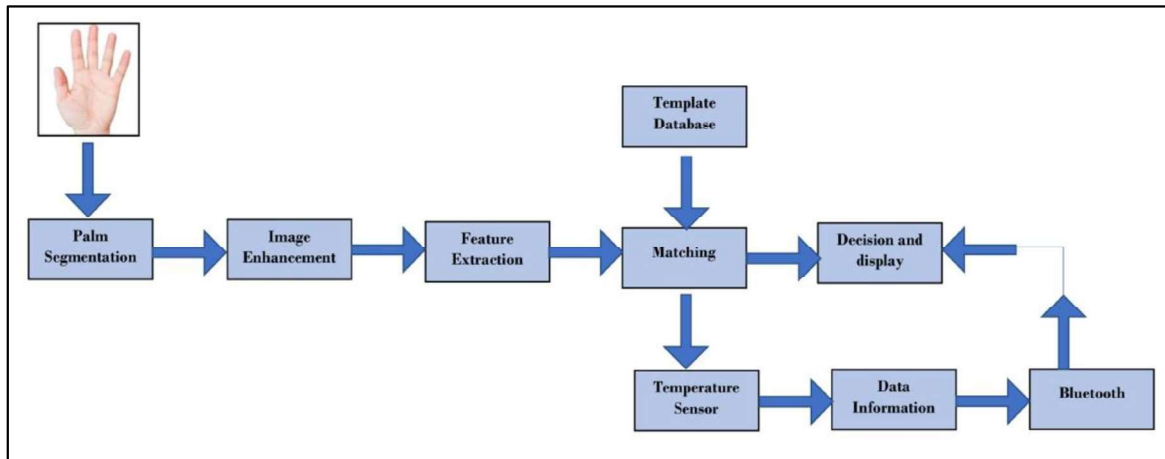


Figure 7: Block diagram of the proposed system.

RESULT AND DISCUSSION

This paper proposes a contact less multiple biometric systems integrated with temperature sensor which is able to produce signals for access granting or denying based on biometric authentication and body temperature

results. The SIFT approach for feature extraction has been implemented. This extraction method is effective and has a greater rate of matching scores than other extraction methods.it performs better for images that are scalable and rotation invariant as shown in Fig. 8.

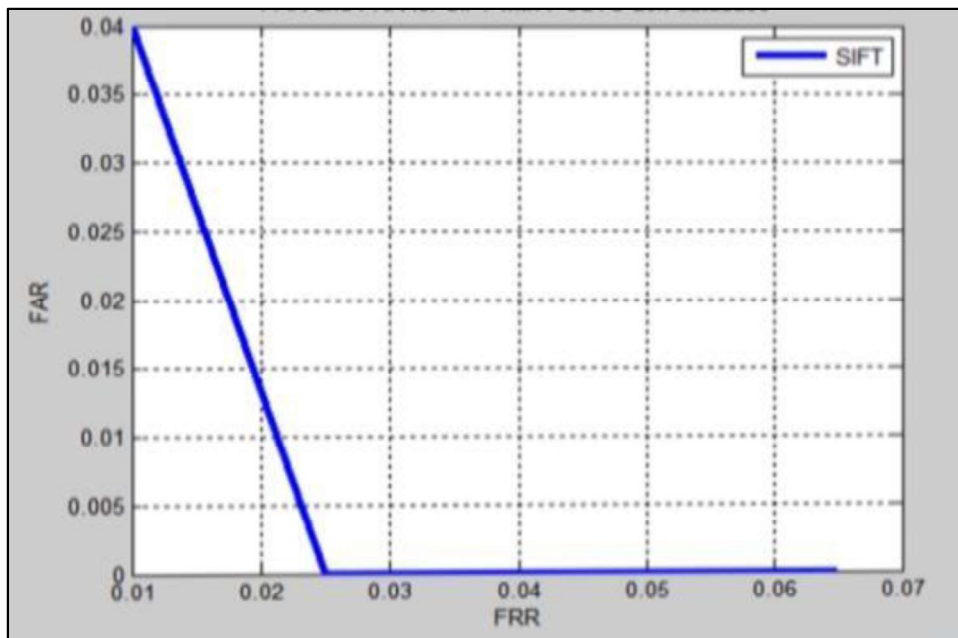


Figure 8: Performance graph using SIFT method.

CONCLUSION

In this paper a simple solution is proposed for a low cost contact less biometric

system which also senses the body temperature of the user. This system provides both security and health safety. It can be considered as an efficient system that can be used to limit the

entry to a certain place for verified users who are healthy. Here, SIFT feature extraction is employed, which detects more features compared to other similar methods. But, SIFT requires more time for processing. In further development of the system, a feature extraction method which overcomes this issue will be utilized.

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Parkinson's Disease Prediction Using Convolutional Neural Network

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ABSTRACT— Parkinson's disease is a neurodegenerative disorder that affects the neurons that produce dopamine in a specific area of the brain called substantia nigra. This causes hindrance in motor and speed skills. For successful treatment of Parkinson's disease, it is essential to monitor the disease's progress. Voice changes at an early stage before the brain cells are affected. Here we aim to predict if a person has Parkinson's disease using voice recording data set of patients by using a neural network. The voice of the patients is recorded and the features are extracted through MFCC. The voice recordings are tested to predict if a person has Parkinson's disease and also to tell the condition of the disease.

Keywords: Parkinson's disease, dysphonia, MFCC, Convolutional neural network

I. INTRODUCTION

Parkinson's Disease (PD) affects the aged population, it is a progressive neurological condition [1]. The pathological hallmark of PD is a slow degeneration of the nigrostriatal dopaminergic system. The widely accepted subcellular factor which underlies PD neuropathology is the presence of Lewy bodies with characteristic inclusions of aggregate alpha-synuclein. PD-specific pathology extends far beyond the nigrostriatal dopaminergic system, affecting the widespread brain areas, including the olfactory system, autonomic, cerebral cortex, and ganglionic brainstem nuclei. Motor symptoms such as akinesia, tremor at rest, postural instability and rigidity are the cardinal signs of PD. There are also many non-motor features of PD including behavioral and psychiatric problems such as dementia, fatigue, anxiety and depression, autonomic dysfunction, addiction

and compulsion, psychosis, olfactory dysfunction, and cognitive impairment [2]. The UPDRS scale, known as the Unified Parkinson Disease Rating Scale, is a rating tool used to gauge the level of Parkinson's disease in patients. This scale has been modified over the years with the help of several medical organizations and continues to be one of the bases of treatment and research in PD clinics [3]. It is used to follow the longitudinal course of Parkinson's disease. The UPDRS rating scale is used mostly in the clinical study of Parkinson's disease. It includes a series of ratings for typical Parkinson's symptoms that cover all of the movement disorders of Parkinson's disease. Assessment based on UPDRS is tiring and time-consuming. The patients' physical presence is required in the clinic which makes its use difficult. Thus, giving rise to the need for an objective, reliable, and easy-to-use diagnostic modality. Individuals with Parkinson's disease (PD) exhibit a motor speech disorder called hypokinetic dysarthria caused by damage to the basal ganglia control circuit. The symptoms related to the vocal impairment of Parkinson's disease patients are called dysphonia [4]. Dysphonia can be recognized as the initial presenting speech feature in Parkinson's, they exhibit mildly strained, tight, or whispered voices. The dysphonia measure could be treated as an important and reliable tool in assessing the voice-related problem and in monitoring it at different stages [5, 6, 7]. Here the feature selection method is used to evaluate the contribution of features in the assessment of disease at different stages for better accuracy [8]. The proposed approach helps to detect Parkinson's disease from the voice attributes of patients by using Convolutional Neural Networks [9]. The premotor stage of PD should be monitored carefully for early detection. The

premotor stage shows the symptoms like Rapid Eye Movement (REM), Sleep Behavior, and Olfactory loss. In this work, a deep learning model is designed to discriminate between normal individuals and patients affected by PD.

II. LITERATURE REVIEW

In the year 2018 Diogo Braga et. al [10] suggested the methodologies to detect Parkinson's in its early stage. The background condition was uncontrolled and the speech was analyzed. The results portrayed the potential of the random forest method and Support Vector Mechanism (SVM). The system did an acoustic speech analysis and the energy was used to feed a classification-based machine learning algorithm. The results showed that acoustic clues that are compatible with persons affected by Parkinson's disease and also the healthy persons. The paper analyzed the problems of Parkinson's disease and explained the reasons behind it, also showed the importance of detecting Parkinson's disease. The aspects like the screening techniques and therapy with their costs were discussed. The neurological implications in speech production and its detection and coverage were described. The machine learning approaches were also mentioned with a brief discussion of the techniques used and the advantages and disadvantages of fusing them. With all these into account, a new approach was proposed in [10], and in comparison with other methodologies, their methodology exhibited high robustness to disturbances. It also has the advantage of non-invasiveness, with low cost and much comfort. In the year 2019 Salim Lahmiri and Amir Shmuel et. al [11] stated it as a neurodegenerative disorder that is due to the loss of dopamine-producing neurons. The symptoms that were categorized as motor and non-motor. A neighbor pattern ranking technique that is coupled with a support vector machine SVM to distinguish the healthy individuals and the Parkinson affected individuals was utilized. The ranking patterns of the voice and the features were ranked accordingly and the ones with great accuracy specificity and sensitivity were distributed for the study the wrapper technique based on the induction algorithm analyzed the pattern sets. The results showed that the SVM classifier achieved the highest classification accuracy for the classification of the features with the first 14 Voice patterns identified by Wilcoxon based pattern ranking technique. They pointed out the need to explore

the multimodal Parkinson's disease diagnosis technique that can be used to improve the performance to increase the accuracy in the future.

Athanasios Tsanas and Max A. et. al [12] mentioned about the unified Parkinson's disease rating scale UPDRS. The verbal phonations that can be used to predict the Parkinson's disease symptoms were examined. A map between dysphonia measures and the scale was observed. The motor and non-motor symptoms were analyzed with the UPDRS which were similar to that of the clinician's observations. The algorithm was equivalent to a brute force search with all possible measures to find the smallest combination possible which is the prediction method used here.

R Prashant et. al [13] analysed the use of questionnaires to develop the predictive model for the Parkinson's disease detection. A predictive model was developed that has an accuracy that is greater than 95 percent. The different strategies used to manage the disease were discussed. The MDS UPDRS Questionnaire was developed for the prediction models to classify the PD affected patients. The machine learning techniques that are used to detect the diseases such as boosted trees, logic regressions, support vector machine and random forest were also utilized. All these techniques had high accuracy and high area under the ROC curve. Among all these logic regression capabilities gives the best results. All these techniques help to analyze the initial evaluation of the patient but for more in-depth analysis SPECT imaging must be used. It was also proved that a patient's self-questionnaire is a better tool for the analysis of themselves. It was stated in [13] that combining both the existing questionnaires through machine learning will be an alternate way that has a better probability to detect PD subjects.

Hakan Gunduzin [15] stated that PD has multiple motor and non-motor symptoms with the focal impairments shown at an early stage. In this, two methods based on CNN to identify the Parkinson's disease were introduced. Both the methods have similar frameworks but their combining mechanism for the features are different. The first method combines a 9-layered CNN as input to the feature sets whilst the second framework uses a parallel input layer that is connected to the CNN layer. It was on the UCI machine. This work is the first to implement that method with parallel layers with a dataset including 3 voice recordings. It was stated that the parallel layer network enables to use of different types of datasets that can be fed into the

network inputs. This gives the multimodal data analysis in PD classification.

AiteXhalet. alin [16] discussed a method that is based on machine learning to rate the PD severity from gait analysis with the help of foot sensors, they used spatiotemporal patterns of gait data. A deep learning architecture and a two-channel network on LSTM and CNN used were for modeling the gait data over a period of time. The previous model provided only binary detection, but the proposed model has the ability to perform multi-category classification that enables us to understand the severity of PD from gait sensors. However, this work only enables to the finding of the severity of PD. Also, VGRF gait data is hard to obtain as the patients have difficulty walking because of the severity of the disease. It was claimed that in future works fused features can be used to achieve greater accuracy. The LSTM also is advantageous as it can include more data types. These approaches provide a baseline for future works and also inspire to make more computer-aided applications.

In the work by Laura Silveira Moriyama et. al [17], the smell of identification tests has been used for the detection of PD. Hyposmia is common in PD patients and can be utilized for PD identification. The study had 221 patients with PD and 207 without. The Queen Square Brain Bank Criteria was satisfied for the diagnosis. The DaTSCAN dataset was used. The smell test showed good accuracy this helps to know about the nasal fluctuations and the analysis of the respiratory tract. It was also stated that dopamine transporter scan is hard to find and are expensive, and also has the chance of misinterpretations. The work suggests that odor tests are cheaper and are more available.

In [18], Gaetano Valenza et. al states that PD affects a person in many ways and they aim for a comprehensive computational assessment of heart beat dynamics as PD has spontaneous cardiovascular oscillations. They are computed at 600s obtained for 29 healthy people and 30 PD patients. The variance was in the Lyapunov exponent. ANS-related HRV metrics were employed for the PD analysis. The plethysmographic signals were recorded and the difference was analyzed. The instantaneous linear and non-linear cardiovascular dynamics in PD was calculated and the features of both PD-affected and healthy subjects were analyzed. The modeling technique was based on the theory in homogeneous nonlinear point process. The statistical PD analysis was done and found that the inter-

subject variability reduced the group differences in cardiovascular dynamics. The accuracy obtained was 70.83%. They only need the ECG as it has cardiovascular dynamics which is easier these days and also portable. The parameter optimization for SVM can be improved in their future models.

The feature extraction classification was discussed by Suleyman Bilgin in [19]. They studied Parkinson's disease which is a nervous system disorder and Huntington's disease which is hereditary causing nerve cell degeneration. The gate dynamics were also disrupted due to the NDD, the early diagnosis is very important. The study was done by 60 with one-minute recordings of the CFS signal that is taken from 13 ALS, 15 PD, 20 HD, and 16 healthy persons were included in the study. The CFS is taken from the left and right foot of the patient during each gait cycle. The CFS is then transformed for the determination of features. The analysis is done by electromyogram or blood tests, all these methods are time-consuming and may have misinterpretations. Wavelet analysis is done to investigate the signal in both the time domain and the frequency domain. The wavelets had the best performance compared to others their comparison had LDA and NBC mean values and fast algorithms for ALS discrimination study were created but they needed more time for the competitive analysis of the gate signals. The study provided solutions to the signal parameter changes that are obtained from the patient they are done by the usage of an artificial intelligence algorithm. The ALS can be discriminated from other groups by the observation of the eD5 Band.

III. METHODOLOGY

The flowchart represents the proposed PD detection procedure. This study proposes a deep learning [20] framework for the early detection of PD. Detection and is done in two stages namely the testing stage and the training stage. It is illustrated in Fig 1.

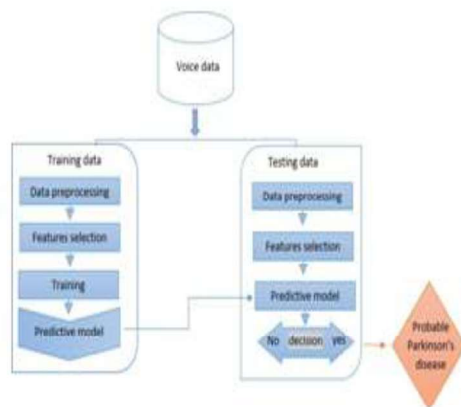


Fig1. Flowchart of the proposed model

TRAINING DATA

The training process consists of 4 stages,

- Data preprocessing
- Features selection
- Training
- Predictive model

➤ Data Preprocessing

The data preprocessing is used to prepare the raw records of data to make them suitable for the application in machine

dataset contain any missing data, it could create a huge problem for the machine learning model. Then the categorical data is encoded. And then the dataset is split into train and test data,

$$x \cdot [k] = \sum_{n=0}^{N-1} x[n] e^{-jkn}$$

N

n=0

kn)

learning. The data preprocessing helps to improve the efficiency and accuracy of the machine learning model. The raw real world generally has many missing values, and noises and also can be an unusable format that cannot be used directly for machine learning purposes.

The first step in data preprocessing is to obtain the dataset. The dataset is converted into CSV (Comma Separated File) file. The python libraries have to be imported in order to perform the preprocessing in python. Numpy library and Matplotlib is used for this purpose. Then the datasets have to be imported, the "read_csv()" function is used for this. Next, the missing data have to be handled.

In the MFCC feature selection which is illustrated in Fig.3, the first step is A/D conversion. Now, the audio is sampled and converted from analog to digital, they'll be in discrete forms. Next, the pre-emphasis is done to boost the energy in higher frequencies, it is done by a filter. Then, windowing is done by slicing the audio waveforms into sliding frames. Then DFT is applied to extract information in the frequency domain by the equations shown below.

$$N-1$$

$$2\pi$$

which is illustrated in Fig.2.

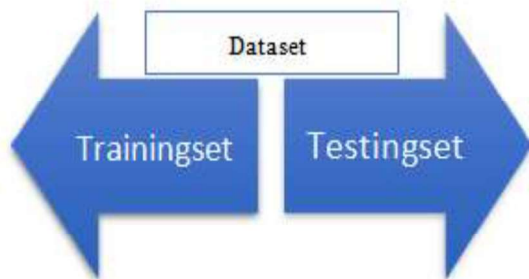


Fig2. Data set

The training set is the subset of the dataset to train the machine learning model. Here the output is already known.

➤ **Feature selection**

Machine learning extracts the features for in-gadenserepresentation of the model. To obtain the audio features, an acoustic model is created. To extract the audio files, a 25ms wide sliding window is used. The features extracted have to be independent, for this many models have been created, and we use Mel-Frequency Cepstral Coefficients (MFCC). It consists of 39 features, 12 of which are related to the amplitude of frequencies.

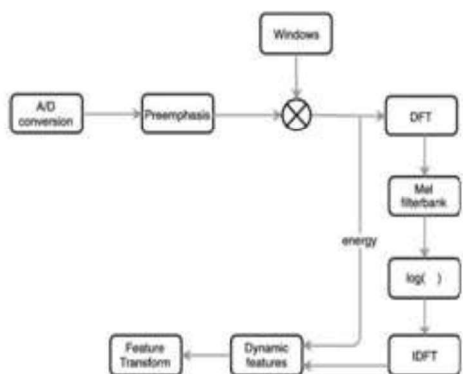


Fig3. Flow of extracting MFCC features

The output of the DFT is squared to $(x[k]^2)$, it is called the DFT power spectrum, here the Mel-scale filter banks are applied to transform it into a Mel-scale power spectrum. The log is then taken from the output of the Mel filterbank. The Inverse Discrete Fourier Transform (IDFT) is done to transform the pitch information. The dynamic features are composed of the 39 MFCC features.

➤ **Training**

A training model is used to train the data, consisting of sample output data and parallel sets of input data. The learning rate for the iteration process is set to 0.00001 with 80 steps in each training iteration. Class is set as with Parkinson's and without Parkinson's, the X and Y classes respectively are split into trainX, testX, trainY, and testY. Then the train data and train label is printed. The tflearn is the tensor flow which is a platform for the neural network.

Long Short-term Memory (LSTM) is a feedback network for the training. The training is done through a supervised model using an optimization algorithm combined with backpropagation through time.

➤ **Predictive model**

The predictive model is a model in machine learning that is used to predict the likely outcomes by analyzing the present and past data. Here the model shows if the given data is Parkinson's positive or negative.

TESTING DATA

The process of testing data is also done in 4 stages,

- Datapreprocessing
- Featureselection
- Predictivemodel
- Decision

The first 3 steps in data testing are done similarly as is in the training process. The data is split as testX and testY and the MFCC features are extracted and compared with the model and then the decision is made.

The decision-making process is done through the variables that are acquired through the training process. They finalize whether Parkinson's disease is present or not.

IV. RESULT AND DISCUSSIONS

In this section, the experimental results and discussions of our proposed CNN architecture is explained. The sklearn technique is used to analyze the accuracy of the training and testing stages. SK-learn is a free software machine learning library for the Python programming language and is also used to split training and testing data. SK-learn is written in Python and uses NumPy extensively for high-performance linear algebra and array operations.

Fig. 4 gives the confusion matrix gives the performance of the model for the provided test data.

		Actual	
		Positive	Negative
Predicted	Positive	True Positive	False Positive
	Negative	False Negative	True Negative

Fig4. Confusion Matrix

To evaluate the performance of machine methods for discriminating Parkinson's patients, the following criteria was employed:

$$\bullet \text{ Accuracy} = \frac{TP+TN}{TP+FP+TN+FN}$$

where TP is the number of true positives, FP is the number of false positives, TN is the number of true negatives and FN is the number of false negatives.

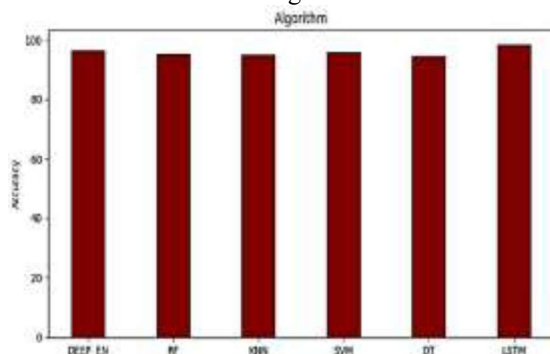


Fig5. Accuracy comparison of the models

With a learning rate of 0.00001 and 80 steps in each iteration, we obtained an accuracy of 98.41%, this gives us a more accurate prediction than the previously done works. Fig5. shows the accuracy comparison of the models. The early detection of Parkinson's disease can be of great use in reducing the impact, that the disease has in store. The CNN is advantageous as it reduces the human help at most, and the training process helps the system to learn the processes.

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IOT Based IV Drip Monitoring and Control System with Compact Medical Stretcher

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ABSTRACT

The majority of incidents, including intravenous combination, are attributed to organizational complexity and an inadequate therapeutic benefit provider-to-patient ratio. The developing number of occurrences like these calls for the improvement of a robotized intravenous organization prepares. This paper describes the programming perspective of an intravenous liquid mixture control framework, including the development of a graphical user interface for mixture verification and the establishment of a database for IV medications. The stream control robotized. The study also compared the physical drop rate with the sensor-observed exploratory drop rate. In over 20 tests also, the system is incorporated with an automated bed which the patient can be controlled using voice commands for his/her comfort.

Keywords- Intravenous infusion, Mixture, Patient, Stream, Treatment

INTRODUCTION

Intravenous treatment is a mixture of medication and liquids into a vein. IV treatment is a fundamental portion of clinical utilizes [1]. There are moreover complications which included in IV implantation are neighborhood and systemic, nearby incorporate thrombophlebitis, invasion, unearthing, and nerve damage and systemic incorporate microscopic organisms, septicemia, emboli, thrombosis, circulatory over-burden etc. This is often done by infusing a needle specifically into the patient's arm [2]. It permits for much more productive treatment of incessant ailments since

it provides medicines, Antibodies and hydration straightforwardly into the circulatory system [3-5].

At display day, IV treatment still intensely depend on manual checking and alterations, where restorative professionals set an IV implantation gadget up agreeing to a doctor's medicine taken after by standard checking and perceptions as anomalous occasions may happen [6]. This paper depicts the computer program viewpoint of the plan and improvement of a remote intravenous mixture control and checking framework when a person is ill and experiences liquid misfortune from reduced admissions, surgery, heaving, the flu, or diaphoresis, the person may need IV treatment [7]. To manage drugs, counting chemotherapy, anesthetics, and symptomatic reagents: Around 40% of all anti-microbial are given. IV solutions and liquids enter the patient's circulatory system straightforwardly through the vein [8]. They hurry inside the body to reestablish liquid volume and provide solutions [9]. Once a medication enters the vein, there is no way to end this activity. Hence, it is imperative to plan the IV medicine legitimately or liquid [10].

Complications of IV treatment incorporate disease, phlebitis, invasion, extravasation, speed stun, circulatory over-burden and anaphylaxis. Non-touch procedures (ANTT) are utilized when overseeing an IV gadget, as this diminishes hazard. The time is how long the IV ought to take to implant. Therefore, the time is 3hours. Complications of IV treatment incorporate: contamination, phlebitis, invasion, extravasation, speed stun, circulatory over-burden and anaphylaxis. Non-touch strategies (ANTT) are utilized when overseeing an IV gadget, as this altogether decreases hazard. The time is how long the IV ought to take to imbue. The time is how long the

IV ought to take to imbue. Hence, the time is 3 hours.

LITERATURE SURVEY

Josephine D. German, John Karlo P. Miña, Claudine Mae N. Alfonso proposed that "A study of shortage of hospital bed in the Philippines using system dynamic." The goal of this study was to identify the preferences of Filipino patients either the density of inpatient beds or the number of clinic beds per 10,000 persons. According to data from the Division of Wellbeing, the country's health authority, only one location—the National Capital Area—met the standards set by the World Health Organization for the number of beds for community clinics in a universal setting. This poses a huge issue to the government and the people of that country because the proportion may be favorable in terms of accessibility, get to and dissemination of wellbeing benefit conveyance within the nation. Through the application of frameworks modeling utilizing framework flow, the show recognized that wellbeing experts, the populace, and money related sources incredibly influence healthcare administrations whereas the 10-year reenactment uncovered that the nation may be able to fulfill the healing center bed necessities by year 2021. This will as it were be conceivable in the event that both open and private clinics will give

Fuh-Gwo Chen, Jen-Ya Wang, Jr Shian Chen, Sheng-Chung, Tu and Kuo-Yi Chen proposed that "A hang and play intravenous infusion monitoring system" In this paper In nursing homes and hospitals, we have created an intravenous (IV) infusion monitoring system. The system integrates hardware devices, consisting of a drip-bag weight scale and an RFID/NFC tag reader, and an IV fusion monitoring software to help nurses control the IV infusion process. The platform for linking an s-type load cell sensor with an RFID/NFC reader is a microcontroller with a 6502-based architecture [11]. A drip bag's tension is converted into a faint electrical signal by the load cell. After being amplified, the electrical signal is passed into a 16-bit A/D converter. The tension is then transformed into a two-byte digital weight data with a range of 0 to 65535.

Fathur Zaini Rachman proposed that "Prototype Development of Monitoring System-

in Patient Infusion with Wireless Sensor Network". In this paper detecting implantation utilize the sensor circuit, which used a photo-diode and a diode laser to give electrical signals to a comparator and then sent to the microcontroller for preparing into information parcels. Information bundles are sent through When the Zigbee facilitator receives the information package, the Zigbee transmission device is then handled and shown on the GUI (graphical client interface), the comes about give data around the implantation condition of persistent care without having to come to the put of establishment. The result model test would seem that, during peak times, the highest tall Zigbee transmitter to Zigbee facilitator is 1.2 metres above the ground of the floor with a most extreme separate of 49 meters. According to transmission throughput tests, information is transmitted more often. Bundles sent by the Zigbee conclusion gadget to Zigbee facilitator, the more the throughput achieved with the strictest restriction (transmission capacity) transmission on a network of 25.

Mon Arjay Malbog Noel Linsangan proposed that "Noninvasive glucose meter for android based device". In this paper, uses a sensor patch and diffused reflectance spectra on the inside of the forearm to measure the blood glucose level [12]. While the Bluetooth module wirelessly transfers the measured glucose level to the Android device for storing, interpreting, and displaying, the Arduino microcontroller processes the data from the sensor patch. Results indicated that there was no difference in the measured values between the developed device and the available glucose meter. Based on the ISO 15197 standard, 39 out of 40 tests, or 97.5% of them, were within the allowable range. Cheng-Ta Chiang Ping-Chen Tsai proposed that proposed is a CMOS liquid level to frequency converter with calibration circuits for identifying the liquid level of intravenous drip. This study's proposed CMOS liquid level to recurrence converter has calibration circuits for identifying the liquid level of intravenous drip [13]. In the paper, a calibration process is suggested. Another development is that he proposed's yields chip are directly digitized, they may be effectively sent over a wide run of transmission media, such as PSN, radio, optical, IR, ultrasonic, and etc. The greatest severe straight error made when using the suggested calibration circuits is 46.44%. The most severe straight

mistake is reduced to 2.04% after calibrating. 32 steps makeup the fluid level run and the comparing yield recurrence run is 3.14 to 58.14 kHz. The area of the chip is 2 u 1.96 mm². The suggested chip is appropriate for devices that measure fluid level, such as devices that determine the fluid level of an intravenous drip.

METHODOLOGY
Flowchart

The Raspberry Pi can then establish a secure shell (SSH) connection with the server and access the database. The computations required by the minicomputer to ascertain the drop rate for a certain prescription are done. In addition, it keeps an eye on the microcontroller's

decision to tighten or relax the IV tube based on data from optical sensors.

After connecting wirelessly The Raspberry Pi will connect to the server, search the database, and decode the prescription data. This makes it possible to choose the ideal drop rate for an IV. When the microcontroller receives the request to start monitoring the drop rate, the Raspberry Pi will read it and deliver it. Calibrating will be done on the controller initially. The servomotor is originally set to 0 degrees in order to do this. The IV tube is completely shut off at this position. Following that, the servomotor will adjust for 5 seconds, making a 1 degree increase every 200 milliseconds as shown in Fig.1.

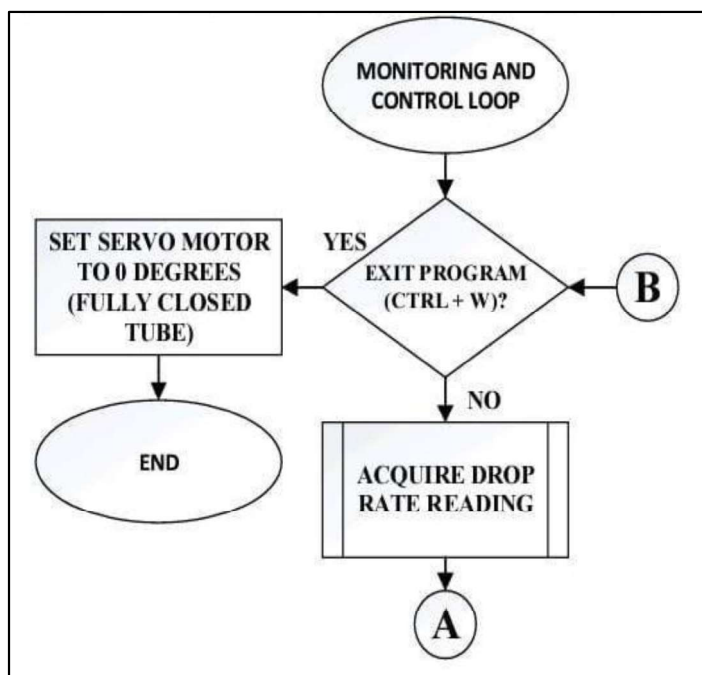


Figure 1:Block diagram.

The credit card-sized Raspberry Pi microprocessor, which is at the centre of this project, directs all activities and sensors. To count the drips, an LDR and laser system is employed. The resistance value of the ldr (Light Dependent Resistor) fluctuates depending on how much light impinges on its surface. Therefore, anytime a drop enters the space between the laser and the ldr, the resistance of the ldr changes, and this change is observed to count the drops. We must utilize an ADC module because the Raspberry Pi can only handle analogue values (Analogue to Digital

Converter). The Raspberry Pi subsequently uploads the drop count to a server. The volume that is accessible in the IV bag is determined using this count. Additionally, an alert is sent to the hospital staff if the volume exceeds the threshold. By manipulating the servomotor attached to the IV bag, the staff can manage the number of drops per second as well as the amount of fluid remaining. The raspberry pi, which will control the servo motor to lift the bed to the patient's preference, will receive voice input via a microphone installed in the bed as shown in Fig. 2.

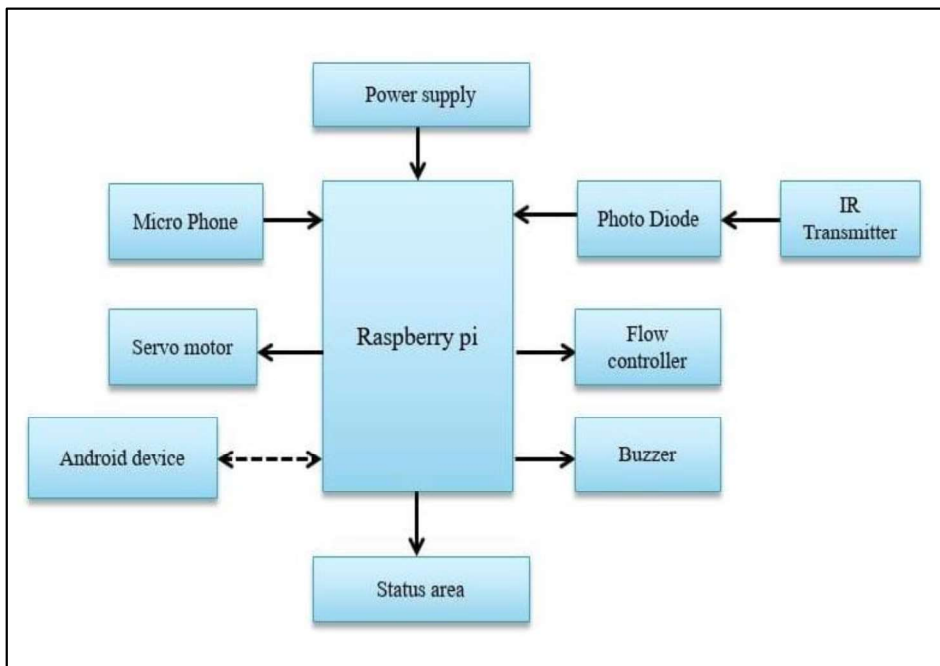


Figure 2: Raspberry Pi microprocessor .

RESULT AND DISCUSSION

In our nation, the ratio of patients to nurses is significantly out of balance. Practically, it is impossible for a nurse to keep track of every patient's intravenous (IV) drip rate. A smart IV therapy device was developed by Kerala-based Eve-labs, a health technology business, to make life easier. The most prevalent medical device in a hospital may be intravenous (IV) drips, and thousands of people across the nation may have one attached to them. However, patients and onlookers may become alarmed if the IV drip retracts or flows blood in the opposite direction. What's even more concerning is the possibility of a patient who already has a life-threatening illness dying from an erratic dosage. It assists the nurse in setting it precisely by detecting real-time drop rates.

The developed system was put through a number of tests, one of which tested the wireless communication's performance. A wireless prototype of the anticipated infusion control and monitoring system is used to assess data delay. And it is calculated as the distance between the prototype and the router varies. The time it takes a data packet to travel from the flow controller and drip metre processing unit to the router and back to the main server is known as data latency. Additionally, a patient's position can be altered by a compact medical stretcher just by hearing them speak.

CONCLUSION

The proponents developed a wireless system for monitoring and controlling intravenous fluid infusions. The developed system provides a database-connected graphical user interface that enables users to enter several patients' IV medications. To determine the drop rate, the prototype may remotely access the database and retrieve the prescription. The flow control's gripping mechanism will then be made easier by this predicted drop. The grip will get tighter or based on the sensing module's current detection of the drop rate, looser. The system's supporters might also contrast the created system's performance with the current IV administration technique done manually. The performance was rated acceptable because there was minimal difference between the drop rates acquired manually and those recorded by the system. Medical professionals at various medical facilities would experience a significant reduction in burden as a result of this study because they would no longer need to make rounds every 20 minutes or more to check on the IV drip rate. A compact medical stretcher can be used to assist patients in adjusting their positions by listening for their sounds.

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Iot Based Medical Assistant Robot For Patient Monitoring

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ABSTRACT—This paper discusses about IOTbasedmedicalassistantrobot for patient monitoring. Which help to develop avirtualdoctor robot that allows a doctor to virtually move around at aremote location at will and even talk to people at remote locationas wanted. The paper explains the background of the study andwill also investigate some previous related workwhich helps todeveloprelevantsystems.Thesystemmakesuseofar oboticvehicle with 4-wheel drive for easy navigation and IOT basedphysiological parametersobservingssystem..The robot alsocontainsa controller boxfor circuitry and a mounting to hold ascreen.

Keywords—IOT,virtual

I. INTRODUCTION

Doctors are usually needed to work at every hospitalandemergencycentereverynowandthen. Buti tisnotfeasiblefor every doctor to be available at every place at desired time.The problem with video calling is that video calls need to bedone from a PC or laptop on a desk. This limits the doctor’scapacity to view patient or around operation theatre at will orevenmovethrough hospitalroomsasneeded.

The directcontactwithdoctorsandmedicalas sistances can be According to the WHO We have less thanone physician per one thousand people for providing properassistance in medical health issues in the world. If a crisis likethecurrentcoronapandemic occurs,thisinsufficiencywillsignificantly be more

observable. As a result, doctors, nursesand medical assistants are forced to serve more people and endupbeingmorevulnerabletotheirownfamiliesandth emselves.This, in turn, is increasing the rate of contact with affectedpeoplemoreandmore.Morepeopleneedmore medicalcaregiversforcheckupsandthisincreasesthe velofexpenditureinthehealthsector.Insuchsituations, arobotmay retrieve records of some vital bodily parameters (such as bodyTemperature, pulse rate, blood oxygen Saturation level) of thepatientwithoutthedoctorornurse’sdirectcontactwi ththem.Itcanconsiderablylessenthepatients’hasslere ducedbydeveloping an IOT based medical assistant robot, it overcometheshortage ofmedicalstaffs.Thismedicalassistantrobotwillconsi derablyreducethefeeofcheckupandunnecessaryhospi tal bills .through this the patient can experience securedandqualityhealthcareservicesatlow cost.

Fromthesestudies,wecertifyabundlesolutio nbydefining the parameters. We have gathered the entire solutioncan be reached out to by combining those factors. These are(i)Doctors ability to be at anyplace anytime (ii)Doctors canmovearoundinoperationtheatres(iii)Doctorscan movearoundthepatientwithease(iv)Doctorscanseem edicalreportsremotely via video calls (v)Doctors canaot to hospitals tolessen direct workload of nurses’ and medical assistants. Aproof-of-idea and the model are introduced in this work. Testresults show experiences that this robot can be utilized as aclinicalassistant.

II. LITERATURE REVIEW

During the year 2010, Buenos Aires, Argentina, on August 31

-September 4, proposed portable and attachable tele-echography robot system: FASTe. Focused assessment with sonography for trauma (FAST) is important for patients who have shock by internal bleeding. However, the patient has little time, and transportation to a hospital may take too long. A system which enables FAST more quickly is required. Therefore, we aim to develop a tele-echography (FAST) robot system that can be used by a paramedic easily for shock patient in ambulance or at injury scene. To develop the system, portability and usability (for paramedic) are significant issues.

We developed a tele-echography robot system which has 4-DOF. The robot is attached to each roughly FAST areas of patient body (body-based setup) and remotely fine-tuned position by a specialist in a hospital. The robot can control the posture of probe by curvature rails. The mechanism that maintains passively the contact force between the probe and patient's body surface by using springs enables the robot small and lightweight. Feasibility experiments of FAST are reported.

In the year 2017 Department of Electromedic Engineering Politeknik Kesehatan Kemenkes Jakarta I Jakarta, Indonesia Self-monitoring enables patients to become more active participants in their healthcare, home pulse oximetry can provide objective data for determining health status and the possible need for medical consultation or interventions. Pulse oximetry is a non-invasive and continuous method for monitoring the blood oxygen saturation level. Pulse oximetry has gained acceptance in the medical community caused

low costs and easy to operation. Prototype pulse oximeter in previous research still use system based on microcontroller. Microcontroller system is ideal for building robotics systems but microcontroller system has a weakness in terms of processing the signal. During the last decade, development of single board computer has provided smaller, faster and more affordable. The aim of this study to develop a prototype handheld oxygen saturation based on single board computer Raspberry Pi for home care. The added value of this research is using the single board computer system and the graphical user interfaces

were redesigned to become more informative. This study uses experimental research with a quantitative approach. The result of this study successfully developed a prot

otype pulse oximeter equipped by LCD touch screen that can display the value of oxygen saturation (SpO₂), pulse rate (PR) and photoplethysmography (PPG). The reliability of oxygen saturation and heart rate were quite stable from $\pm 1\%$ to $\pm 2\%$ compare gold standard, with standard deviation range of 0.577 to 1.

In the year 2012 Kyushu University, Fukuoka, Japan Control systems for Autonomous mobile delivery robots have been described before. However, the control they provide is limited, leaving potential for serious errors. The current mobile robot systems concentrate on position accuracy and operational function but leave open management of safety hazards such as entering the dangerous and not intended areas as stairway. In order to increase the safety of the robot, it is as important to work with sensors installed in the external environment as the sensors installed on the robot. For this purpose, visible light communication (VLC) is a promising device to be used with the robot system. VLC creates an in-house GPS system by installing special LED lights that can replace standard lighting in key locations in the hospital. We have developed an in-hospital transportation robot, called HOSPI in which the control system has been enhanced by combining the navigational sensors of the robot and a VLC using installed lighting in the building. By using VLC, robots can obtain more information about the environment. As the first step for the practical application of VLC to robot system, we use VLC to overcome problems in conventional localization approaches, and to provide an additional line of defense in the case of catastrophic failures. This paper also describes experimental and actual operational results in detail of robots equipped, in an actual hospital, with the described process

In 2020th international conference on control, Automation and automation Path finding for multiple robots is one of most important problems in robotics when to find a way to move robots from their starting positions to reach their respective goals without collisions. However, in the case of a complex environment with the presence of humans and other unpredictable moving objects, fixing a single path to the goal may lead to a situation where there are a lot of obstacles on the planned path and the robots may fail to realize the moving plan. To address this issue, a new approach of

using multiple path planning where each robot has different options to choose its path to the goal is introduced in this paper. The information about planned moving paths are shared among the robots in the working domain, combined with obstacle avoidance constraints in local ranges, and formulated as an optimisation problem. Solution of the problem leads to the optimal moving plans of robots. The effectiveness of the proposed approach is demonstrated by experimental results.

Tuan Nguyen Gia Dept. of Information Technology University of Turku Finland, presents the implementation of an intelligent home-based elderly patient monitoring system. Four patient's physiological parameters are being continuously monitored, namely, temperature, glucose, and 3D accelerometer and gyroscope data for fall detection. Contextual sensors are mounted across the home to observe the patient's surrounding environment such as temperature and humidity. All sensors, wearable and contextual, transmit their measured data to smart gateways (fog layer) via nRF communication protocol. At the fog layer, diverse functions are being carried out, from collected measurements transfer to healthcare providers for further processing and analysis via Internet (cloud layer), sending push notifications and reports to patient's mobile phone, to alerting ambulance or civil defence authorities in case of an emergency. To insure power autonomy and eliminate the need for frequent sensor node battery replacement, an efficient thermal energy harvesting system is developed. Associated with a boost converter, the thermal energy harvesting system is able to sustain 3.3 OCV leveraging a temperature difference of 20°C between patient's body and room temperature, while achieving an efficiency of 82.6%. In 2019 Elsevier B.V. Body temperature is an important physiological indicator in the whole process of pig breeding. Temperature measurement is also an effective means to assist in disease diagnosis and pig health monitoring. In the conventional method of measuring body temperature, a mercury column is used to obtain the rectal temperature. The operation of this method is complicated and requires a large amount of labor. This kind of temperature measurement method is contact and can make the pig stressed, which is disadvantageous for the healthy growth of pigs. Therefore, rectal temperature measurement no longer meets the needs of the large-scale pig industry in China's welfare agriculture. In recent years, the emerging pig body temperature detection

technologies are electronic temperature measurement technology, infrared temperature measurement technology and so on. Infrared temperature measurement technology has been the main means of measuring the temperature of pig body surface with its advantages of non-contact, long distance and real-time. At present, infrared temperature measurement technology and infrared image processing technology used in pig breeding are still in the exploration stage. Nowadays, the infrared temperature measurement equipment based on point-by-point analysis represented by infrared thermometer and temperature measurement equipment based on full-field analysis represented by infrared thermal imager have been applied to pig breeding industry. These types of temperature measurement are more in line with the need of the pig breeding industry to transform and upgrade to the automation, in line with the development concept of welfare farming and smart agriculture, and its development prospects are very impressive. IST-Africa 2019 Conference Proceedings Paul Cunningham and Miriam Cunningham (Eds) IIMC International Information Management Corporation, 2019: There is a need for a system that responds to various queries in real-time, to advise and inform expectant mothers during their pregnancy. Several smart services have been deployed, bundled with health information systems, and other digital services. While such solutions better services in the healthcare settings, they may not be available to the masses in the rural. Besides they rarely dispense the information precisely and accurately. A new digital ecosystem, represented by chatbots seem to offer promising solution by embodying the function of a virtual healthcare expert, who is always available to provide information in the required precision. Powered by AI and machine learning algorithms, chatbots are forecasted to bring forth accuracy, precision and availability of information when used. This paper discusses the need to develop chatbots to be integrated in smartphones; intended to provide support to to-be mothers during their journey in pregnancy.

III. METHODOLOGY

A. Block diagram
 The system makes use of a robotic vehicle with wheels drive for easy navigation. The robot also include a controller box for circuitry and a mounting to hold a mobile phone or tablet. The mobile or tablet is used to hold live video calls. The doctor can use an IOT

based panel to control the robot. The control commands sent online are received by the robot controller. The robot controller operates over wifi internet. The received commands are received in real time and the robot motors are operated to achieve the desired movement commands. Also the robot has other functions including battery status alert to remind of battery charging on time, the various sensor outputs are connected to the microcontroller. If the output of the sensor is analog and the ADC connected to controller converts the signal to digital form. The sensed digital data is compared with the standard value if it does not match, the patients are made aware of the disease using the monitor display connected to the PC. The Robotics system gives the necessary medicines for the disease of the patient and also treats the patient in a hospital manner.



Raspberry Pi is the name of a series of single-board computers made by the [Raspberry Pi Foundation](http://www.raspberrypi.org), a UK charity that aims to educate people in computing and create easier access to computing education. The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python.

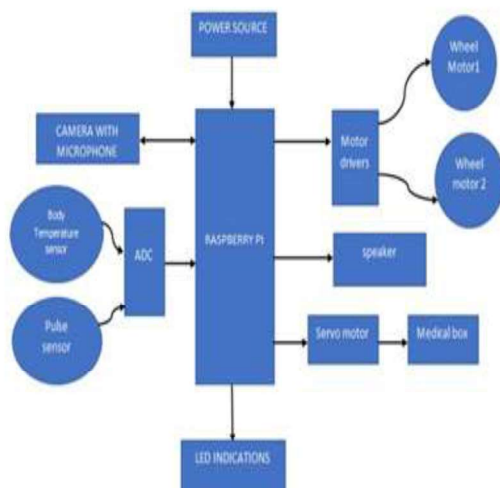


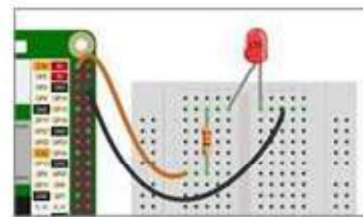
Figure shows schematic block diagram of the system

Powersupply

PCB power supply design can encompass more than just an actual power supply; systems ranging from personal computers to home appliances need a power supply to convert AC power from the wall to DC power with low noise content. PCB power supply design is about more than just converting between AC and DC power.

Raspberry Pi

LED Indication



Red and green lights are used to show different functions. A flashing green LED light indicates that a program is running; meanwhile, a flicker displays how the program is functioning. Red LED lights indicate whether or not the Raspberry Pi is receiving enough power.

Motor Driver



A motor driver takes the low-current signal from the controller circuit and amps it up into a high-current signal, to correctly drive the motor. It basically controls a high-current signal using a low-current signal. There are different types of motor drivers available in the market, in the form of ICs.



A loudspeaker is an electroacoustic transducer, that is, a device that converts an electrical audio signal into a corresponding sound.

Servomotor



A servomotor (or servomotor) is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

Medical Box

Overcome medical emergencies and keep your medicine organized with Milton's compact medical box. Made from high quality and durable plastic, this medical box features a see-through lid for easy accessibility. Armed with an ergonomic handle, this is perfect for portable use.

ADC ADS1115



The analog-to-digital converter (ADC) is a common accessory for Raspberry Pi. This is a 4-channel

ADC based on Texas Instrument's ADS1115, which is a precision, low-power, 16-bit ADC chip. We make this ADC into a compact Raspberry Pi Zero form factor and integrated an analog Grove connector so that you can also use analog Grove modules with it.

Body temperature sensor



A temperature sensor is a device used to measure temperature. This can be air temperature, liquid temperature or the temperature of solid matter. There are different types of temperature sensors available and they each use different technologies and principles to take the temperature measurement.

Pulse sensor



Heartbeat sensor is an electronic device that is used to measure the heart rate, i.e. speed of the heartbeat. Monitoring body temperature, heart rate and blood pressure are the basic things that we do in order to keep us healthy. Many modern DSLR cameras and video cameras will have internal microphones. These cameras will also generally have microphone inputs to connect higher-quality microphones for improved audio.

B. FLOW CHART

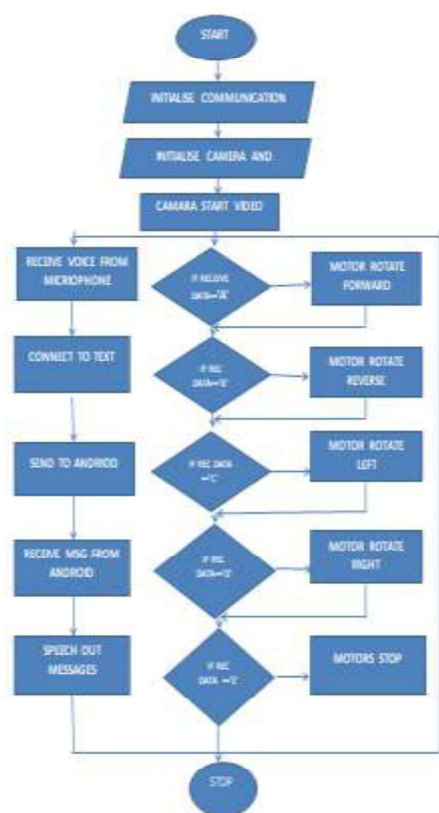


Figure shows flow chart of the system

IV. RESULT & DISCUSSION

We tested the body temperature of patient with the developed system. The patients data with the comparable data is given in TABLE I. Then we tested the pulse rate and oxygen saturation level of patients and these data with comparable data is given in the TABLE II.

TABLE I. DEVICE MEASURE BODY TEMPERATURE DATA OF FIVE PATIENTS OF DIFFERENT AGES

Mindray pulse (Bpm)	Sensor pulse (Bpm)	Mindray SpO2 (%)	Sensor SpO2 (%)
102	101	99%	98%
95	94	85%	86%
93	93	92%	92%
72	72	95%	95%
109	107	93%	93%

TABLE II. DEVICE MEASURED PULSE RATE AND OXYGEN SATURATION LEVEL DATA OF FIVE PATIENTS OF DIFFERENT AGES

Patient No.	Gender	Age	Mindray Temp	Sensor Temp
1	Male	24	30	30
2	Male	21	32	31
3	Female	30	39	39
4	Female	26	35	35
5	Female	22	32	33

V. CONCLUSION

In this paper we have worked on designing and implementing an IoT based medical assisting robot. This robot helps doctors and nurses to monitor patients virtually. It also supports disabled patients. It includes an IoT based physiological monitoring system.

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Detection of Diabetic Foot Ulcer using Knn Algorithm

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ABSTRACT— A diabetic foot ulcer is a wound that mostly affects the bottom of the foot and develops in people with diabetes. The proposed method makes use of sensors and the KNN algorithm to detect diabetic foot ulcers. The term "internet of things" refers to actual physical items equipped with sensors that share information with other systems and devices over the internet. The KNearest Neighbor algorithm is the most basic machine learning method for assessing data similarity. An open source electronics platform called an Arduino board can read inputs and convert them into outputs. This concept eliminates time-consuming tasks like routine medical visits and provides real-time updates on the patient.

Index Terms—Diabetic Footulcer, sensors ,IoT, KNN algorithm

I. INTRODUCTION

The most frequent foot wounds resulting in lower extremity amputation are diabetic ulcers. According to estimates, diabetic foot ulcers account for about 40% of hospital admissions among people with diabetes mellitus. Multiple problems are common in diabetes mellitus patients, with foot ulcers being one of the most serious. If essential care is not given, diabetic foot ulcers are more likely to grow, which could result in infection, gangrene, amputation, and even death.

Type-1 and type-2 diabetics are the two different subtypes of the disease. Patients with type 1 diabetes either do not produce any insulin or produce it in very little amounts. Although insulin is created in type-2 individuals, it is not enough for the body to operate. Diabetic foot ulcers are more likely to develop in long-term type-1 or type-2 diabetes patients. A diabetic foot ulcer is a condition where the patient's foot becomes injured. It primarily develops and remains open on the bottom of the foot.

To spot foot ulcers early on, a diabetic patient should monitor changes in their ulcers on their feet. In the beginning, a few symptoms like swelling, redness, cracks, pus, sores, stench coming from any foot, gangrene, and open lesions are very important to recognise. Individuals may experience different symptoms. The majority of diabetic people experience diabetic foot ulcers (DFU), a consequence of diabetes. On the foot, it will result in open wounds DFU that is left untreated can end in infection and amputation, which require the removal of a foot or a leg. Early detection of foot ulcers is crucial because diabetes is the primary health issue that people of all ages encounter. This study investigates the medical status of diabetic ulcers and forecasts the diseased state.

The system consist of various sensors which are used to measure the parameters such as temperature, Dynamic foot pressure additionally change in heartbeat and Blood pressure are measured. The pathogenic factors cause superficial temperature change than can be qualitatively measured by using temperature sensor LM35. Plantar ulcers in diabetics are due to excessive pressure on the soles exerted during normal activities such as walking and running (dynamic foot pressure) Static plantar pressures are significantly lower than dynamic foot pressures in a stationary person. With the help of the pressure sensor dynamic foot pressures are measured and abnormal pressure points identified.

The patient's smart phone uses a bluetooth connection to transmit the readings, which are then stored in a cloud database. The term "internet of things" refers to actual physical items equipped with sensors that communicate and share information with other systems and devices over the internet. The Internet of Things is essential for addressing current issues in the healthcare industry. Internet of things (IOT) consist of sensors/

Devices which attach to the cloud through some kind of connectivity. This is rapidly growing network that are able to collect and exchange data in realtime with the help of embeded sensors. Once the data is in the cloud, software processes it and may then choose to take some action, such as issuing an alert or automatically altering the devices or sensors. All of these actions are carried out without the user's involvement. Therefore, the integration of IOT with healthcare has been a significant progress in technology for a higher quality of life.

The exchanged data is compare with the predefined situations ,which means inside the cloud the data is analysed as per the condition set and with the help of KNN algorithm. One of the simplest machine learning algorithms, based on the supervised learning method, is K-Nearest Neighbour. The K-NN algorithm makes the assumption that the new case and the existing cases are comparable, and it places the new instance in the category that is most like the existing categories. A new data point is classified using the K-NN algorithm based on similarity after all the existing data has been stored. This means that utilising the K-NN method, fresh data can be quickly and accurately sorted into a suitable category. This will make it easier for both patients and doctors to analyse and forecast foot ulcer symptoms. In order to alert the patient and the doctor, this task will be able to spot any abnormalities in the patient's behaviour. This makes it simple and quick to locate various patients' medical reports. In fact, this model lessens the time-consuming tasks, such as frequent medical visits, and provides real-time updates on patients.

II. LITERATURE REVIEW

Amine Rghiou has developed an intelligent architecture for monitoring diabetes patients using machine learning algorithms in "A Smart Architecture for Diabetic Patient Monitoring Using Machine Learning Algorithms." The cost of the healthcare system can be reduced by the use of many technologies, including the Internet of Things, embedded systems, artificial intelligence, and smart devices. This study used 5G technology to monitor the diabetic patient's blood glucose levels. A set of sensors, wearable technology, a smartphone application, and a server with a database were presented as the architecture. In this architecture, various wireless technologies were applied. The various sensors were connected to the smartphone via Wi-Fi. The cellphones were connected to the cellular network using 5G technology in order to send data to the database

server. The suggested system was designed to collect information on a diabetic patient's blood glucose level, temperature, and physical activity, then transport that information to a base station using a smartphone and a 5G connection. The system later analysed the data intelligently using artificial intelligence and complementary learning techniques to assist users in controlling their blood sugar levels and anticipating future changes in health.

In " Exploiting Machine Learning Algorithms to Diagnose Foot Ulcers in Diabetic Patients" Shiva Shankar Reddy and Gadiraju Mahesh studied various machine algorithms to predict diabetic foot ulcer. The most typical application of ML approaches is the prediction of various diseases. Extreme Learning Machine (ELM), a neural network approach, is suggested to meet the goals by properly predicting DFU. Three other existing algorithms—KNN, SVM with a Gaussian kernel, and ANN—are also taken into consideration. These are put into practise with R programming. Accuracy, zero-one loss, threat score/critical success index (TS/CSI), false omission rate (FOR), and false discovery rate are the five evaluation measures used to compare algorithms (FDR). For ELM, the results for accuracy, 0-1 loss, TS/CSI, FOR, and FDR are 96.15 percent, 0.0385, 0.95, 0, and 0.05, respectively. KNN and ELM achieved better result.

In "IoT Based Hybrid Method for Patient Monitoring and Medication," Naveen Kumar has put forth a cutting-edge system to send the patient's vital signs to the doctor's smartphone from a distance. The doctor can deliver or recommend the drug from a remote location after observing the patient's critical characteristics. An Android app is created to let the medical personnel monitor patient data in real time while seeing the patient from a distance. The suggested model enables the physician to remotely prescribe medication and monitor the patient's physiological data (HR, NIBP, Temperature, ECG, and SPO2). The virtual presence of the doctor will be made possible by this method.

A way to create a scanner to measure dynamic foot pressure has been suggested by Milka De Madhale in "A study of dynamic foot pressure measurement in diabetic patients." The purpose of this project is to create a low-cost, portable foot pressure scanner and evaluate its validity and reliability in order to aid in the prevention of foot ulcers. Dynamic foot pressures are monitored and aberrant pressure sites are found using the scanner.

With the use of these data, offloading protective footwear can be created, potentially balancing loads and redistributing pressure on the foot.

The proposed system, which was described in "Diabetic foot ulcer mobile detection system using smart phone thermal camera: a feasibility study" by LuayFraiwan, MohanadAlKhodari, JoluNinan, Basil Mustafa, Adel Saleh, and Mohammed Ghazal, consists of a thermal camera that is connected to a Samsung smart phone that is used to capture thermal images. This thermal imaging system simulates an ulcer-indicating temperature gradient of more than 2.2 °C, which corresponds to the temperature differential described in the literature. Basic image processing techniques are used to process and segment the obtained images. Otsu thresholding and the Point-to-Point mean difference techniques are used in the analysis and interpretation. Thermal pictures were examined and interpreted as part of the proposed system's implementation on the MATLAB Mobile platform.

To evaluate this approach, four test images—three with skin temperatures raised to more than 2.2 °C injected at various areas and one with no temperature fluctuation to the feet—were employed. The system was able to pinpoint the site of the temperature increase with the help of the two methodologies used during the analysis and interpretation step.

III. METHODOLOGY

Fig 3.1 FLOW CHART

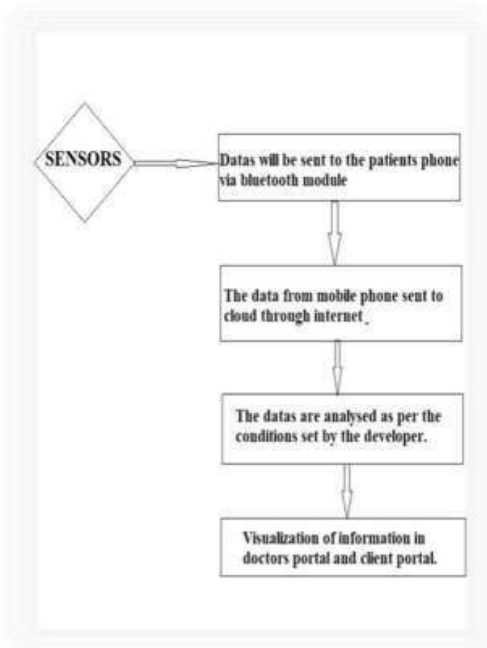
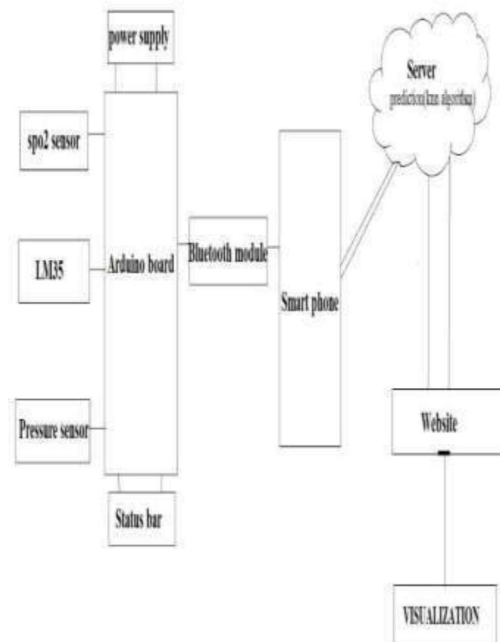


Fig 3.2 BLOCK DIAGRAM



Prediction technique

The data are evaluated using the KNN method, which is one of the simplest machine learning algorithms based on supervised learning. It predicts whether the patient has a diabetic foot ulcer. The K-NN algorithm makes the assumption that the new case and the existing cases are comparable, and it places the new instance in the category that is most like the existing categories. A new data point is classified using the K-NN algorithm based on similarity after all the existing data has been stored. This means that utilising the K-NN method, fresh data can be quickly and accurately sorted into a suitable category. Although the K-NN approach is most frequently employed for classification problems, it can also be utilised for regression. Since K-NN is a non-parametric technique, it makes no assumptions about the underlying data. It is also known as a lazy learner algorithm since it saves the training dataset rather than learning from it immediately. Instead, it uses the dataset to perform an action when classifying data. The KNN method simply saves the information during the training phase, and when it receives new data, it categorises it into a category that is quite similar to the new data.

If there are two categories, Category A and Category B, and we have a new data point, x_1 , which category does this data point belong in? We require a K-NN algorithm to address this kind of issue. First, we'll decide on the number of neighbours; we'll go with $k=5$. The Euclidean

distance between the data points will then be determined. The distance between two points, which we have already examined in geometry, is known as the Euclidean distance. We determined the closest neighbours by calculating the Euclidean distance. As you can see, the three closest neighbours are in category A, hence this new data point must also fall within category A.

IV. RESULT AND DISCUSSION

Diabetic foot ulcer detection using KNN algorithm is designed and developed successfully. The temperature, dynamic foot pressure, spo2 information of patient is captured using relevant sensors and results are transferred to smart interface using hc-05 bluetooth module. The datas obtained from sensors are transferred to a sever over the internet and are analyzed as per the conditions set.

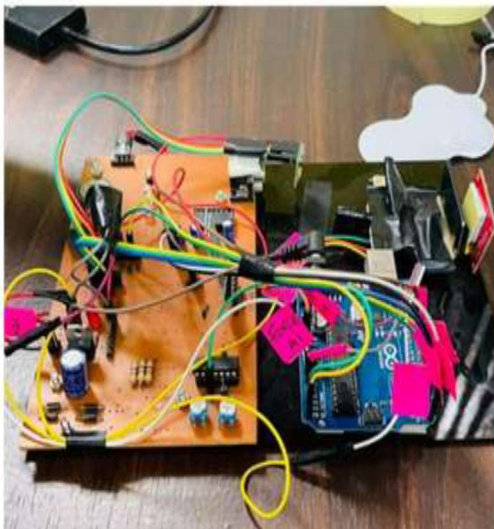


Fig 4.1 Hardware

Figure 4.1 shows the hardware part of proposed model. It consist of three sensors, Arduino board, leds,and a power supply unit. The three sensors are pressure sensor, temperature sensor and spo2 sensor.The Arduino board stores all the program to store and transfer the datas from the sensors. The status led blinks when the data transfer takes place Fig 4.2 Smartphone-bluetooth interface.

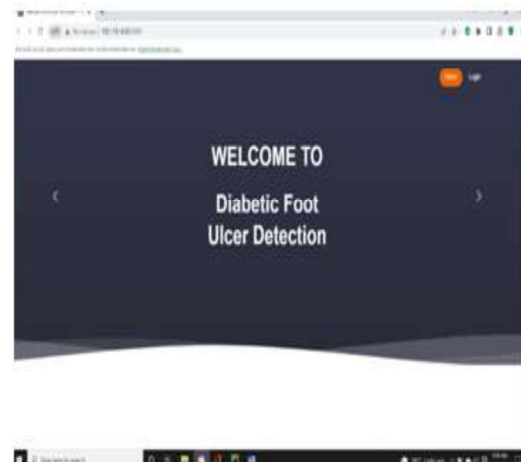


Figure 4.2 shows the smartphone interphase.

The datas from the hardware part send to the patients smart phone via Bluetooth. The data from the smartphone sent to cloud through internet.



Fig 4.3 website interface

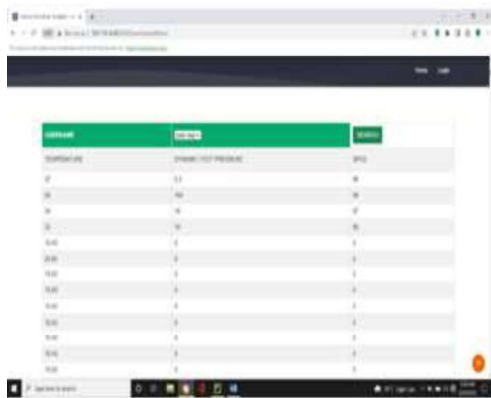


Fig 4.4 Sensor value page

The figure 4.3,4.4 shows the webpage interface in doctors side. Figure 4.3 is the welcome page, it consist of Home button and login button. While clicking on login button it goes to login page. The login page allows the doctor to access the information of each patient by entering the username and password. The figure 4.4 shows the sensor value page, from the sensor value page doctors can select the patient name and can search patients medical condition. The datas from the sensors can visualize in this page. While clicking the predict button, it will go to the result page.

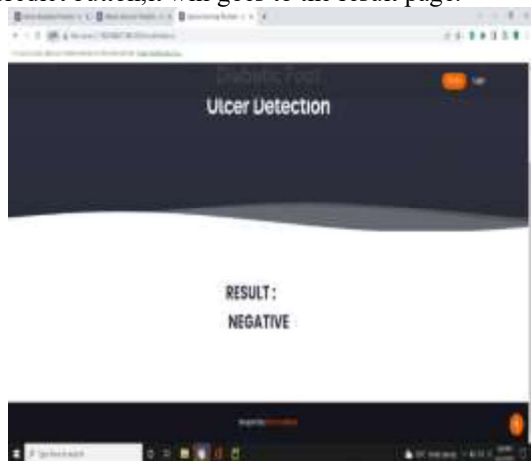


Fig 4.5 Result page

Figure 4.5 shows the result page of the proposed model. It shows negative result for the normal value. By clicking the predict button in sensor value page , it goes to this page and shows the result.

V.CONCLUSION

In this work it is very useful to know the basic physiological parameter of the diabetic foot ulcer patient in realtime. Most diabetic patients who develop diabetic foot ulcers (DFU) do so because it

is a consequence of the disease. The foot will get open wounds as a result. DFU that is left untreated can end in infection and amputation, which require the removal of a foot or a leg. Early detection of foot ulcers is crucial because diabetes is the primary health issue that people of all ages encounter. This study investigates how ulcers are caused by diabetes and forecasts the unhealthy condition. The system consist of various sensors which are used to measure the parameters such as temperature, Dynamic foot pressure additionally change in Blood pressure are measured. The pathogenic factors cause superficial temperature change than can be qualitatively measured by using temperature sensor LM35. Plantar ulcers in diabetics are due to excessive pressure on the soles exerted during normal activities such as walking and running (dynamic foot pressure). Static plantar pressures (as opposed to dynamic foot pressures) are significantly lower in a stationary person. With the help of the pressure sensor dynamic foot pressures are measured and abnormal pressure points identified. The temperature, dynamic foot pressure, spo2 information of patient is captured using relevant sensors and results are transferred to smart interface using bluetooth module. The datas obtained from sensors are transferred to a sever over the internet iot and are analyzed as per the conditions set using knn algorithm.

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Canny Edge Detection Based Preprocessing and Feature Extraction for Tooth Decay Classification Using CNN

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ABSTRACT--As health is an important factor, taking care of it is also increasing day by day. Food habit is a considerable thing and dental diseases that is causing due to it have also been considered. So it is essential to develop a model that help in the prediction of tooth decay which help as to identify the decay. It helps in early detection without the help of a doctor. Segmentation is a process which is done for diagnosis of dental disease. Then preprocessing is done for the appropriate leveling of required features. Later canny edge detection method is used for segmentation process. Deep CNN method is used for prediction of images. This method ensures greater accuracy when canny edge segmentation method is used.

Keyword—GLCM—Grey level co-occurrence

1. INTRODUCTION

Matrix; RELU Rectified Linear Unit; CNN—Convolutional Neural Network

Nowadays the dental decay are increasing day by day. Because our diet is changed. Now sugar products and candies are ruling our diet. This food particles held up in the cavities and generate bacteria. Cavities are permanently damaged areas in the hard surface of our teeth that develop into tiny opening or holes. Cavities are also called tooth decay or caries permanently damaged or caries, are caused by a combination of factors, including bacteria in your mouth, frequent snacking, sipping sugary drinks and not cleaning your teeth well. Dentists usually use X rays for analyzing and for prediction of human dental state. That can be used as a tool for analyzing the state of teeth, gum and other for predicting the human illness. There are various type of X rays available

for prediction but most commonly used is panoramic X ray which help the dentists for preoperative examination. The process of dividing the biomedical image and the set of pixel is the segmentation process. Edge detection process is used for the segmentation process. Canny edge detection is used for this. To detect wide range of edges in the image canny edge detection is used. This method reduces the data to be processed and give greater accuracy than any other method. It get image smoother by reducing noises and suppress the pixel which is not up to the maximum. Thus pixel with maximum value can be obtained. Noises are removed by using the filters. The pixel values in each kernel is then measured for the further processing. For the image processing mainly acquisition, import, analyzation and analysis are done.

Image processing can be of analog and digital. Digital image made use of computer and analog processing for the print outs or for the hard copies. The proposed method is the prediction of tooth decay from x ray image using deep CNN by use of canny edge detection. The solution make use of deep learning method. This method allows for the automatic extraction of data which is used for the further process. The feature of deep learning is that they learn from the input that given during the training phase. Training phase and testing phase are the two phases used. Deep learning using CNN is most popular one which gives spatial relation between the objects which help to represent effectively the features.

Neural network method is used for detection of edges in dental X-ray images where inputs to the network are pixels of original image after minimizing the output error, and output pixels

are replaced in the edge-detected image. Convolution Neural Network (CNN) is used because in this iterative training and learning takes place from input to output mapping. This algorithm is helpful in finding problems such as tooth decay. This method may be extended for the diagnosis of major problems related to teeth

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III. LITERATURE REVIEW

In 2018, Xu, X., Liu, C. and Zheng, Y proposed 3D tooth segmentation and labelling using deep convolutional neural network. In this method Traditional geometry-based methods tend to receive undesirable results due to the complex appearance of human teeth (e.g., missing/rotten teeth, feature-less regions, crowding teeth, extra medical attachments, etc.). Furthermore, labeling of individual tooth is hardly enabled in traditional tooth segmentation methods. To address these issues, we propose to learn a generic and robust segmentation model by exploiting deep Neural Networks, namely NNs. The segmentation task is achieved by labeling each mesh face.

In 2019, Al Kheraif, A. A., Wahba, A.A. and Fouad, H proposed Detection of dental diseases from radiographic 2D dental image using hybrid graph cut technique and CNN. The Data mining techniques, image processing, and Computational intelligence techniques are playing a vital role in biomedical research. Dental image processing helps to improve the early detection and classification of the diagnostic process to make accurate decisions. The radiographic 2d dental image is widely utilized for analytic thinking of several dental disorders. In this paper traces the complete steps such as classification and

segmentation as well as pre-processing of dental images has been carried out.

In 2018, Silva, G., Oliveira, L. and Python, M proposed Automatic segmenting teeth in X ray images. This review presents an in-depth study of the literature on segmentation methods applied in dental imaging. Ten segmentation methods were studied and categorized according to the type of the segmentation method (region-based, thresholdbased, cluster-based, boundary-based or watershedbased), type of X-ray images used (intra-oral or extra-oral) and characteristics of the dataset used to evaluate the methods in the state-of-the-art works. We found that the literature has primarily focused on threshold-based segmentation methods (54%). 80% of the reviewed papers have used intra-oral Xray images in their experiments, demonstrating preference to perform segmentation on images of already isolated parts of the teeth, rather than using extra-oral X-rays, which show tooth structure of the mouth and bones of the face. In 2018, Hatvani, J., Horvat, A., Michetti, J., Basarab, A., Kouame, D and Gyongy, M proposed Deep

Learning based super resolution applied to dental computed tomography. The resolution of dental computed tomography (CT) images is limited by detector geometry, sensitivity, patient movement, the reconstruction technique and the need to minimize radiation dose. Recently, the use of convolutional neural network (CNN) architectures has shown promise as a resolution enhancement method. In the current work, two CNN architectures—a subpixel network and the so called U-net—have been considered for the resolution enhancement of 2-D cone-beam CT image slices of ex vivo teeth. To do so, a training set of 5680 cross-sectional slices of 13 teeth and a test set of 1824 slices of 4 structurally different teeth were used. Two existing reconstruction-based superresolution methods using l_2 -norm and total variation regularization were used for comparison. The results were evaluated with different metrics (peak signal-to-noise ratio, structure similarity index, and other objective measures estimating human perception) and subsequent image segmentation-based analysis. In the evaluation, micro-CT images were used as ground truth. The results suggest the superiority of the proposed CNN-based approaches over reconstruction-based methods in the case of dental CT images, allowing better detection of medically salient features, such as the size, shape, or curvature of the root canal.

Apurva Sonavane, Rohit Yadav and Aditya Khamparia proposed Dental Cavity classification using CNN. Dental and Oral diseases are very

common diseases and half of the world population suffers from it. Due to poverty or unhygienic practices, these diseases are common, and it is estimated that 5% of total medical expenditure in the world is on oral diseases. In this paper, we have focused on detecting cavities. Recent developments Machine Learning and Artificial Intelligence have helped a lot in medical science. Due to these algorithms, diagnosis and treatment of diseases can be done efficiently. To detect dental cavities different imaging modalities are used by doctors, however, in this paper we have used visual images of teeth's and applied deep convolution neural network(CNN) to classify the teeth into caries or non-caries. We have used the images from the Kaggle dataset, and after tuning our model we were able to achieve 71.43% accuracy.

III.METHODOLOGY

A.FLOW CHART

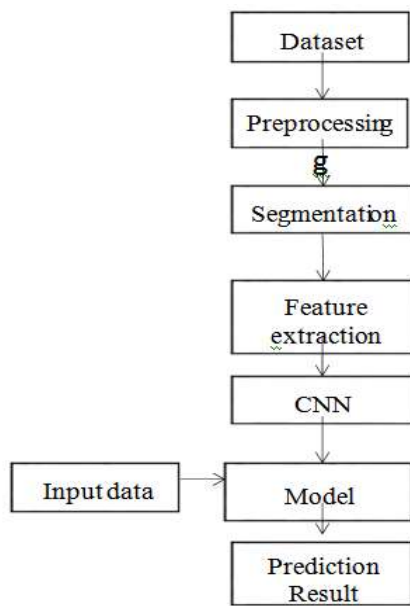


Fig 3.1 Flow chart of proposed system

Using the popular method digital X ray prediction of tooth decay is making possible. Passing the X ray through mouth of the patient it will give the image of teeth and jaw. Thus collecting the X ray image from the Kaggle site that means which contains both positive and negative images later used for training the model.

IV.RESULT AND DISCUSSION

The proposed segmentation for dental image achieved 92.60% accuracy by deep CNN algorithm for trained images.

The X ray image used for training was collected from the Kaggle site. Images were trained and tested several times for getting an accuracy about 92%. X ray images were read by the processor and it was preprocessed and segmented. The readed image were converted into grey scale image and normalized using the numpy. Later for using CNN for the classification and prediction packages Tensor flow and Keras were used. Tensor Flow is used for storing and for running the program Keras package was used. And thus the model is created. Then input data for testing is inputted into the model and then the decay is predicted.

TABLE 1. Analysis Of Efficient Segmentation

Method	Precision	Recall	Accuracy	F1 score
Active contour	.756	.60	.789	.80
Sobel Edge	.79	.75	.802	.79
Canny Edge	.998	.93	.923	.92
Graph Cut	.802	.863	.831	.86

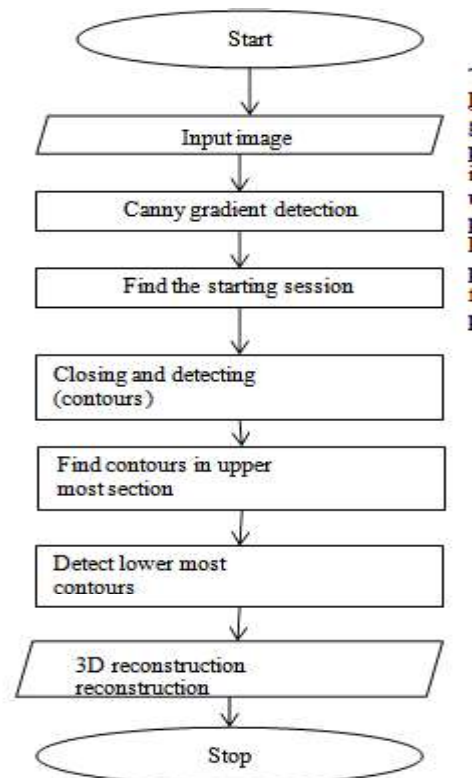


Fig 2 Canny edge detector

V. CONCLUSION

In this project, dental X-ray images were collected about 1700 images and a dataset was generated by splitting the images into 900 training with 800 tests. They search the pixel for quality. Best precision for segmentation was in Canny edge detection.

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Multi-Level Classification of Retinal Disease using SFCN

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ABSTRACT

Premature detection of diabetes using retinal images is still challenging. The severity of diabetic retinopathy cannot always be detected or assessed with the current techniques. Our research uses a convolutional neural network to extract the retinal image's properties and pinpoint the stages at which a normal condition becomes an abnormal one in order to identify the presence of diabetes. The retinal images are categorized using a Supervised Fuzzy Clustering Network (SFCN) based on the severity of diabetic retinopathy. Feature learning, reconstruction, and self-supervised fuzzy clustering modules make up the SFC network. The network's ability is secured by the feature learning and reconstruction module, while the fuzzy self-supervision module gives the network guidance. We use retinal dataset into our model to analyse the performance and project the outcome in order to assess the network's effectiveness.

Keywords- Convolutional Neural Networks (CNN), Network, Premature detection, Retinal disease, Supervised Fuzzy Clustering Network (SFCN)

INTRODUCTION

Diabetic retinopathy is a disease that damages the blood vessels of eye due to excessive blood sugar level. Which is commonly found in diabetic patients that lead to serious vision problems Diabetic retinopathy disease do not exhibit any early symptoms. Numerous medical tests are available to diagnose the disease. Fundus image analysis is one of them. Which help to evaluate blood vessels, nerve tissue problems etc. Although, it does not exhibit

any early signs so that later it turns to spots or dark strings it can lead to persistent Spots or dark strings floating in your vision (floaters) Blurred vision, fluctuating vision, Dark or empty areas in your vision, vision loss. It is recognized by a detailed eye examination. This requires trained and experienced doctor as there is only a slight difference between a diseased eye and a normal eye. So, it becomes hard to detect.

To overcome these difficulties other methods are being used. In diabetic retinopathy prediction is not useful in early stages. M. D. Abramoff, Y. Lou, A. Erginay, W. Clarida, R. Amelon, J. C. Folk, and M. Niemeijer, proposed a method in 2016. Incorporation of deep learning to enhance automated identification of diabetic retinopathy on a publically accessible dataset. Present a method using points-of-interest and a visual vocabulary that comprises crucial characteristics needed to diagnose retinal pathology in order to improve categorization, particularly across diverse ethnic groups. Without the need for pre-processing and using separate training sets to account for, say, ethnic variances, variation in pictures of the human retina with respect to differences in pigmentation and the presence of distinct lesions can be analysed. E. Ahn, A. Kumar, D. Feng, M. Fulham, and J. Kim have suggested a different approach called "Unsupervised deep transfer feature learning for medical picture categorization". Adjudication can be used to measure faults in diabetic retinopathy. (DR) grading based on subjective judgment and consensus, as well as to develop a more accurate automated method for DR grading. The algorithm, U.S. board-certified ophthalmologists, and retinal specialists rated each image separately. The reference standard was the adjudicated consensus of the retinal specialists. We calculated the (quadratic-weighted) kappa score to assess agreement

between different graders as well as between the graders and the algorithm. We calculated area under the curve (AUC), sensitivity, and specificity to compare the performance of several manual grading methods and the algorithm for various DR severity cut offs (such

as mild or worse DR, moderate or worse DR). These techniques all simply reveal if an eye is ill or not. Four categories makeup DR; Mild Moderate Nonproliferative Retinopathy (Fig. 1).

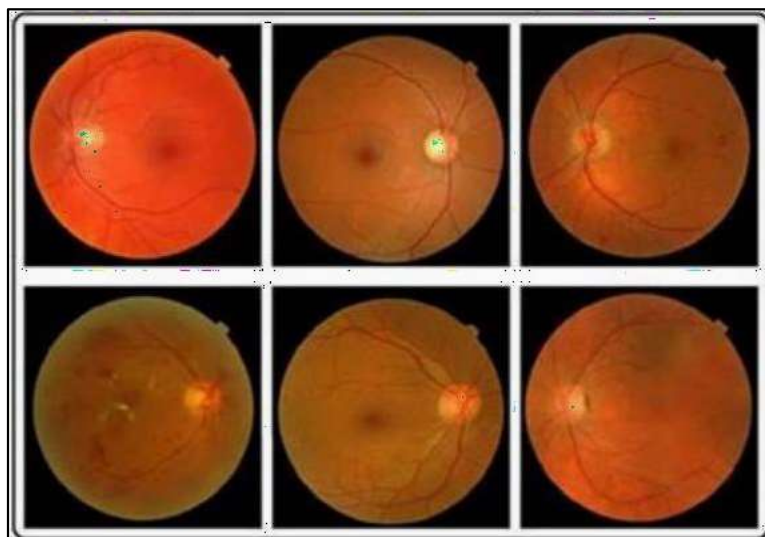


Figure 1: Several retinal images with different retinopathy.

Therefore, we must go through various stages to determine the extent of the eye's damage. We developed a method to identify the stages of diabetic retinopathy. SFCN-based multilevel classification of retinal disease. DR is categorized based on the degree of severity using SFCN.

LITERATURE REVIEW

K Jayasri, P Subathra and K Anuram proposed a paper in 2013 .A crucial element in the discovery of ophthalmological illnesses is the blood vessels in the retina. These are employed in identification systems that are computer-based. It has been acknowledged that, in some cases, training the fundus image cannot distinguish between blood vessel symptoms and those of disorders such as diabetic retinopathy. The debauched vessel segmentation method used in the picture segmentation procedure improves accuracy [1]. The defective retinal fundus image is suited for the blood vessel extraction algorithm, which will aid in the diagnosis of exudates and poor vessel contrasts.

In the year of 2014, Akansha Mehrotra, Shraddha Tripathi, Krishna Kant Singh, Priyanka Khandelwal introduced a paper that study presents a technique for automatically

identifying blood vessels from fundus images [2]. For highlighting the blood vessels in the retinal image, it performs some basic image processing tasks. Morphological operations like tophat and bottom hat transformations are applied to the preprocessed image. The input image is divided into two clusters using the Kohonen clustering network. Applying the approach on a retinal image from the DRIVE database allows for method testing. The outcomes are contrasted with three additional cutting-edge techniques. The proposed approach's accuracy, sensitivity, and false-positive rate are all higher than those of the other methods, suggesting that the preprocessed method is more precise and efficient.

Gehad Hassan, Nashwa El-Bendary, Aboul Ella Hassanien, Ali Fahmy, and Vaclav Snašel proposed a paper on 2015. According to a method based on mathematical morphology, retinal blood vessel segmentation. In order to extract the retinal image vessels, this research provides a blood vessel segmentation approach that maybe employed in computer-based retinal image analysis. Mathematical clustering and k-means clustering are utilised for the vessel segmentation [3]. They apply mathematical morphology to the retinal image to execute smoothing operations in order to highlight the

blood vessels and reduce the background information. The improved image is segmented using the k-means clustering algorithm, and the suggested method is evaluated on the DRIVE dataset and contrasted with other methods. The trial results of the suggested method show greatest accuracy of 96.25 percent and average accuracy of 95.10 percent.

In the year of 2019, Ramakrishnan Sundaram, Ravichandran Ks, Premaladha Jayaraman presented about a hybrid segmentation approach that suggested separating the blood vessels from the retinal fundus image. The suggested approach combines image fusion, bottom hat transform, Multi-scale Vessel Enhancement (MSVE), and morphological operations. The area-based morphological operator is used to highlight the blood vessels following the execution of the suggested segmentation method. The High Resolution Fundus (HRF) pictures dataset is used as the ground truth to compare the results and verify the suggested algorithm [4]. Compared to the current techniques, it can be concluded that the suggested algorithm accurately segments the blood arteries.

During the year of 2021 Akey Sungheetha and Rajesh Sharma R designed another paper. The severity of the diabetic illness cannot be determined using standard procedures. Utilizing convolution neural networks, the research work extracts the features to identify the stages of development of diabetic retinal illness (CNN). The finest tools for detecting tasks are CNN models with deep learning. This method is effective for categorizing image data, especially for retinal fundus image analysis [5]. The confusion matrix detection procedure is used to categorise the severity of the diabetes condition. By adopting the suggested CNN framework, the Hard Executes (HE) seen in an eye's blood vessel are used to diagnose diabetes on. The suggested framework has a higher accuracy than existing conventional detection algorithms.

In the year of 2014 S. Roychowdhury, D. D. Koozekanani, Keshab K and Parhi introduced a method, It incorporates morphological processing, which uses mathematical morphology to process digital images by applying a Structural Element (SE) to binary or grayscale images [6]. The algorithm segments blood vessels in three stages. Preprocessing using a high-pass filter and extracting a binary picture constitutes the first

stage. For the vessel regions, a different binary picture is produced from the improved image. Then, from these two images, the primary vessel regions are extracted. The two binary pictures that were left over from the first stage are classified in the second stage using the Gaussian Mixture Model (GMM) classifier. GMM uses a set of 8 features that are extracted based on pixel neighborhood and first and second order gradient images. The vessels and the classified vessel pixels are mixed in the final stage. This approach is more precise, with an accuracy of 0.952.

PROPOSED SYSTEM

This method suggests using a supervised fuzzy clustering network to classify retinal pictures based on the severity of diabetic retinopathy (SFCN). Feature learning, reconstruction, and self-supervised fuzzy clustering modules make up the SFC network. The network's ability is secured by the feature learning and reconstruction module, while the fuzzy self-supervision module gives the network guidance [7].

Flow Chart

The Fig. 2 shows a schematic diagram of Multi-Level Classification of Retinal Disease Using SFCN. It consists preprocessing, training, testing and prediction stages.

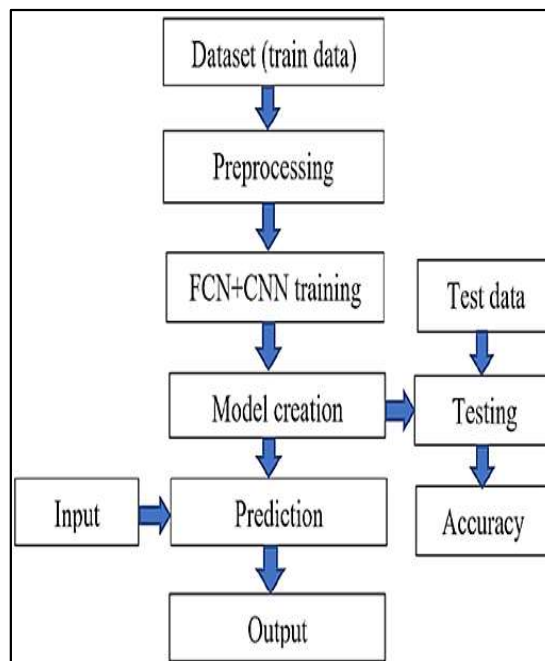


Figure 2: Flow chart of the proposed system.

Dataset

In our work, we do SFCN using Kaggle datasets. The largest community of data scientists worldwide is Kaggle. People searching for datasets for their next machine learning project have access to public datasets created by others and can share their own datasets on Kaggle. Regarding eye care, the world faces many difficulties, including disparities in the availability and calibre of services for prevention, treatment, and rehabilitation. Vision loss can be avoided with the early identification and treatment of eye illnesses. In order to achieve this, Kaggle has developed the Retinal Fundus Multi-disease Image Dataset (RFMiD), which consists of 3600 fundus photos altogether that were taken with three distinct fundus cameras and classified into 46 disorders by two senior retinal experts. 80 percent of the fundus is used to apply the architecture's training [8].

Pre-Processing

The following describes the algorithm for pre-processing the raw picture data to create useful floating point tensors for feeding into FCN and CNN:

- Examine the image files (stored in data folder).
- Converting the JPEG content into RGB grids of channels-based pixels.
- For use as input in neural networks, convert these into floating-point tensors. Re-scale the pixel values (between 0 and 255) to the [0, 1] range (because neural networks can be trained more effectively with this range).

CNN Training and Model Creation

Assigning paths and defining categories (labels) as well as resizing our images are all part of the dataset preparation for training makes the photos 48×48×1 in size. Image pixel values and index are contained in an array called

training. For use by CNN, the image dataset is divided into x and y. The model is trained using x train and y train, and tested using x test and y test. x_train and y_train are used to train the produced model. In the training phase, packages like Tensorflow and Keras are employed. Google created the high-level Keras deep learning API to implement neural networks. It is used to make the implementation of neural networks simple and is developed in Python. Additionally, various backend neural network computations are supported. No matter what language or platform you use, Tensorflow enables you to train your model [9, 10].

Testing and Prediction

Making the model means training it. A conclusion is reached after comparing the developed model to the x test. Their y test and that result are contrasted. The model file is then stored. A website is made specifically for the prediction procedure. The website's framework of choice is Flask. The viewed image is saved to the local storage and read during prediction. The process involves converting the image to grayscale. The image is then downsized to 48×48, and the pixel values (between 0 and 255) are normalized to the (0, 1) interval (because neural network training with this range is most effective in this range). This image is compared to the model, and prediction is made using the difference in pixel values.

RESULT

On the MESSIDOR, DRIVE, and DIARETDB1 datasets, self-supervised fuzzy clustering network obtains accuracies of 87.6 percent, 81.7 percent, and 84.7 percent, respectively. When we compare our SFCN technique to one unsupervised method for the KAGGLE datasets, the method achieves 100 % accuracy as shown in Table 1.

Table 1: Accuracy of SFCN for different datasets.

Dataset	Accuracy
Messidor [10]	87.6
Diaretdb1 [10]	84.7
Drive [10]	81.7
Kaggle (Our Proposed Method)	100

The retinal image was successfully submitted to the website, and the model subsequently identified the stage of diabetic retinopathy to which it belonged. The model can be used to identify four distinct stages. The diabetic retinopathy stage to which the retinal image belongs was correctly identified by the model. The model was tested by choosing a random retinal image and uploading it to the site. The model then identified the retinal image's stage and confirmed it.

CONCLUSION

In this paper, the classification problem of diabetic retinopathy, which has gained great research interest by supervised models, is solved using Self-supervised Fuzzy Clustering Network (SFCN). The current methods need a lot of data and labor. As a result, they are pricey. As a result, the proposed SFCN model focuses on classifying unsupervised retinal images using a reconstruction model, a fuzzy self-supervision module, and feature learning modules.

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Low Cost Portable Ventilator with Pressure Regulation using Arduino

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ABSTRACT

The patient is suffering from an injury or illness that makes it hard to breathe. A ventilator may help to breathe during these conditions. It is useful in surgery where you are asleep, but this is usually for no more than a few hours. So a simple ventilator is a machine that helps a patient to breathe when they are having a surgery or cannot breathe on their own due to a critical illness. That. That is why the device is more important in hospitals. Here the patient is connected to the ventilator with a hollow tube that goes in their mouth and down into their main airway or trachea. In this paper develops a portable ventilator using AMBU (Artificial Manual Breathing Unit) Bag. The pressure and volume of air passed to the patient from the ventilator can be measured using sensors and the readings can be displayed using an Android app. The count, pressure and volume of air passed to the patient from the ventilator can be measured using relevant sensors and the readings can be displayed in both LCD display and Android app. The controlling of pressure is also possible with the help of an Android app. The main advantages of this ventilator are that it is less expensive, portable and also automatically works. In emergency conditions the doctor can adjust the amount of air using a control mechanism that is built in Android application. Also if the Doctor is not there a will be a notification sent to telegram of the Doctor or the hospital health assistant, and people around are alerted by the buzzer if pressure increases.

Keywords- AMBU bag, Prototype, Ventilator, Portable, Pressure regulation

INTRODUCTION

A biological system called the respiratory system, also known as the respiratory apparatus or ventilator system, is made up of particular organs and structures that are utilized by both plants and animals to exchange gasses [1]. Depending on the size of the organism, its habitat of residence, and its evolutionary background, the anatomy and physiology that cause this vary widely. The linings of the lungs internalize the respiratory surface in land animals. Millions of tiny air sacs, known as alveoli in mammals and reptiles and atria in birds, are responsible for the gas exchange that takes place in the lungs. Because of the abundant blood supply in these tiny air sacs, the air and blood are in proximity to one another. These air sacs link with the outside world by a network of hollow tubes called airways, the greatest of which is the trachea, which divides into the two main bronchi in the center of the chest [2]. These enter the lungs where they divide into secondary and tertiary bronchi that become increasingly more minute tubes called bronchioles.

Today, respiratory illnesses are the main causes of health issues. Chronic respiratory conditions (CRCs) affect the lungs' airways and other pulmonary structures [3]. The most prevalent ones include pulmonary hypertension, asthma, occupational lung disorders, and chronic obstructive pulmonary disease (COPD). Air pollution, dust from the workplace, and recurrent lower respiratory infections in children are other risk factors also tobacco smoke. CRDs cannot be cured, although there are numerous ways of treatment that can dilate important airways and reduce shortness of breath can aid in symptom management and enhance the quality of life for those who have the disease [4]. The respiratory system is also affected by the viral disease

caused by the pandemic coronavirus. Dyspnea is the medical term for the coronavirus symptom of shortness of breath. Ventilator is the name of the medical device that is used to treat respiratory failures [5].

Ventilators are used for patients who are unable to breathe, so the term "life support" is also used. If you're unable to breathe on your own, this device will assist you. Another name for it is a "mechanical ventilator." It's also frequently referred to as a "breathing apparatus" or "respirator." When caring for someone who is ill with a contagious illness, medical professionals are required to use respirators, which are masks [6]. A bedside device called a ventilator has tubes that attach to your airways. A ventilator mechanically assists in supplying your body with oxygen. Through a tube that enters your mouth and travels down your windpipe, air is expelled. Additionally, the ventilator might exhale for you can choose to handle it on your own.

There's a chance the breathing tube will hurt. You are unable to eat or speak while it is connected. On ventilators, some patients might not be able to eat or drink regularly. If so, you will need to receive your nutrients through an IV, which is placed into a vein with a needle. Normal breathing causes your lungs to take in the oxygen your cells require to survive and release carbon dioxide [7]. You can programme the ventilator to breathe for you a specific number of times per minute. A doctor can also select when to activate the ventilator when you need assistance. In this instance, if you don't take a breath after a predetermined amount of time, the machine will automatically blow air into your lungs.

The patient receives air from the ventilator through a pipe that is connected either through the mouth or a hole made in the neck. A ventilator can also be used during surgery to help recovering patients breathe and to keep patients whose oxygen levels are low alive. The most potent therapeutic tools are ventilators. They can be categorized as high frequency, positive pressure, or negative pressure ventilators depending on their type of work [8]. Due to the expensive price of this technology, hospitals only have a small supply accessible. The

ailments that caused your breathing issues cannot be cured by a ventilator. It aids in your survival until your lungs can function on their own as a result of your recovery [9]. When the medical professional deems you healthy enough, they will try breathing normally. Even while you can attempt to breathe on your own, the ventilator remains connected. The tubes will be taken out and the ventilator will be switched off after you start breathing normally [10].

LITERATURE REVIEW

During the year 2020 Ryan M. Corey Evan M. Widloski, David Null, Brian Ricconi, Mark A. Johnson, Karen C. White, Jennifer R. Amos, Alexander Pagano, Michael L. Oelze, Rachel D. Switzky, Matthew B. Wheeler, Eliot B. Bethke, Clifford F. Shipley, and Andrew C. Singer are introduced Low-Complexity System and Algorithm for an Emergency Ventilator Sensor and Alarm .Numerous organizations have created affordable emergency ventilators in response to the COVID-19 pandemic's predicted lack of ventilators. These products frequently consist of pressure-cycled pneumatic ventilators, which are simple to manufacture but frequently lack the sensing or alarm capabilities present on commercial ventilators [11]. This study describes an inexpensive, easily manufactured electronic sensor and alarm system for pressure-cycled ventilators that predicts therapeutically important metrics like pressure and breathing rate and emits an alarm when the ventilator breaks down. An electronic pressure sensor attached to the patient's airway sends a signal that is monitored by a pair of non-linear recursive envelope trackers in a low-complexity signal processing system. The technique uses little memory and only a few calculations on each, and it was inspired by those used in hearing aids.

Abdul Mohsen Al Hussein, Heon Ju Lee, Justin Negrete , Stephen Powelson , Amelia Servi ,Alexander Slocum , Jussi Saukko in 2010; a working prototype that can be operated on a test lung has been developed. The tidal volume and breath rate of the prototype are user-configurable. In the article "Design and Prototyping of a Low Cost Portable Mechanical

Ventilator," it has an assist control and an over-pressure alert. It uses very little power, lasting 3.5 hours at its most demanding setting on a single battery charge [12]. It includes a handle and simple-to-use latches, is portable, weighs 9 lbs (4.1 kg), and is 11.25 x 6.7 x 8 inches. On a computer screen, the prototype can provide settings and status. Since these ventilators frequently breakdown and become vulnerable over time, the manufacturer must be paid for expensive service agreements.

In the year 2018 A Portable BVM-based Emergency Mechanical Ventilator is introduced by Jozef, Michal Kelemen, Ivan Virgala, Peter Marcinko, Peter Tuleja, Marek Sukop, Erik Prada, Martin Varga, Jan Ligus, and Filip Filakovsky. The paper deals with the development of artificial lung ventilation. The purpose of the study is to demonstrate a developed bag-valve-mask ventilator that might be employed as a substitute for a mechanical ventilator in COVID-19-related life-threatening scenarios. We first go over the fundamentals of positive pressure ventilation. Then, for emergency mechanical ventilators to be an appropriate substitute in both homes and hospitals, we create regulations for them [13]. The following part presents the mechanical and control design. Finally, using measured pressure in the patient's airways, we experimentally validate the ventilators that we have constructed. The data made public demonstrate the possibility for created ventilators to be deployed in real-world settings. Index Terms: pneumatic system, coronavirus, COVID-19, control system, and artificial lung ventilation.

During the year 2019 Dr. Arun Prasath D.Deeba, R.Vignesh Gandhi, R.S.Shivadarshana,Dr.G. vishnuvardhanan ,N.vigneshwari are introducing Smart Ambu Bag Using Electronic devices. Accidents of many kinds occur in the world today. Unable to prevent accidents. Can attempt to preserve a person's life before deciding to create the ventilator that is required. Ambu bags are often used in the ambulance for a brief period. The patient will receive ample ventilation from the ambu bags [14]. However, the patient was not receiving enough ventilation from the ambu bags for a very long period, so we decided to create a

smart ambu bag that serves as a ventilator in the hospital. By utilizing a clever ambu bag that will give the patient enough ventilation, it will save time.

In 2020 Ryan Rhay Vicerra, Edwin Calilung, Jason Española, Elmer Dadios, Alvin Culaba, Edwin Sybingco, Argel Bandala, Alma Bella Madrazo, Laurence Gan Lim, Robert Kerwin Billones, Siegfred Lopez, Dino Dominic Ligutan, Julius Palingcod, and Carl John Patrick Castillo have effectively constructed a programmable logic controller (PLC) of industrial grade to control the mechanical ventilation of an emergency ventilator based on a bag-valve-mask. Numerous mechanisms were noticed, and the outcomes have been reported. Overall, the usage of a programmable logic controller as a component of the emergency ventilator's control system has been successfully adopted by the proponents. For emergency biomedical equipment to be commercialized in the future, the PLC, a component of industry-grade 4, is required [15, 16]. The advocates for the emergency ventilator with a bag valve and mask look forward to improving on adding more ventilator parameters to monitor, such as percent of oxygen (FiO₂), and researching various computing approaches that can be applied through the PLC.

Edwin Calilung, Jason Española, Elmer Dadios, Alvin Culaba, Edwin Sybingco, Argel Bandala, Ryan Rhay Vicerra, Alma Bella Madrazo, Laurence Gan Lim, Robert Kerwin Billones, Siegfred Lopez, Dino Dominic Ligutan, Julius Palingcod, and Carl John Patrick Castillo in 2020; proposed creation of two main mechanical design prototypes for a BVM-based emergency ventilator. It was demonstrated that a modified Scotch yoke mechanism powered by a vehicle wiper motor maybe used to create a simple, compact, and possibly inexpensive ventilator design [17]. Controlling the speed and location of the compression pad as it compresses the BVM during each cycle was challenging due to the Scotch yoke compression mechanism. Only 2 digital proximity sensors, placed at the top and bottom of the compression stroke, served as position feedback. The load impacted the motor's speed as well. These characteristics made it difficult to manage the timing precisely

and rate of delivery of the necessary tidal volume of breath.

During the year 2019 Mukaram Shahid introduced a Prototyping of Artificial Respiration Machine Using AMBU Bag Compression. Ventilators are discussed here as essential medical equipment. They are mostly used to help seriously unwell patients. The AMBU (Artificial Manual Breathing Unit) bag has been used to develop a low-cost ventilator. This equipment is significantly more affordable than its competitors and is completely capable of carrying out all the duties of a typical ventilator. Additionally, it has the ability to regulate patients' BPMs (breaths per minute) to the level the doctor specifies. Additionally, this ventilator has the option of adjusting air delivery volume. The inspiration to expiration ratio and peep rate can both be controlled similarly. As a result, it makes the ventilator practical for patients of all ages and classifications. Two modes are included with this system. The first one calls for required ventilation, while Ventilation support is a characteristic of the second. The doctor may use the ventilator's built-in trigger, which modifies the breathing pattern when it notices a change in air pressure, or he or she may specify a time for this modification of the respiration pattern. An energy-efficient, portable, and reasonably priced ventilation system has been developed through the use of this prototype. The inexpensive price is primarily attributable to the off-the-shelf materials used in its construction and the accessibility of the sensors. In addition to all of this, the system has basic features like air volume control, BPM (breath per minute), and peep rate modification. Consequently, this device can very well be a solution to the issues facing developing nations.

A Remote Control System for Emergency Ventilators during SARS-CoV-2 was introduced in 2020 by Michael Barrow, Francesco Restuccia, Mustafa Gobulukoglu, Enrico Rossi, and Ryan Kastner from the UC San Diego Scuola Superiore Sant'Anna Pisa. Here, a global remote control system for temporary ventilators was established. It

connects to various ventilators using inexpensive hardware add-on modules, and it communicates with telemedicine software by way of three-tier control architecture [20]. They use two example ventilator designs to show system integration in this study, and they include a remote control option that enables caretakers to monitor rapidly and simply and manage these ventilators from a distance.

METHODOLOGY

Flow chart

The obligatory control mode is automatically employed in this project. Fig. 1 depicts the breath delivery system's flow. The patient is given breath based on an equal time delay. By using the controller's internal timer. The scheduled delay is based on the doctor's recommended breath rate. Due to the pressure limiting valve at the AMBU bag, the supplied breath is set at 60cmH₂O (centimeter of water). This quantity was likewise discovered to be the highest breath pressure required for an older patient. The flowchart for a cheap portable ventilator is shown in the picture. The flowchart in this example has a start block that must first initialize all global variables and Communication. Global variable initialization is employed. For the initialization of communication and machine codes for the clearance of the server path. Check to see if the button is pressed.



Figure 1: Flowchart.

The metrics used by IR sensors. In the event that it is 1, the gear motor turns in the opposite direction if not. They are the gear motor's outputs shown on the screen. If the no button is pressed, it changes the database and receives input is given to the path once more, and any alterations are examined; it ceases functioning after these events if the button clicked read pressure sensor with speed-controlling motor in keeping with the reading. Furthermore, this value will be kept in if a database is used, programming is stopped but a recheck is done, when the button is pushed.

Block Diagram

The schematic block diagram of the system's operation is shown in Fig. 2. This process began with a set of coding on the microcontroller, the system's primary component. Into this component, which was posted? Microcontroller output, located in the L298 motor driver, the H-bridge was used to command an Arduino-controlled DC motor to compress and Let go of the AMBU bag.

The patient receives breaths because of this process. The air pressure sensor monitors the patient's breathing and notices any changes in

respiration. Check the status of the air and oxygen filters. There are input obstructions that need to be changed. It also detects and controls the oxygen and air supply to ventilators.

Arduino UNO occupies the center of the block diagram. The Arduino UNO includes a 28 pin ATMEGA 328 IC. Arduino begins to operate when a 5 volt power supply is connected to it for the operation. When the start button is pressed and turned ON, the device work is started by will. The AMBU bag is in its default state when the IR sensors and the dilated state will be able to detect this. The plank coupled with a 12 volt gear motor begins to revolve as Over the AMBU bag, the engine will be compressed. The air in the AMBU bag will then be delivered to the prosthetic lungs at that moment. For proper rotation, the gear motor requires 12 volts; however, the Arduino's I/O pin can only produce 5 volts. So insufficient the motor obtains the

voltage supply. That'll result in the motor's correct rpm. The engine will also create a back. It causes damage to the Arduino UNO. These issues will affect a motor driver IC L293D in between an Arduino and a solution motor, too. It is possible to measure and store the pumping count in the server. The node MCU, a Wi-Fi integrated module, receives the pumping count or data first. Then the data MCU was internet-transferred from the node to the server database. As a result, the data was saved in the database. Utilizing the IP in Android, the data can be displayed by IP address or server domain. Here, three LED indicators are utilized. a proper one Power LED is used to detect the power source. An LED programme is utilized as a measure of the program's effectiveness and a data LED to show whether data is effectively flowing here an alarm gadget uses a buzzer system.

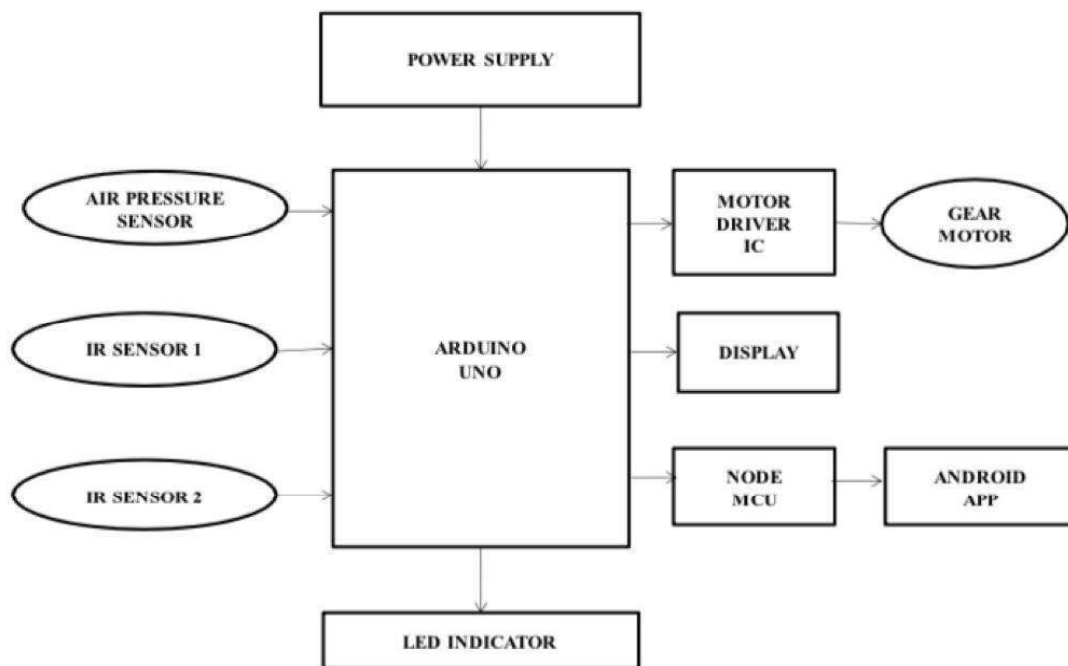


Figure 2: Block diagram.

The components are:

Arduino Uno

A micro-controller board called Arduino/Genuino Uno is based on the ATmega328P (datasheet).It features 14 pins for digital input and output, 6 analogue inputs, USB

connection - 16 MHz quartz crystal, a ICSP header, power jack, and reset button. It's just either use a USB cable to connect it to a computer or a power source battery or an AC-to-DC adaptor.

Ambu bag

A bag valve mask also referred to as a manual resuscitator or "self-inflating bag" or by the brand name Ambu bag. It is a portable device that is frequently used to patients who are not receiving positive pressure ventilation should get it either breathing or not breathing enough.

Node MCU

It employs a non-module flash-based SPIFFS file system and is an open source Lua firmware for the ESP8266 Wi-Fi SOC from Espressif. The firmware was first created as is an extension of the well-known ESP8266-based Development modules for NodeMCU

IR sensor

A sensor that measures and recognises infrared radiation in its environment is known as an infrared (IR) gadget Infrared sensors come in two varieties: active and passive. Active infrared sensors produce and pick up infrared radiation. Two components make up active IR sensors: a light emitting LED and a receiver.

L293D

Popular 16-Pin Motor Driver ICs include the L293D. Two DC motors can be operated simultaneously by a single L293D IC.

It is quite easy to use this L293D motor driver IC. The IC utilizes the Half H-Bridge, Speed, and Direction principles Possibility of control Gear motor 3.1.6(12v, 100 rpm)

Gear Motor (12v, 100 rpm)

Robotics applications use 100RPM 12V DC geared motors. It produces a powerful 27 Kg Cm of torque. The motor includes a Off-centered shaft and metal gearbox.

LCD (16x2)

Liquid crystal display is referred to as LCD. It is a specific type of electronic display module used in a wide array of devices and circuits, including mobile phones. Devices like phones, laptops, TVs, and calculators. These exhibits because multi-segment light-emitting diodes are primarily preferred and seven divisions.

Buzzer

It is a piezoelectric, electromechanical, or mechanical audio signaling device (piezo for short). Buzzers and beepers are frequently used in alarm clocks, timers, and user input confirmation, such as a mouse click or keyboard.

Circuit Diagram

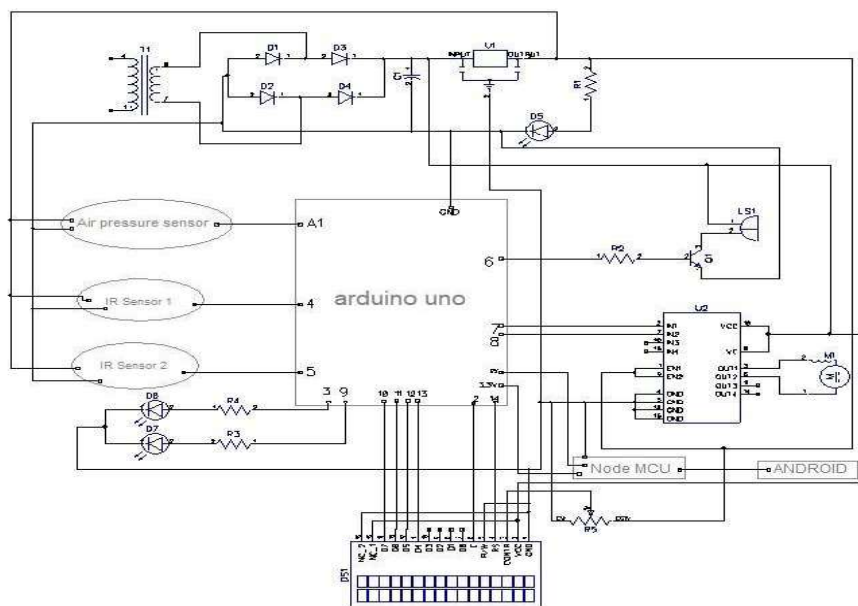


Figure 3: Circuit diagram.

Diptrace software is used to mimic the circuit development. This simulation is carried out to ensure that the circuit is correctly built and

that there are no short circuits or other errors. The main parts of this circuit are an infrared sensor module (SN-IR-MOD), an Arduino UNO, and a servo motor. The AMBU bag's inflation and deflation are detected by the rod and the servo motor, respectively, while the infrared sensors (designated as IR1 and IR2) are employed for this purpose. When rotated clockwise, the AMBU bag expands; when rotated counter-clockwise, it contracts. The finished prototype's diagram. The artificial lung that was utilized throughout the prototype's testing is also depicted in the diagram. A power supply system is shown in the circuit diagram. It is made up of a voltage regulator, a bridge circuit, and a step down transformer. 230V ac is converted to 12V by the step-down transformer and finally to 5V by the voltage regulator. An air

pressure sensor and two IR sensors make up the remaining three sensors in the circuit design. The air pressure is measured using an air pressure sensor, and the number of air pumps is counted using IR sensors. A transistor, a resistor, and a buzzer makeup the buzzer system. Its purpose is to deliver buzzer notification when a high pressure is detected. Three LED signals are next. The power, data, and programme are represented by the letters D5, D6, and D7, respectively. The display component in this case is a 16*2 LCD. Then, using a stick that is attached to it, a part of the servo motor is utilized to inflate and deflate the AMBU bag. An Android app designed to display patient status and function as a pressure control mechanism uses a node MCU to transmit data over Wi-Fi and provide connectivity.

Ventilator Prototype

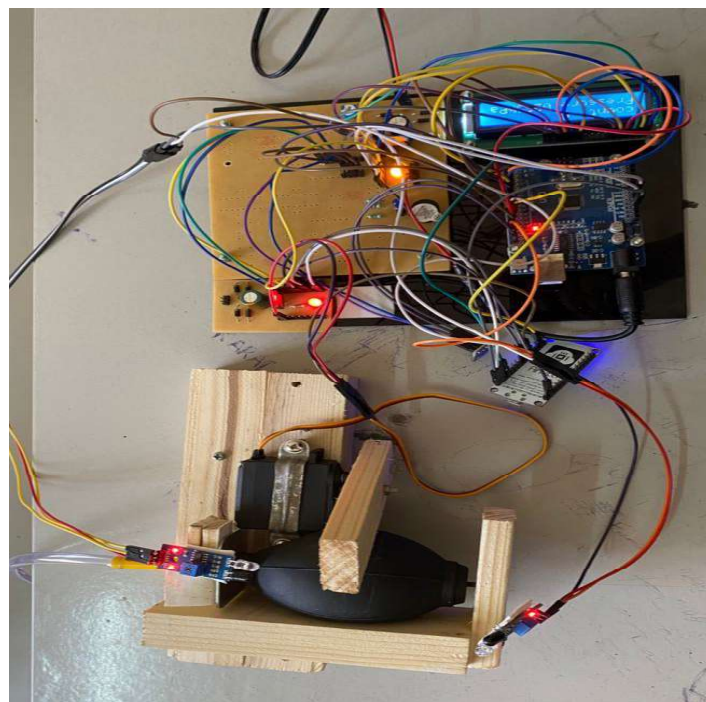


Figure 4: Ventilator prototype.

RESULT AND DISCUSSION

Successful design and development of a low-cost portable ventilator employing pressure regulation. The patient was provided information about the number, pressure, and volume of air in particular sensors are used to record the ventilator, after which both a 16*2 LCD panels and a database are used to store the results (Fig. 4). Database and transmitted to an Android app

for additional purposes. The physician can alter the treatment in an emergency employing a built-in regulating system, the amount of air application for Android. Additionally, a will exist if the Doctor is absent. Hospital or doctor's notification given via telegraph the bell alerts nearby individuals and the health assistant if Pressure builds.

The LCD shows the pressure and the breath count, both the count and the pressure of

the air being pumped out by the ventilator can be shown on this 16*2 LCD display (Fig. 5). The number determined by an IR sensor's obstacle detection. The counting process starts here as the

motor-driven rod compresses the AMBU bag, and for each compression, the count is increased by one.



Figure 5: LCD display.

The App interface is shown below in Fig. 6. This software, called Vento app, was made using Pycharm. There are two parts to it. One is to see the patient's condition. Here, along with an exact time and date, the ventilator's air volume, pressure, and count are all displayed. The data is updated every ten seconds. A control

mechanism is then included in the second portion. There are two modes available in this area. Modalities 1 and 2 these two modes are used to regulate the pressure by changing the servo motor's speed while employing a particular delay.

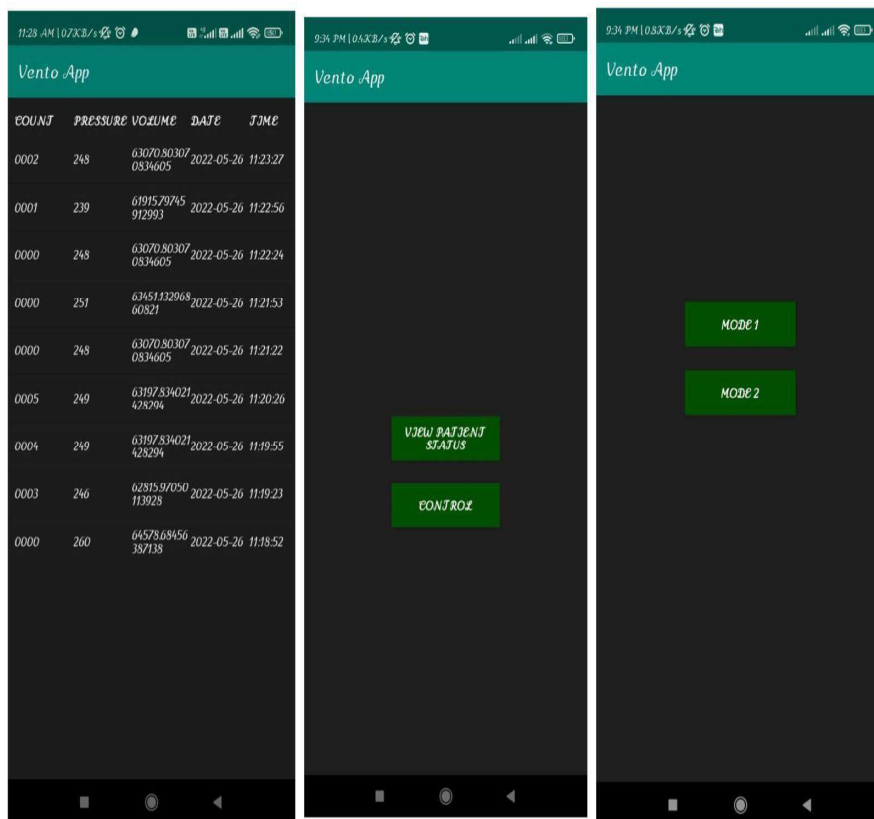


Figure 6: Vento app interface.

The notification coming in the Telegram as follows.

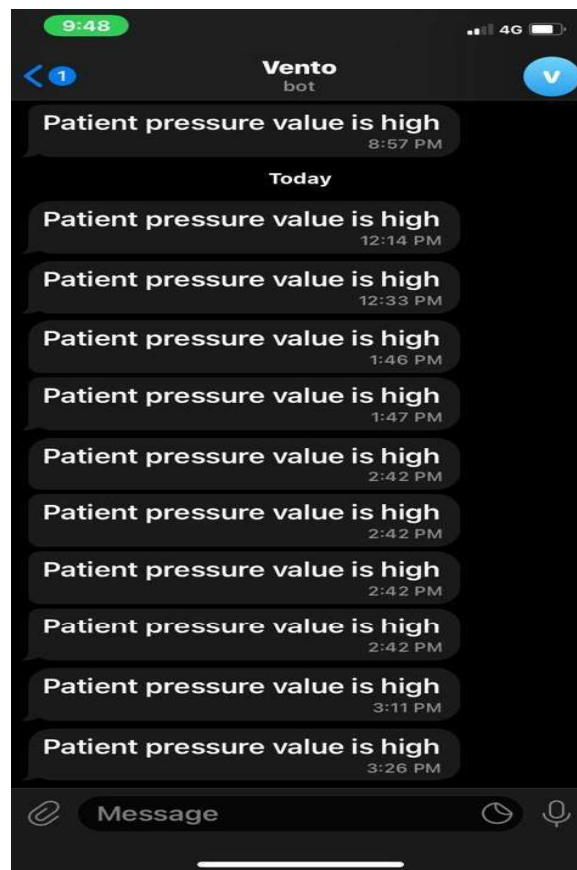


Figure 7: Telegram notification.

The doctor's phone receives the telegram notification (Fig. 7). Therefore, the doctor is informed whenever there is a pressure variation, and even from a greater distance and without physically seeing the patient, he or she can control or regulate pressure using the Vento app.

CONCLUSION

In this work, a prototype for a transportable, inexpensive, and energy-efficient breath delivery device was created. By coupling the Arduino to this prototype, it is possible to turn on the batteries and the power supply. Inflation and deflation of the AMBU bag were detected using IR sensing technology in this investigation. Upon receiving signals, the mechanical AMBU bag's automated release mechanism would generate the air that the lung needs. This gives the prosthetic lung a steady flow of air. This task discovered that the breath had a noticeably higher consistency. Supplied with a performance of 18.6 1.45 bpm and less than 10 percent difference between the two employing the developed technique like the manual way. Inflation and deflation of the

AMBU bag were detected using IR sensing technology in this investigation. Upon receiving signals, the mechanical AMBU bag's automated release mechanism would generate the air that the lung needs. This gives the prosthetic lung a steady flow of air. This task discovered that the breath had a noticeably higher consistency. Supplied with a performance of 18.6 1.45 bpm and less than 10 percent difference between the two employing the developed technique like the manual way.

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Intelligent IoT Based Syringe Pump Controlling and Monitoring Drip Level, Temperature, And Pulse Rate Using A Smart Phone Application

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ABSTRACT

The syringe pump is a miniature infusion pump that's utilized to give little volumes of liquid (with or without medicine) to an understanding or for chemical and biomedical research. This study describes how a smartphone application can be used to create micro-liter accuracy, lightweight, and remotely controlled syringe pump developed by the MIT app inventor using Intelligent Internet of Things (I²oT). The human health parameters such as heart rate, temperature, and drip level of the patient are measured using biomedical sensors and the corresponding readings and ECG graph are displayed using the Android app. This framework is able to entrust alert messages approximately the patient's basic wellbeing information as content messages to the smartphone through Bluetooth. The main advantages of this syringe pump are that it is less expensive portable and also automatically works.

Keywords- Biomedical sensors, Health parameters, Intelligent Internet of Things (I²oT), Syringe pumps, Wirelessly controlled

INTRODUCTION

The infusion pumps are used to provide a patient with a modest amount of medications and fluids. Medication is delivered by a syringe pump or fluid over several minutes (with or without medication). This spares time for workers and decreases blunders. These syringe pumps and mixture pumps reduce the side-effects of uneasiness, torment, and contamination related with standard sedate infusions. Syringe pump machines with modern

technology often include an in-built gadget with a small screen that measures and displays data and can alert the health care professional in the event of occlusion, loose syringe, low battery, or incorrect setting. Electro-spinning, electro-spraying, dilution, tissue perfusion, and palliative care all use medical syringe pumps. Syringes are frequently used to give intravenous (IV) drugs [1].

Since it is habitually utilized in genuine restorative circumstances where the quiet is incapable to eat or drink, it is additionally known as a syringe driver or syringe implantation pump [2]. Using a syringe pump, the medications are supplied to the patient in a liquid form in a controlled and determined amount. It's a small implantation pump that's utilized to give little sums of liquid to a quiet gradually (with or without medication) or for chemical and biomedical investigate. A few syringe drivers can infuse and pull back liquids simultaneously. Temperature, drip level, and heart rate are all measured utilizing an Intelligent IoT (I²oT) system, which will be further solidified when temperature, drip level, and heart rate are all measured [3].

The Med-fusion 4000 is a smart and wireless SIP from Smith Group. It is still constructed with all of the numerous electronic and mechanical components, making it excessively hefty. Because of the technical challenges, increased miniaturization of syringe pump mechanical components is required to lower the weight of some electronic portions such as the screen, keyboard, and calculator, making the syringe pump lighter and more wearable. In this work, a smartphone app is utilized to supplant these electronic pieces in arrange to extend scaling down. A remote arrange is made between a syringe pump and a smartphone app, permitting us to control it

remotely. This is used to increase health care access and to keep track of infusion history [4].

LITERATURE REVIEW

In 2018, Vaishnavi Patil, Sanjay Singh, and Vaibhav Kshirsagar suggested an Arduino Mega health monitoring system that measures five parameters including ECG, heartbeat, respiration, temperature, and blood pressure using non-intrusive biomedical sensors. In this study, it was proposed to use the Internet of Things to continuously monitor a patient's condition despite the patient's busy schedule and to assess the patient's health status for clinicians. The Arduino Mega Controller is used in the suggested technique, which is coupled to non-invasive biological sensors. The yield is appeared on any computerized observing framework utilizing an Arduino Mega. The sensors' data is transferred to the Thing Speak cloud, where doctors and other interested parties can store and access patient data [5].

In 2016, Sourabh Dudakiya et.al proposed a predictive monitoring technique in order to establish a viable patient monitoring system that allows healthcare providers to continually monitor their patients by utilizing wearable patient monitors. Sensors, a data collecting unit, a microcontroller (i.e. Arduino), and software are used in the proposed system. This technology can deliver text messages or email reports with alarm messages regarding the patient's crucial health data. The health care expert can provide essential medical recommendations utilizing this information. As a result, the suggested system addresses some of the shortcomings of the current system while also providing a dependable health monitoring system that can track ECG, RR, HR, BP, and BG.

In 2016, M.Deepalakshmil and Dr. RJayaparvathy stated Diabetes is caused by increased blood sugar content in the body. It damages diabetes patients' internal organs, which can be managed with insulin injections. Various infusion methods, such as insulin pens and insulin pumps, have been proposed to deliver insulin while blood glucose levels are continuously monitored. However, the size and cost of those systems are both excessive. In India, there's as of now no low-cost coordinates affront mixture framework accessible. The proposed framework is a Coordinates Affront

Implantation framework that keeps blood glucose levels inside a foreordained run whereas diminishing measure and taken a toll. It will deliver an appropriate insulin dosage as well as other information [6].

In 2016, Biswajit Mahaty, Suman Mondal, Uttam Sahu, Somnath Patra, and Dipankar Mandal suggested a Human Wellbeing Monitoring Framework based on a piezoelectric sensor. The major goal of this study is to provide a non-invasive system that eliminates human errors, allows for further patient checks, and reduces the average time it takes an expert to dissect a patient's health state.

In 2016, a Novel Portable Micro-pump and Infusion System for Drug Delivery was proposed by Paul Pankhurst and Zahra McGuinness Abdollahi. A unique portable fixed-displacement micro-pump for regulated dosage and timing is detailed in this work, along with its design, construction, and experimental findings. The novel pump is designed to overcome many of the shortcomings of current portable pumps by providing high efficiency, high precision, ease of use, and inexpensive cost for single-use drug delivery systems. Primary testing was carried out, and the results were presented. The pump is meant to work with a motor drive that is the size of a standard pen, allowing the patient to move around more freely and feel better. The innovative micro-pump has a wide range of uses [7].

In 2018 Pooja Rajendra Prasad et.al suggested Information Security Considerations for Wireless Infusion Pumps. Possible attacks have been detailed in this work to generate an awareness of the potential threats that wireless infusion pumps may face. Furthermore, components that require protection have been discovered. This research presents controls for Wireless Infusion Pumps by including security measures during the design phase of software development [8].

METHODOLOGY

The Mega 328P microprocessor is used on the Arduino UNO, a microcontroller board. It has six analogue inputs, a 16 MHz ceramic resonator, 14 advanced input/output pins (six of which can be used as PWM yields), a USB connection, a control jack, an ICSP header, and a reset button on the board.. Everything you need to get started using the microcontroller is

included; you can use a USB cable to link it to a computer or an AC-to-DC adapter or battery to control it. You can experiment with your UNO without worrying about making a mistake; in the worst scenario, you can buy a replacement chip for a few bucks and start over to control the Arduino Uno board, a USB connection or an external power source can be used. Naturally, the control source is picked. Outside (non-USB) control can be provided via a battery or an AC-to-DC adapter (wall wart). To connect the connector, put a 2.1mm center-positive plug into the board's control jack.

The GND and Vin stick headers on the Control connection can accept battery leads. The board can run on anything from a 6 to 20-volt outside supply. On the odd chance that it delivers less than 7V, the 5V stick could deliver less than 5V, making the board unstable.. If more than 12V is used, the voltage controller may overheat and destroy the board. The suggested range is from 7 to 10.

In this paper, the syringe pump mechanically moves the piston of a syringe to put medication, which is controlled by using a phone connected through Bluetooth and an IoT device. There are two Android application used in which one phone is connected through Bluetooth and then we connect it with the system and run the program. The other phone is connected through IoT and the data will be stored in the server. When we give the command

the syringe pump will on and off automatically. All three devices should be connected through hotspots. The corresponding heart rate graph, valve, drip level, and temperature are shown correspondingly in the application.

Flow chart

Fig. 1 shows a schematic diagram of an IOT syringe based on a smartphone app. Here the flowchart starts with a start-up block, which requires initializing all global variables and communicating first. Worldwide variable initialization is utilized to scramble the machine and initialize the communication to clear the server way. The heart rate sensor, body temperature, and drip level are all tested when the button is pressed. The cylinder engine rotates forward if it equals A; else, it rotates backward. The syringe motor's two outputs are shown on the screen. Whether the button is not clicked, the programme updates the database's data, responds to the path once more, checks to see if any changes have been made, and then stops work. The motor speed will be changed based on the readings from the dribbling, body temperature, and heart rate sensors if the button is not touched. And this value will be saved in the database after the application ends, but it will be checked again if any button is pushed as shown in (Fig. 2).

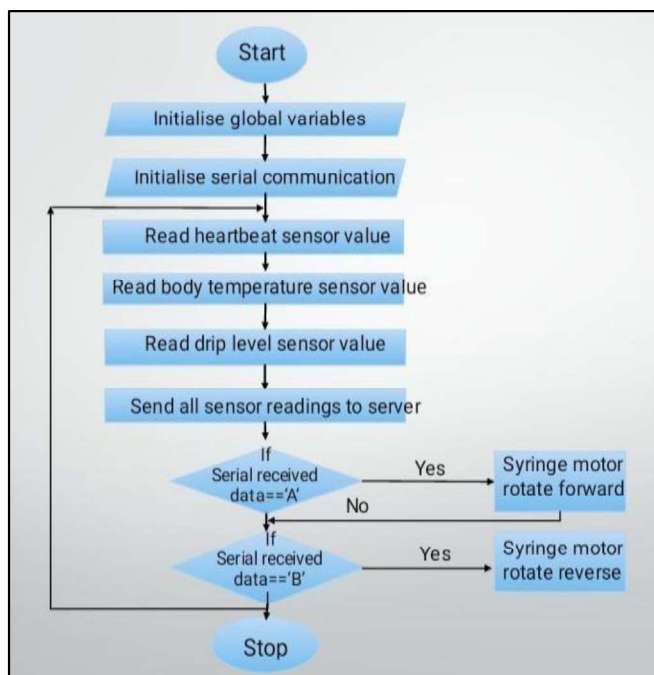


Figure 1: Flow chart.

Block Diagram

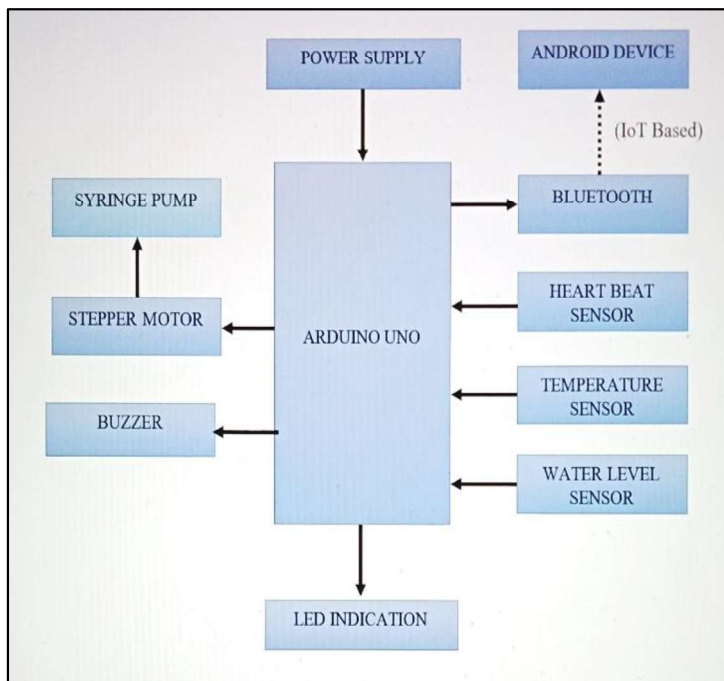


Figure 2: Block diagram.

Arduino Uno

Arduino UNO is the ideal board to learn how to code and work with electronic devices. The UNO is the most solid board you can start with if this is your first time working with a rig. The Arduino UNO is the best documented and most popular board in the Arduino family.

Syringe Pump

Syringe pumps are used to manage a completely small amount of medication into IV tubing by physically moving the piston of a syringe.

Servo Motor

They're DC motors that revolve in exact "steps" or increments. It comes in handy when you need to position anything very precisely; it's utilized in 3D printers to perfectly place the print-head and in CNC machines.

LED Indication

The green LED with the ON image shows that the Arduino is fuelled up. The L-shaped yellow LED is simply connected to pin

13. When pin 13 is set to HIGH, the LED turns on. Pin 13 can, however, be used for various purposes.

Android Device

An Android phone could be a high-tech smartphone that works on Google's Android working framework (OS), which is utilized by many distinctive phone producers.

Bluetooth

A short-range farther development standard for transmitting data between settled and convenient contraptions over brief partitions utilizing UHF radio waves inside the ISM bunches, expanding from 2.402 to 2.48 GHz, and for building person locale frameworks.

Heart Beat Sensor

An electronic gadget that measures the heart rate or the rate at which the pulse beats. The most things we do to remain solid are screen our body temperature, heart rate, and blood weight (Fig. 3).



Figure 3: Heartbeat Sensor.

Temperature Sensor

It is a temperature measuring device. This can be the temperature of the atmosphere, liquids, or solid stuff. Temperature sensors come in an assortment of shapes and sizes, and the yall screen temperature utilizing distinctive innovations and standards (Fig. 4).



Figure 4: Temperature Sensor.

Drip Level Sensor

This sensor can be used to detect leaks, monitor a sump pit, and measure water levels (Fig. 5).



Figure 5: Drip level Sensor.

Power Supply

PCB Frameworks extending from individual computers to domestic machines require a control supply to change over AC control from the divider to DC control with negligible clamor substance. More than simply changing over between AC and DC control is included in PCB control supply plan.

RESULTS AND THEIR DISCUSSIONS

The calibration of the syringe driver is one of the most important tasks. The following points must be considered: the stepper engine's rotation, the length of the Trapezoidal screw, and the syringe's measurements. The Arduino code can be used to make the calibration. For this, the distance between two turns should be computed as follows:

8mm 48 steps by turn
1 Step → 0.16667 mm

When this condition is added to the Arduino code, the movement will be accurate about the syringe volume calibration. A powerful magnifying lens (PARALLAX) and a MATLAB program are used to calculate the stream rate. As shown in Table 1, the micro-pump could provide microliters' stream rates.

TABLE 1: The Experimental Measurements.

Motor speed [mm/s]	Temp Sensor	Heartbeat sensor	Drip level sensor
0.8	0032	0085	0100
0.6	0032	0083	0100
0.5	0022	0085	0100
0.47	0032	0088	0100
0.37	0031	0084	0100
0.33	0032	0083	0100
0.3	0031	0086	0100
0.28	0030	0087	0100

Right presently Using MEMS Nanofabrication technology, we are attempting to miniaturize the syringe pump. A biocompatible PDMS-based substrate is coated with tiny piezoelectric films that consume little energy. Manufactured quickly and easily using fragile-lithography. Drugs are safely contained and transported in the chamber. In order to remotely control our gadget and draw closer to the circle while using persistent glucose

checking, a Bluetooth Low-Energy (BLE) is actualized (CGM).

According to the information we have, the syringe mixture pump has the ability to deliver micro-injections precisely, and by connecting to a smartphone app, it has been given the freedom needed to operate the syringe pump. Fig. 6 below displays the plotted ECG charts for three health factors, including heart rate, temperature, and drip level.

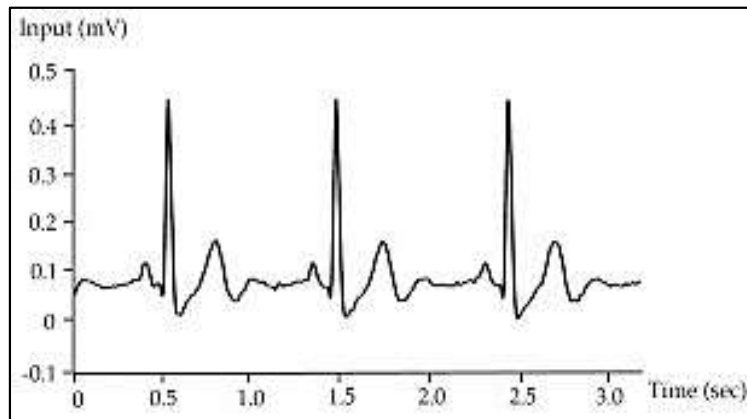


Figure 6: Corresponding ECG Waveform.

The syringe pump is now lighter than the Micro-pump TM Taste or the Med-fusion 4000 Taste thanks to the framework integration that allowed us to do away with a few electronic components that are typically bulky (the console and screen).. Besides, not at all like these SIPs, our framework is wirelessly controllable through a basic interface. In this manner, our two objects specifically the App and the wirelessly-controlled Taste dispensing with the additional weight and complexity of electro-mechanical parts constitute an intelligent IoT (I2oT) framework that is able to be advanced set when a temperature, heart rate, and drip level sensor is included tiding them the full biomedical framework.

CONCLUSION

With the development of wearable gadgets that are simple to use and secure, mobile health has transformed the way health care is delivered. Prototyping a syringe driver that is automatically and remotely operated, with a health monitoring setup and accompanying ECG wave plotting, will help progress miniaturization efforts so that it maybe connected to healthcare providers via Cloud platforms. A desired

biomedical patch is now being developed employing MEMS Nanofabrication technology techniques and a monolithic integrated circuit. Furthermore, we intend to turn this biomedical apparatus into an I2oT platform for intelligent drug administration, such as insulin for diabetics or chemotherapy for cancer patients.

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Rice Leaf Disease Detection and Crop Yield Prediction Using Random Forest

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Abstract— Rice production contributes a considerable amount to national income. Rice production can be affected by various diseases like brown spots, bacterial leaf blight, leaf smut caused by fungi, bacteria, etc. In this research, the diagnosis of rice plant leaf disease is done using random-forest classification and Digital image processing. The random forest classifier is efficient and accurate on a large dataset. The image is uploaded to the system by following digital image processing steps and using a random forest algorithm to perform on the processed image which outputs disease name, cause, symptoms, and remedy respectively. The proposed method also predicts the crop yield based on temperature, rainfall, humidity, and soil pH level. Overall, the model achieves 90% of accuracy.

Index Terms—Machine learning, Image processing, Random forest classification, Crop yield

I. INTRODUCTION

Rice is the deliberate source of food in India so the detection of rice leaf disease plays an important role in the Indian economy. The current methods in use are not much effective. Methodologies with high costs are not affordable to common people.

Image processing is the technique used to process digital images using machine learning algorithms with the help of a digital computer. Digital image processing is the process of manipulating of digital images. Its focus is on a computer system that can process an image. It uses computer algorithms. Digital image processing is used to obtain some useful information from the digital image. Image processing includes steps like image acquisition, image enhancement, image restoration, color image processing, wavelets and multiresolution processing, compression, morphological processing, segmentation, representation and description, and object recognition.

This research intended to extract features from a given image. Digital image processing takes the digital image as input and generates a useful information as output.

Crop production is affected by the input parameters of soil and climate. Parameters vary from area to area and user to user. It may also be a tiring challenge to collect such information in an even larger area. The large information set is used to predict crop production. There are different methodologies developed and evaluated by researchers.

Crop yield prediction can be used to determine the upcoming production yield so that the farmers can take necessary actions to increase the yield. Some climatic and soil parameters are used for the prediction.

The early detection of rice leaf disease helps to reduce the impact on production. The earlier we detect the disease, the earlier we can take precautions by considering the current year parameters of soil and climate as a reference to overlook the characteristics of the coming year's yield.

Machine learning (ML) is a type of artificial intelligence (AI) it will help to become more accurate the software applications. The input of machine learning algorithms is historical data. From that, we can predict the new outputs. Machine learning is very important because it gives more accurate predictions and it's a competitive differentiator for many companies like Facebook, Google, and Uber.

Different types of machine learning algorithms are supervised learning, unsupervised learning, semi-supervised learning, and reinforcement learning.

In supervised learning machine learning, data scientists supply the training data labeled with algorithms and define the variables they want the algorithm to assess for correlations. Input and the output of the algorithm are already known.

Unsupervised learning is a machine learning algorithm that trains on unlabeled data. The main goal of unsupervised learning is to Underlying the structure of the dataset and group this data based on similarities and represent it in a compressed format.

Semi-supervised learning is the mix of the two types. It was introduced to counter the disadvantages of both supervised and unsupervised machine learning. The semi-supervised learning algorithm is trained upon a combination of labeled and unlabelled data. It will contain large unlabelled data and a small amount of labeled data.

Reinforcement learning is one of the machine learning algorithms is used in areas such as: Robotics: They can perform tasks in the physical world. Example: A rabbit is an agent exposed to the environment. Fig.1 shows the model of reinforcement learning. Video gameplay: it is used to play several video games.

Random Forest could be a well-known machine learning algorithm. Machine learning algorithms are supervised and unsupervised learning and the random forest algorithm is belonging to the supervised learning technique. It can be used for both Regression and Classification problems in machine

learning. It's supported the concept of ensemble learning, which may be a process of mixing multiple classifiers to unravel a fancy problem and boost the performance of the model.

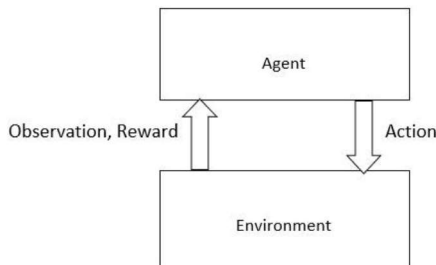


Fig. 1. Reinforcement learning

Random Forest may be a classifier that contains a variety of decision trees on various subsets of the given dataset and takes the common to enhance the predictive accuracy of that dataset. Decision trees are the backbone of a random forest algorithm. A choice tree may be a decision support technique that forms a tree-like structure. The random forest employs the bagging method to come up with the desired prediction. It can handle large datasets efficiently. The random forest algorithm provides the next level of accuracy in predicting outcomes over the choice tree algorithm.

The data can be classified in 2 ways: Supervised and Unsupervised learning. The data mining process can be used to identify the class of data. A random forest algorithm is used in both rice leaf disease detection and crop yield prediction. The random forest algorithm is very effective because it can perform both classification and regression at the same time with a very large data set.

The purpose of this paper is the detection of rice leaf disease and the prediction of crop yield by using a random forest algorithm. This paper is arranged as; Section II is the literature review. Section III describes the proposed method for detection and prediction. Section IV shows the experimental arrangements for the implementation of the system. Section V concludes and summarizes the paper while providing suggestions for future work.

The rest of this paper has the following sections, Section II consists of the associated works. Section III introduces the proposed method. The experimental outcomes and critiques are presented in Section IV. Finally, phase V summarizes the paper.

II. LITERATURE REVIEW

In this paper, a random forest algorithm is used to detect rice leaf disease and crop yield prediction. Image segmentation is performed on the test image and features are extracted. A random forest classification algorithm is applied to the segmented image and the disease class is obtained. The crop yield prediction mechanism takes the necessary input data such as weather parameters and performs a random forest algorithm and predicts the crop yield for the upcoming production.

In [1] the classification algorithm is used to detect papaya disease. A Naive Bayes classifier (NBC) is a machine learning algorithm that is used to differentiate objects based on particular features. This paper aims to detect papaya disease using Fuzzy Naive Bayes Classifier (FNBC). The resource person's knowledge is given as input to the system so that the farmers can detect disease without the help of an expert. The resource knowledge is then processed using FNBC to detect the disease class. is used for classification because it is easy and fast in computation, good enough to handle data in qualitative and quantitative forms, and does not require large training data.

In [2] it shows a detailed knowledge of how the machine learning algorithm and digital image processing are implemented in corn plant disease detection. For image, the classification image is processed using Synthetic Minority Oversampling Technique (SMOTE) and using k-means cluster method. The main function of digital image processing in this paper is to upload an image then enlarge the inputted image and from that form its binarization and then image balancing using SMOTE technique. These synthetic training records are generated by randomly selecting one or more of the k-nearest neighbors for each example in the minority class. After getting classified images Gradient Boosting Decision Tree (GBDT) is processed.

In [3] apple fruit infections are detected by using image processing technology. A random forest classifier algorithm is used to extract color and texture features of test images for disease classification. Texture features like Local Binary Pattern, Complete Local Binary Pattern, Gabor Features, and color features like Global Color Histogram, and Color Coherence Vector. The K-means clustering technique is also used in this paper for detecting infected parts of the fruit. The proposed method is made by accompanying some state of the color and texture features are extracted from the test image, then color and texture features are combined together and random forest classifier is used for disease classification. If the fruit is infected by any disease then the infected part is segmented using the k-means clustering technique.

In [4] random forest algorithm is used for the prediction of crop yield. Predictions are done before the cultivation. Climatic and soil parameters are the inputs used for the prediction. This predicts the production of upcoming years. The result obtained from the prediction is useful for making decisions for the upcoming production.

III. PROPOSED METHOD

The proposed system is a methodology for rice leaf disease detection and crop yield prediction using a random forest algorithm. The random forest algorithm is used because of its accuracy. This is a simple, user-friendly system and it consumes less time. Admin, user, and system are the three modules that make up this system. The system is accessible to both admins and users. The administrator has access to the list of registered users, as well as the ability to add disease information and see who has been rated. Users

can create accounts and upload photographs to the system. Both administrators and users will be handled by the system.

Input: Affected image or Crop yield parameters.

Output: Disease identification or yield prediction.

Algorithm:

Steps:

1. log in to the system
2. Upload the image otherwise go to step 7
3. Load training images
4. Read the testing image
5. Perform the random forest algorithm for disease detection
6. Identify the disease, suggest remedies, list out symptoms and causes and go to step 10
7. Enter parameters for crop yield prediction
8. Perform the random forest algorithm for crop yield prediction
9. prediction
10. Predict the yield and go to step 10 10. End

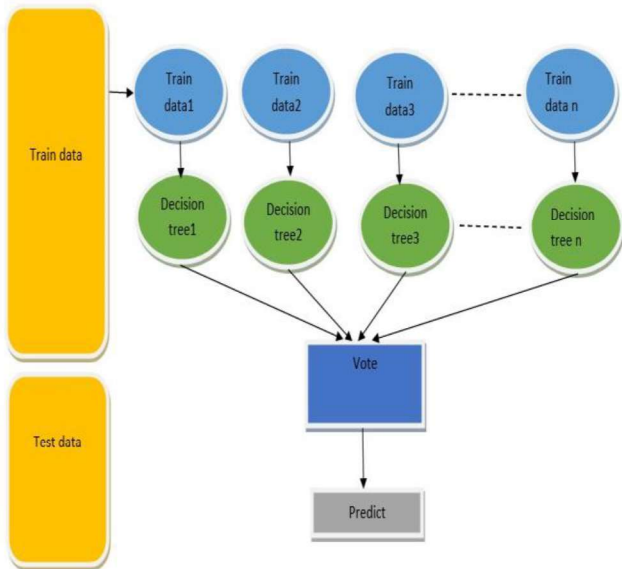


Fig. 2. Working of Random forest algorithm

Rice leaf disease detection and crop yield prediction system using random forest algorithm. The programming language used is python. Here random forest works differently in both scenarios. Digital image processing has a keen role in disease detection[5]-[7]. Fig. 2. shows working of random forest algorithm. Random forest uses a train-test split. Here, 80% is training and 20% testing. The 20% testing is used for prediction.

Fig 3. shows the Architecture of the proposed method for both disease detection and crop yield prediction. For disease detection, the user can upload the training image that is the affected rice leaf into the system, and feature level extraction will happen. Finally using the random forest algorithm to detect the affected disease. In crop yield prediction users can enter the details such as Temperature, Humidity, Rainfall, and Soil pH. The data are extracted from these details and crop yield prediction will happen by using the Random Forest algorithm.

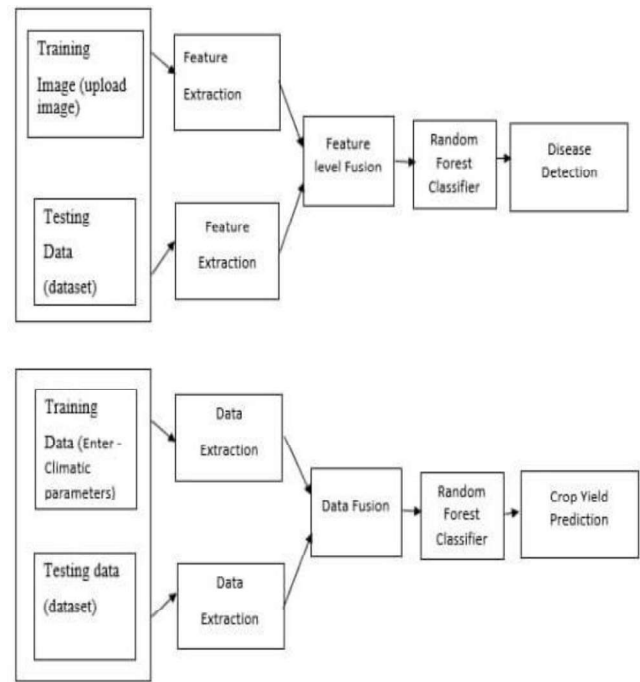


Fig. 3. Architecture of the proposed method

A. Disease Detection

The initial step is to collect images and create a data set that contains the images of various rice leaf diseases. A .csv file is formulated from the created data set. Some of the commonly seen rice leaf diseases are Brown spot, bacterial blight, leaf smut, tungro, blast, etc. The other dataset is a collection of nondisease data. Every time a prediction is made, it is compared to the dataset that has been provided. The more massive the dataset, the more accurate the result.

In the next step, the user can upload an image to the system. The features are extracted using Grey Level Cooccurrence Matrix (GLCM) and calculate the mean value for each feature. Then the mean value is converted into an int array. The attribute and label values for the uploaded images are taken, then inputted into the random forest model and the result is obtained. Along with the result, the system provides symptoms, causes, and remedies for the disease.

Each disease is considered as a different class and each class has unique characters and features according to which the image is classified. The disease class is predicted based on the features of the input rice image. The features we considered are energy, homogeneity, dissimilarity, correlation, and contrast. Features are extracted using Gray Level Co-occurrence Matrix (GLCM). The GLCM functions characterize textures of an image by calculating how often pairs of the pixel with specific values. The disease classes are obtained as output with its symptoms, causes and remedy to solve them.

1) *Energy*: The Sum of squared elements in the GLCM is also called uniformity or the angular second moment.

2) *Homogeneity*: It shows the uniformity of the pixels in the image. Also known as inverse difference moment. It

measures the density of distribution of elements in the cooccurrence matrix and in its diagonal.

3) *Dissimilarity*: Dissimilarity is the measure of distance between pairs of pixels in the region of interest. It is the lack of similarity or likeliness in appearance to something else.

4) *Correlation*: It is the measure of linear dependencies in images. A high correlation means a high number of linear structures present on an image.

5) *Contrast*: It is also known as inertia, it measures the difference in brightness between the object and its background, and the local variations of gray levels in the co-occurrence matrix. A high contrast causes large variation in the image.

B. Bacterial leaf blight

Bacterial Leaf Blight is a rice leaf disease caused by the bacteria, *Oryzae sativa*. Fig.4 shows the leaf affected by Bacterial Leaf Blight. Normally the leaf color range is light green to greyish green, when it gets affected by *Oryzae sativa* it's color changes to yellowish lesions with uneven edges. Then the leaves become yellow they gradually wilt and die. In severe cases, the crop loss may be as high as 75%, and millions of hectares of rice are infected annually.

C. Leaf blast

Blast is a rice leaf disease caused by the fungus *Magnaporthe oryzae*. Fig.5 shows the image of the leaf blast affected leaf. It affects parts of a rice plant: leaf, collar, node, and sometimes leaf sheath. Blast can occur whenever blast spores are present. Lesions can be found on all parts of the plant, including leaves.

D. Tungro

Tungro is a rice leaf disease caused by the bacteria Rice Tungro Bacilliform Virus (RTBV) and Rice Tungro Spherical Virus (RTSV). Fig .6 shows that tungro diseases are transmitted by leafhoppers. Leaves become yellow or orange-yellow. Controlling the Tungro virus is by spraying insecticides. Spraying of insecticides can reduce the populations of the green leafhoppers which means it will reduce the speed of spreading the virus.

E. Leaf smut

Leaf smut is caused by a fungus and is most prevalent in blue grasses, but can also occur in some cool-season grass varieties. Fig. 7 Leaf smut is caused by the fungus *Ustilagoidea virens*. The symptoms are discoloration of grains, grains Transformed into a mass of Yellow fruiting bodies, smut balls bursting and becoming black, and greenish-black smut balls with a velvety appearance.

F. Brown spot

Brown spot is a fungal disease caused by *Cochliobolus miyabeanus* that infects the coleoptile, leaves, leaf sheath, panicle branches, glumes, and spikelets. The most noticeable damage is the numerous big spots on the leaves which can kill the whole leaf shown in Fig. 8. When infection occurs in the seed, discolored seeds are formed.



Fig. 4. Bacterial blight.

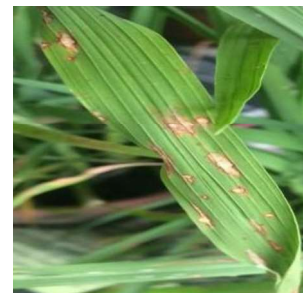


Fig. 5. Leaf blast.



Fig. 6. Tungro.



Fig. 7. Leaf smut.



Fig. 8. Brown spot.

G. Crop Yield Prediction

The initial step is to collect climatic parameters and soil parameters to create a data set that contains various parameters for crop production[8]. Data pre-processing technique is adapted to convert the raw data to a good data set. A .csv file is formulated from the created data set. Some of the commonly used parameters are temperature, soil pH, rainfall, and humidity. Table.1 shows the normal ranges for these parameters.

Table 1. Normal parameter range

Sl.no	Temperature	Humidity	Rainfall	pH
1	25 - 35°C	65 - 80 g.kg ⁻¹	17 - 30 cm	6.5 - 7.5

The user inputs the parameters and random forest model to compare these values with the values that are present in the data-set and generate a corresponding result such as high, low, or medium production for the upcoming year.

IV. EXPERIMENTAL SETUP

The system contains three data sets. The first data set contains almost 10,000 images of 5 different rice leaf diseases. The second data set contains uninfected rice leaf images and other images. The third data set contains parameters for crop yield prediction.

Depending upon the resulting output, the users can able to take necessary action for the coming production so that it is a user-friendly system.

	A	B	C	D	E	F	G	H	I
1572	1570	0.126848	0.011722	14.47323	0.902203	552.8968	Bacterialblight		
1573	1571	0.125079	0.011263	19.45895	0.81613	1126.783	Bacterialblight		
1574	1572	0.160162	0.017427	10.48046	0.840915	315.0896	Bacterialblight		
1575	1573	0.117117	0.012173	16.89018	0.781713	818.9477	Bacterialblight		
1576	1574	0.172573	0.018885	11.70894	0.90587	478.7589	Bacterialblight		
1577	1575	0.092909	0.010011	23.08118	0.718301	1364.277	Bacterialblight		
1578	1576	0.208427	0.019308	11.41108	0.88462	538.5847	Bacterialblight		
1579	1577	0.209564	0.020154	13.40985	0.886898	624.8167	Bacterialblight		
1580	1578	0.238293	0.021823	7.414086	0.96495	194.5378	Bacterialblight		
1581	1579	0.207824	0.017313	10.91862	0.919531	421.5451	Bacterialblight		
1582	1580	0.225647	0.019868	8.4719	0.947463	238.6517	Bacterialblight		
1583	1581	0.189778	0.016286	11.72509	0.907529	457.6619	Bacterialblight		
1584	1582	0.099905	0.011911	24.09338	0.619111	1360.168	Bacterialblight		
1585	1583	0.270986	0.025859	7.598764	0.934722	234.356	Bacterialblight		
1586	1584	0.494922	0.04777	1.562659	0.993901	5.843303	Blast		
1587	1585	0.262963	0.023675	7.041707	0.954199	180.6962	Blast		
1588	1586	0.30597	0.037784	3.165217	0.974737	20.67635	Blast		
1589	1587	0.287163	0.024255	6.419678	0.945017	151.4337	Blast		
1590	1588	0.314882	0.039065	3.083533	0.972015	20.18161	Blast		
1591	1589	0.312165	0.032289	4.324652	0.972091	57.64951	Blast		
1592	1590	0.546231	0.066027	3.063572	0.884365	115.132	Blast		
1593	1591	0.223929	0.01937	7.804877	0.944171	184.1073	Blast		
1594	1592	0.408213	0.049154	2.179621	0.990432	10.95424	Blast		
1595	1593	0.319099	0.027696	4.85147	0.965933	83.07152	Blast		

Fig. 9. Disease detection dataset

	A	B	C	D	E
1	Temperature	Humidity	pH	Rainfall	Label
2	20.87974371	82.00274423	6.502985292	202.9355362	high
3	21.77046169	80.31964408	7.038096361	226.6555374	high
4	23.00445915	82.3207629	7.840207144	263.9642476	high
5	26.49109635	80.15836264	6.980400905	242.8640342	very high
6	20.13017482	81.60487287	7.628472891	262.7173405	high
7	23.05804872	83.37011772	7.073453503	251.0549998	very high
8	22.70883798	82.63941394	5.70080568	271.3248604	medium
9	20.27774362	82.89408619	5.718627178	241.9741949	low
10	24.51588066	83.5352163	6.685346424	230.4462359	very high
11	23.22397386	83.03322691	6.336253525	221.2091958	very high
12	26.52723513	81.41753846	5.386167788	264.6148697	medium
13	23.97898217	81.45061596	7.50283396	250.0832336	very high
14	23.97898217	80.88684822	5.108681786	284.4364567	medium
15	24.01497622	82.05687182	6.98435366	185.2773389	very high
16	25.66585205	80.66385045	6.94801983	209.5869708	very high
17	24.28209415	80.30025587	7.042299069	231.0863347	very high
18	21.58711777	82.7883708	6.249050656	276.6552459	high
19	23.79391957	80.41817957	6.970859754	206.2611855	high
20	21.8652524	80.1923008	5.953933276	224.5550169	low
21	23.57943626	83.58760316	5.85393208	291.2986618	medium
22	21.32504158	80.47476396	6.442475375	185.4974732	very high
23	25.15745531	83.11713476	5.070175667	231.3843163	medium
24	21.94766735	80.97384195	6.012632591	213.3560921	medium
25	21.0525355	82.67839517	6.254028451	233.1075816	medium
26	23.49381344	81.33265073	7.375482851	224.0581164	very high
27	25.0756354	80.52389148	7.778915154	257.0038865	very high
28	26.35927159	84.04403589	6.286500176	271.3586137	very high
29	24.52922681	80.54498576	7.070959995	260.2634026	very high

Fig. 10. Crop yield prediction dataset

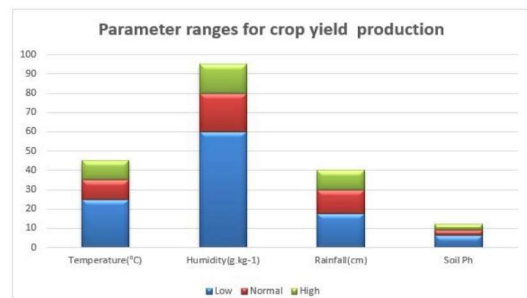


Fig. 11. parameter ranges for crop yield production

Fig. 9. shows the dataset for rice leaf disease detection. Dataset consists of mean values of 5 features in each image in the dataset and corresponding 1 label. The features are energy, homogeneity, dissimilarity, correlation, and contrast. The labels can be bacterial leaf blight, bacterial blight, leaf blast, tungro, and leaf smut. Fig. 10. shows the dataset for rice crop yield prediction. Dataset consists of 4 parameter values and a corresponding 1 label. The parameters are temperature, humidity, rainfall, and pH. The labels are low, high, and medium. Fig. 11. shows the graph representing parameter ranges for crop yield prediction. The graph portrays low, high, and medium ranges for each parameter.

V. CONCLUSION

This paper presents the algorithm that can be used to classify rice leaf diseases and predict the crop yield using the Random forest algorithm. Image classification using the random forest algorithm is highly accurate when compared with other machine learning algorithms like Naive Bayes, gradient boosting, etc. This provides both regression and classification at the same time so that its prediction is more than 85% accurate and also it predicts the crop yield based on the climate input parameters. This is highly efficient and also less time-consuming.

This proposed system provides the disease name, its symptoms, cause, and remedies following the inputted image and also provides the prediction of crop yield for the coming year. Crop yield prediction is based on some climatic parameters like humidity, soil pH, rainfall, and temperature. The built website is user-friendly. The net page is developed to predict rice leaf disease and crop yield by providing data from that area.

VI. ACKNOWLEDGMENT

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Sentiment Analysis on Student Feedback Using RNN

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Abstract— Almost all organizations collect feedback to improve the quality of service provided. Frequent and ongoing feedback analysis is inevitable for the development of any organization. But handling this huge amount of data is time-consuming and not economical. In the present feedback system, qualitative analysis of data is not possible. It may require huge manpower to analyze the feedback. Also, the currently used grading system is not useful in conveying the exact emotions of students. To overcome this, a system is proposed that gives summarised feedback and works on sentiment analysis. The summarised feedback contains deep key phrases. Key phrases can provide highly condensed and valuable information that helps in acquiring the main idea of the content. It attempts to capture the deep semantic meaning of text content. Here, the Recurrent Neural Network (RNN) algorithm is used for keyphrase extraction and sentiment analysis.

Index Terms— Feedback Summarising, Keyword Extraction, Machine learning, Recurrent Neural Network (RNN), Sentiment Analysis

I. INTRODUCTION

Collecting feedback frequently is a significant way to improve the achievement in learning. Through feedback collection the emotion of student for each teacher can be understood. Effective feedback, both positive and negative are valuable information that will be used to make important decisions. Educational institutions are one of the significant areas that require feedback for the improvement of the existing learning process, teaching material, and evaluations. But handling these qualitative opinions is a challenging task. The process is timeconsuming and not economical as it requires manpower.

In most cases, the main purpose of feedback is not utilized. So, we propose a software that can analyze the sentiment from the feedback and detect keywords based on their nature. The frequency of emotion is plotted as graph. High-quality keyphrases allow the understanding, organizing, and accessing of the content. This predicts the aspect described and the orientation of the given feedback. The basic idea of the keyphrase generation model is to compress the content of source text into a representation. After training, key phrases are generated and we get the predicted word sequences with the highest number of probabilities.

In the existing system, the qualitative feedback is collected manually or using a grading system. A grading system cannot be considered a good approach as the actual feedback is not evaluated. By this method exact emotion of the student cannot be identified in the case of manually collected feedback, the data is huge. So, the chance of completely

avoiding the feedback is high. If the whole feedback needs to be considered, then there arises the problem of hiring people for feedback evaluation, which is not economical. And if there is any correction in the given feedback then it is difficult to correct or even not possible sometimes. In the existing system, the feedback is collected by a teacher or any other staff. The disadvantages of existing system are: The lack of security of the data, requires more manpower, it is more time consuming, it consumes a large volume of paperwork, it requires manual calculations, and it has no direct role for higher officials, and overall performance analysis is not easy. The proposed system overcomes these problems of the conventional method.

The deep key phrase generation helps in acquiring the main idea of text content without losing what the students have conveyed. Sentiment analysis and key phrase extraction is done using RNN (Recurrent Neural Network) algorithm. Finally, a graph is generated that gives the overall opinion of students about each faculty.

Contributions: The contributions can be:

- We introduced a feedback system to collect feedback from the students, the students can upload feedback for each teacher. The feedback can be uploaded in the form of both text and voice
- We implemented a speech-to-text conversion system that covers the feedback given in the form of a speech-to-text format.
- We propose a generative model for keyphrase extraction based on sequence to sequence learning which enables the model to successfully predict both

present and absent phrases, as well as out-of-vocabulary words; we use the yake library for keyword extraction.

- The system also predicts emotion from given feedback. The feedback is analyzed processed and emotion is predicted, whether it is a positive, negative or neutral emotion.
- We also generate a graph based on the emotions predicted. The percentage of emotions of the teacher is analyzed and then based on that value the graph is plotted.

The paper flows as: We introduce the literature survey in Section II and then justify the intuitions of our method in Section III. Next, we introduce our experiment setups in Section IV and the results are given in Section V. Finally, our findings are concluded in Section VI.

II. LITERATURE REVIEW

In this paper sentiment analysis is performed using different algorithms in different platforms, algorithms like Naive Bayes,

SVM, ANN, and RNN are analyzed. With the help of the analysis made the accuracy of the algorithms is determined and the best algorithm is chosen for the implementation of the system. Naive Bayes algorithm shows up to 80% accuracy, SVM shows up to 85% accuracy, ANN shows up to 87% and RNN shows more than 88% accuracy. RNN is used in this system as it shows more accuracy.

Sentiment analysis using the Naive Bayes algorithm is used for analyzing the positive and negative opinions in the collected data. These factors can then help e-commerce companies focus on improving service and company quality which will be associated with increased traffic, sales, and company profits. Then data collection process, data cleaning, and lexicon classification is performed. R Studio is used to process the three stages. R Studio is a software application that uses the basis of the R programming language. Here the data collected are Twitter tweets. A data crawler is used to collect the tweets. The Naive Bayes method is used here to classify the sentiment levels. There are mainly 4 steps they are collecting data, text parsing, tokenization, and text mining using the naive Bayes algorithm.

- Collecting data: In this data collection process, data tweets obtained using crawler data from Twitter are used.
- Text parsing: Parse the tweets by describing them verbatim is text parsing.
- Tokenization: Tokenization is the process of processing sentences into several words that have been separated from characters and taken into words that have value. That is cleaning the tweets and selecting meaningful words.
- Text mining: Text mining is performed by using the Naive Bayes method. We calculate the value of the class

probability by dividing the number of class data by the total or number of existing documents.

Up to 3000 data tweets are analyzed and about 80% accuracy is achieved [1].

Recognition of emotions is a problematic issue in the analysis of natural languages since a lot of data is stored. Various methods were developed and applied to recognizing emotions in multiple applications such as image, voice, video, and text. Also, emotional understanding in applications where interaction occurs between humans and machinery will increase robots' performance. However, in photographs and videos, feelings are computational, really costly, and challenging to identify. Proposes a method for emotion detection from text using hypergraph-based SVM. The HISVM displays various emotional relationships. The new scheme is introduced in the field of text emotion recognition. Here seven simple emotion categories such as anger, fear, disgust, sadness, guilt, and surprise are used for textual emotion recognition. A newly trained classifier recognizes feeling from text input by applying a learning model. Human emotion can be recognized from the text by classifying text based on some emotional classes.

For that, a dataset is prepared for each emotional class. Data Collection is found and then classify to test cases and training scenarios. Word is tokenized and text was converted to the appropriate sequence. We use the word embedding technique to classify positive and negative emotion-based words. Using this, different types of emotion can be detected. Using data types precision rate and accuracy rate on types of emotions were found. The Hypergraph-based support vector machine is used for hypergraph regularisation and to build our baseline since it's a classification-based work. That form of SVM provides the desired accuracy. [2].

Increase in access to the internet more people are joining and participating in social media services, which led to the generation of a large amount of data on social media platforms like Facebook, Youtube, Twitter, etc. This paper performs sentiment analysis for 'iPhone X' using Twitter API, Facebook API, and data collected from news websites using python as a platform. ANN is applied to the collected data using R programming and removes unwanted words, special characters, and spaces. the dataset may include the date, number of positive tweets, number of negative tweets, number of neutral tweets, and polarity. The polarity and sentiment of the tweet were recorded using the inbuilt library TextBlob. The data collected is partitioned into train and test datasets. The training data is used to train the neural network, it uses a back-propagation algorithm. And test dataset is used to determine the accuracy of the result, it uses a feed-forward neural network. After training the neural network a neural net graph was plotted and the output of all the neural net was the polarity of the input data [3] [5].

Explains the generation of deep key phrases using RNN. In

this paper, RNN encoder-decoder model is used. Here the source content is compressed to a hidden representation using an encoder and generates corresponding keywords using the decoder. A keyphrase is a short piece of text that summarizes the main semantic meaning of a longer text. High-quality keywords help to understand, organize, and accessing of document content. As a result, many studies have focused on ways of automatically extracting keyphrases from the textual content. A bidirectional GRU is used as an encoder and a forward GRU as a decoder. The attention mechanism is combined with RNN to automatically locate relevant input components. Furthermore, the coping mechanism is incorporated to help the model in finding important parts based on the positional information. RNN with a copying mechanism could predict the words that are out of vocabulary but in the source text. Thus the model can generate keywords by understanding the content of source text as real annotators, regardless of the presence or absence of a key phrase. In this paper, phrases that do not match any source text are denoted as absent keyphrases. The keyphrases that fully match a part of the text are denoted as present keyphrases. When ranking phrase candidates, these features only target to detect the importance of each word in the document with respect to the statistics of word occurrence and co-occurrence and are unable to reveal the full semantics that underlies the document content. To overcome the drawbacks of previous studies, the process of keyphrase prediction is examined again with a focus on how real human annotators would assign keyphrases. When a document is given, human annotators will firstly read the text to get a basic understanding of the content, then they try to understand its essential content and then summarize it into keywords It represents long text with representative short text chunks [4].

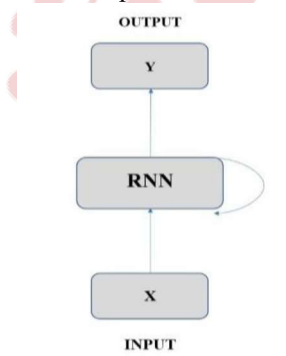


Fig. 1. RNN process

III. PROPOSED METHOD

The system helps in qualitative analysis of the feedback. It analyzes the sentiment from the feedback and detect keywords based on their nature. High quality keyphrases allow the retrieval of content when organized. The emotion detection is performed by opinion classification on the data-set using RNN. There is separate login for student,

teacher and admin. The users can log into the system using their credentials. Students can upload the feedback either in text or speech form. Speech is converted to text using API. The collected feedback is then used to generate deep key phrases and to analyze sentiment using RNN. The sentiment analysis is done into main three classes, positive, negative, and neutral.

The system has three modules, admin, teacher and student. Admin is assigned overall management of system and can view feedback about all teachers. The teacher has permission to view feedback about oneself. Students can upload feedback in the form of speech or text. Voice is then converted into text and is stored in the database. The data-set contain feedback and its analysed sentiment. The model of data-set if shown in figure:5. The emotions are classified into good, bad and average. The final result is a graphical representation of the analyzed sentiment. We propose a generative model for keyphrase extraction based on sequence to sequence learning which enables the model to successfully predict both present and absent phrases, as well as out-of-vocabulary words. The feedback is analyzed processed and emotion is predicted, whether it is a positive, negative or neutral emotion. We also generate a graph based on the emotions predicted. The percentage of emotions of the teacher is analyzed and then based on that value the graph is plotted. The deep key phrase generation helps in acquiring the main idea of text content without losing what the students have conveyed.

RNN is specialized for processing a sequence of data, $x(t) = x(1), \dots, x(t)$ with t is the time step index ranging from 1 to t . For the tasks that involve sequential inputs, such as language and speech, it is often better to use RNNs. In an NLP problem, if you want to predict the next word in a sentence we need to know the words before itself. RNNs perform the same task for every element of a sequence, with its output being dependent on the previous computations, so they are called as recurrent RNNs have a internal memory which captures information about what all has been calculated so far. RNN is a class of ANNs (Artificial Neural Network), here the connections that are between the nodes will form a directed or an undirected graph along the temporal sequence. This feature allows the exhibition of the temporal dynamic behaviour. RNN are derived from feedforward neural networks. RNN can make use of their internal memory to process variable-length sequences of inputs. This makes them applicable to tasks such as connected and unsegmented handwriting recognition or speech recognition. Recurrent neural networks are theoretically going to complete and it can also run arbitrary programs to process arbitrary sequences of inputs.

Algorithm Steps:

1. Training data set
2. Model creation using RNN

3. Feature extraction
4. Login to the system
5. Upload feedback
6. Extract deep keyphrases
7. Detect emotion
8. Graph is generated
9. End

In fig 1 it shows the proposed sytem block diagram. The system is trained using a dataset. During training a tokenised pickle file, and a model will be created. The tokenise pickle file contain the tonised dataset vectors. Using the created model prediction is performed. The model is loaded and if the values in that model is 0 the it is neutral, if 1 then negative, otherwise positive.

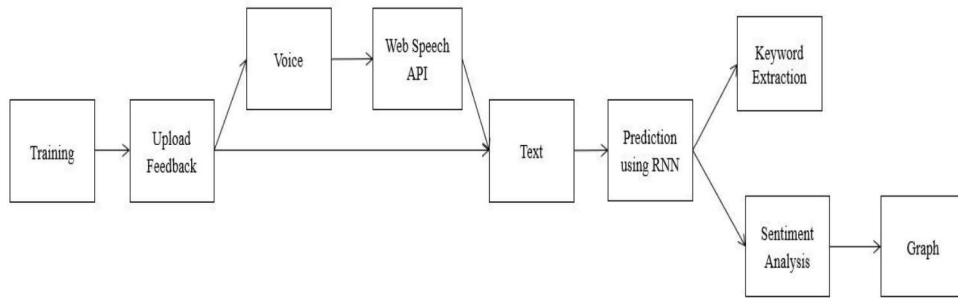


Fig. 2. Block diagram

The labels and text is collected and tokenised. The messages and labels are converted into 80% training and 20% testing. Then tokenised and then a model is created, using this model, The features are trained data is given to the mode. The tokenised data is compressed as pickle file. the data is then accessed from this pickle file. Keras library file is used for preprocessing. Then the features are extracted. The student can login to the system using their credentials and upload feedback for the respective teacher. Using RNN algorithm java the deep key-phrases are extracted and the emotion is predicted. The percentage of emotions is calculated and with respect to that the graph is plotted using json file.

There are good reasons why speech input in web applications might be beneficial for users.

- opening the field for a new input method enhances accessibility. Just like Braille Touch enables visually impaired users to type without looking, speech in- put might provide a convenient means of alternative input.
- speech is a hands-free input method.
- users have become more and more used to speech input on mobile phone applications and might demand that competing web applications have the same capabilities.

For the speech- to- word conversion, we use Web Speech API. The Web Speech API is designed for speech analysis and speech conflation. It allows web people to transfer speech input to web uses. The web operations use the Web Speech API to transfigure the speech into word.

The Web Speech supports the conversion of speech to textbook and vice versa. The Web Speech API allows people to record audio from the microphone, which is also transferred via an HTTPS POST request to the speech recognition web service. The result can also be reused within the limits of a JavaScript operation running in the Chromium surfer. The TSP Speech Database serves as a gold standard in this evaluation. It's one of the countable annotated speech recognition data sets that are available on the world wide web at no cost.

The database contains greater than 1400 utterances from 12 men and 12 women speakers. In total, there are 720 lines distributed over 72 lists of 10 line each. This list is known as the Harvard lines. The recordings were performed in an auditory anechoic room and designed to have a low noise position. Fig 4 shows the dataset. All rulings are in English, and utmost of the speakers were adult native speakers. Each line in the TSP Speech Database is independently transferred to the speech recognition web service. It appears that the web

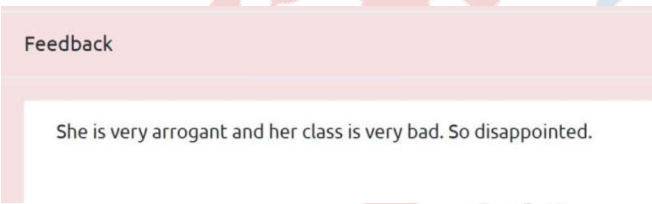


Fig. 3. Upload feedback

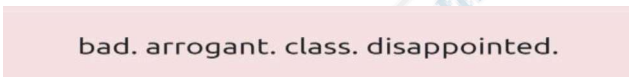


Fig. 4. extracted key words of Uploaded feedback

IV. EXPERIMENTAL SETUP

A. Speech to text conversion

For speech to text conversion, we use Web Speech API. The Web Speech API is designed for speech analysis and speech synthesis. It allows web users to send speech input to web applications. The web applications use the Web Speech API to transform the speech into text.

service accepts audio data in the FLAC format. Conversion from the surge- encoding of the dataset to the FLAC encrypting needed by the web service is loss-less, which is fortunate for evaluation. Differences in case, whitespace, and punctuation aren't taken into account.

The Web Speech API is event- grounded, which fits by well with the rather call-back-heavy style of typing code with JavaScript. The event- grounded framework allows programs to asynchronously use speech. Events are also used to report intermediate speech recognition results which are suitable because it allows programs to give nearly immediate feedback to the people.

B. Key-phrase extraction

Student uploads feedback for separate instructor. The collected feedback is analysed and keywords are taken. the

taken keyword represent a summary of the collected feedback Still, they're substantially grounded on the statistical parcels of the words and do not really take into account the semantic aspects of the full document. KeyBERT is a minimum and easy- to use keyword taking fashion that aims at working this issue. Keyphrase provides a piece of largely- condensed information that can be effectively used for understanding, organizing, and reacquiring word content. YAKE! is a lightweight unsupervised automatic keyword taking system which rests on words statistical features taken from single documents to choose the most important keywords of a sentence, which builds upon original sentence statistical features taken from single documents; i.e., it doesn't need any training corpus [13].

```
Emotion,Text
neutral, very good.
neutral,average
neutral,Although they explain all the concepts very clearly but it would be much better if they could provide some good notes as well
neutral,"teaching is good but some teachers are not able to interact properly and are not able to clear the concepts properly, teachers are punctual.
"
neutral,teacher are punctual but they should also give us the some practical knowledge other than theoretical
neutral,"University teaching here is very much dependent upon slides,though it is a easy way of teaching but still leaving some concepts unclear..otherwise interaction wi
neutral,"The university is good but it also has a long way to go. More teachers should have their PhD and college fests related to academic curriculum must be improved to
neutral,Some are good and some are not
neutral,teaching delivery is good .but it is better to reduce there speed of lecture delivery to understand the student better
neutral,Very good teaching and management but too much load on student and working hours
neutral,interaction of some faculty was good but not all faculty..
neutral,"some lectures are excellent,but not everyone"
neutral,not all the teachers are teaching well but it's fine
neutral,"everything was good regarding to university but, some lecturers don't have grip on the subject and lag in the teaching"
neutral,normal
neutral,good but not good . sir improve the subject
neutral,"teaching is ok but the interaction with the students need to improve, i mean they have to focus on dull students more than intelligents...."
neutral,teaching is good but some lecturers are showing partiality between south people and north people
neutral,lecture delivery and punctuality was good but the interaction with students was not good.
neutral,teaching is good some lecturers are showing partiality between south people and north people
neutral,"excellent, but reduce the speed of teaching ,up to understand the students"
neutral,university management is extordinary but some of the faculty is very bad
neutral,"In terms of knowledge of subject, content delivery, creating interest for the subject, it is good but no supplementary material and no revision notes our provide
neutral,Some Teachers are really informative and supportive but none of them complete their syllabus on time due to which we have to suffer at the end
neutral,punctuality and lecture is good here but interaction isn't good.
neutral,its booring
neutral,I WAS A STUDENT OF A BOARDING SCHOOL .....(jnv) I STUDIED FOR 7 YEARS THERE RESIDING IN HOSTEL ..NOW LIVING IN LPU IS SAME LIKE THAT..AND STILL MORE SAME AND PUN
neutral,Teaching level is average
neutral,The teachers are very good but level of teaching can be still improved by using good resources
```

Fig. 5. Data-set

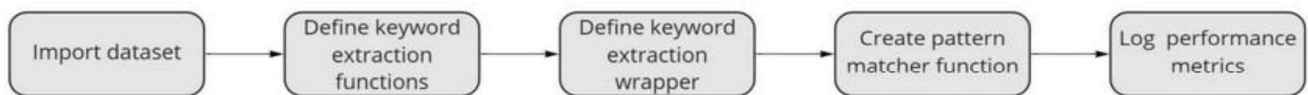


Fig. 6. Steps in keyword extraction

The input document is embed using a pre-trained BERT model. Keywords and expressions (n- grams) are retrieved from the same document. Each keyword is also put together into a fixed- size vector with the same model used to embed the document. The steps in keyword extraction is shown in fig 6.

In fig 3 the feedback uploaded is shown and fig 4 shows the extracted keywords. The very first import the dataset that has the collected textual data. We 'll also produce separate

functions that apply the retrieval reason. further we 'll produce a function that applies the retrieval on the entire corpus. Spacy will also help us define a matcher object that will return true or false if a keyword matches a syntactic pattern that makes sense for our task. Eventually we 'll pack up everything in a function that produce our final report. Each extractor takes in as an argument the line from which we want to retrieve keywords and returns a list of keywords, from the suitable to the worse according to their importing fashion.

C. Emotion detection

The system predicts emotion from given feedback using RNN algorithm. For accurate prediction, the dataset used here is developed by collecting feedback and its emotion from students of different schools and colleges. On training the dataset, a pickle file is generated. This enables to make new predictions at a later time, without having to train the model again. Pickling converts python object structure into a byte stream. The feedback is analyzed processed and emotion is predicted, whether it is a positive, negative or neutral emotion [7] [8].

V. RESULT

The system predicts the emotions after analysing the feedback and the keywords are extracted.

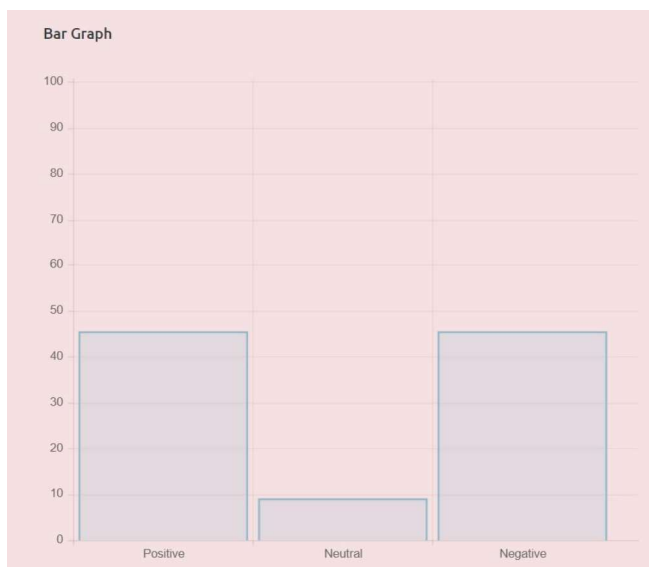


Fig. 7. Graph generated

There is about 90% accuracy in the system. With the rate of predicted emotions graph is plotted. Fig 6 shows how the graph is viewed for admin and teacher, where 60% of predicted emotion is positive and 40% of emotion predicted is negative[9].

VI. CONCLUSION

This paper uses a supervised learning technique, opinion mining to detect the emotion of the student. This student feedback system collects feedback from the students. Sentiment analysis is performed on the collected feedback to detect the emotion of the student. The generated emotions are plotted into a graph in which it is possible to understand the overall rating of the performance of a particular teacher. This strategy will be useful to analyze which teaching method can be the most beneficial for students, which in turn helps improve their achievements in learning. Automating the

student's feedback may give several advantages together with saving price, time, and creating economic report generation, etc. The utilization of opinion mining will facilitate summarizing the feedback report effectively and evaluating performance.

This system can be implemented in any sector due to its wide range scope. In the future, this system can be designed in such a way that not only the English language but other native languages can also be used. Also, the input speech can be directly used for sentiment analysis which is faster and more precise[10]. This will help in understanding the emotion from the depth, tone, phonetics, etc of speech.

VII. ACKNOWLEDGEMENT

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Efficiency of Neem Leaf Powder and Banana Pith Powder as a Natural Coagulant

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ABSTRACT

It is necessary to treat the water before use in households because of poor wastewater collection systems contaminates the surface water and poorly managed urban runoff. The essential treatment process of drinking water and wastewater are coagulation and flocculation. Banana pith powder can remove wide variety of contaminants and Neem is one of the flexible trees and it helps in treatment of waste water. The cultivation of neem trees is extremely encouraged in most emerging countries. Protein present in this tropical tree performs as an effective coagulant. Use of chemical coagulants for Treatment of wastewater costs excessive, hence nearly all village inhabitants go for supplies usually which is of minimal quality and disclosing them to waterborne infections. This study objective is to determine the ability of two coagulants which are *Azadirachta Indica* leaf powder (Neem leaf powder) and *Musa paradisiaca* pith powder (Banana pith powder) as a natural coagulant by checking certain parameters such as PH, turbidity, hardness, conductivity, TSS, DO, BOD and jar test is conducted. These experiments were conducted without adding and addition of these coagulants with different dosage for treating canteen waste water and river water. Canteen waste water is collected from our college canteen (KMCT College of engineering for women, Kozhikode) and Kallai river water which is contaminated by industrial effluents is taken as samples for treating. This project shows natural and environment friendly solution for waste water treatment.

Index Terms— Canteen waste water, Kallai river water, Natural coagulant, *Azadirachta Indica*, *Musa paradisiaca*, TSS, BOD, DO, PH, Turbidity, Hardness, Conductivity.

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I. INTRODUCTION

Water is usually used for variety of purposes like drinking, washing, bathing, recreation as well as numerous other varied industrial applications. According to World Health Organization (WHO) reports, wholesomeness of water means absence of suspended solids, inorganic solids and pathogens. Even though 71% of earth surface is covered by water, only less than 0.3% of all fresh water is in river, lakes and the atmosphere, and an even small amount of earth fresh water contained within manufactured products and biological bodies. Now a days due to poor land use management, drinking water has become scant. Most of the Surface water is being polluted by industrial water discharge, sewage, and run off from the land, while ground water is polluted by waste dumping site and salt water intrusion. Health issues like gastrointestinal illness, reproductive problems caused by presence of certain contaminants in water and immune compromise person may be especially at risk for becoming ill after drinking contaminated water. So this contaminated water must be treatment process before it can be circulated to the consumers for domestic use, including drinking. One of the most simple and essential effective process that can be adopted for waste water treatment is coagulation. From the olden days onwards use of seeds, leave roots, barks, fruit peels, and vegetable peels obtained from the plants are used in purification method. Natural coagulants reveal various benefits which comprise a reduction in collection of sludge, reduced cost, non-poisonous, ecosystem friendly etc.

This project is aimed to evaluate efficiency of natural coagulants such as *Azadirachta Indica* leaf powder (Neem leaf powder) and *Musa paradisiaca* pith powder (Banana pith powder) by treating two different samples such as canteen waste water and kallai river water.

II. OBJECTIVE

- To examine the efficiency of banana pith powder and neem powder as a hypothetical coagulant to treat waste water from canteen and kallai river, with different dosages of coagulant
- Conventional jar test procedure performed
- To compare effectiveness of coagulants in three different samples

III. METHODOLOGY

3.1 Sample Collection

In this project canteen waste water and Kallai River water is used to analyze the efficiency of natural coagulants. Canteen waste water was collected from canteen outlet of KMCT College of Engineering for Women and Kallai River water collected from kadupini mankavu.

3.2 Coagulant Preparation

3.2.1 Preparation of Azadirachta Indica leaf powder

Neem leaves collected and washed with water to remove dust and pulp. Clean leaves dried in sunlight for a period of seven days before crushing. By using common home grinder the leaves were made into fine powder. Powder of 500 g collected in sterile bottle with airtight cap.



Fig-1: Azadirachta Indica leaf powder

3.2.2 Preparation of Musa paradisiaca pith powder

Banana pith collected from the local fruit market at Kozhikode. Kept in sunlight for 2 weeks, and dried pith is collected. This banana pith was made into fine powder by using common home grinder. Powder of 500 g is collected in sterile bottle with airtight cap.



Fig-2: Musa Paradisiaca pith powder

3.3 Treatment Technique

3.3.1 Coagulation flocculation by jar test

Two separate experiments are performed: first, Neem leaf powder as coagulant, second, Banana pith powder as coagulant. The jar test apparatus is used for finding optimum dosage of coagulants and study the effect of coagulant dosage on coagulation. Various parameters such as turbidity, conductivity, TSS, pH, Chloride, Hardness, DO, BOD were measured before and after the coagulation.

Five different dosage of the coagulants were placed in each beaker, the first having 5g, and the remaining five varying from 5-35 g at 5g interval in order to determine the optimum dosage. Five jars were filled with 1000ml of waste water sample and the jars were then placed in the jar test apparatus and the stirrers lowered into each. The stirring speed was set at 100rpm for rapid mixing for 1 minute and 40rpm for slow mixing for 20 minutes. After completing jar test, these samples were allowed to settle for 30 minutes and then the supernatant was taken for analysis. From the results obtained, the dosage of coagulant with best results in removal of turbidity of waste water is taken as optimum.

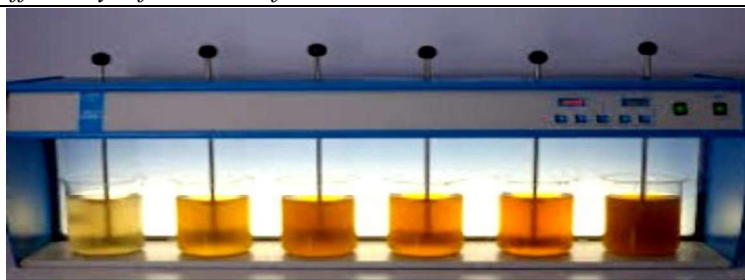


Fig-3: Jar Test

IV. RESULT AND DISCUSSION

This section deals with the various test results and its discussion of coagulation-flocculation in waste water treatment using natural coagulants (neem leaf powder and banana pith powder) in different samples of different sources such as canteen waste water and kallai river water .

4.1 Results of Canteen Waste Water Treatment by Using Neem Leaf Powder and Banana Pith Powder

Table-1: Characteristics of canteen waste water before treatment

Parameters	Before treatment		
	Sample 1	Sample 2	Sample 3
pH	4.16	5.61	5.84
Turbidity(NTU)	80	60	110
Conductivity(mmhos/cm)	4.720	5.28	5.54
Hardness(ppm)	33	23.5	26
TSS (mg/l)	1400	2200	1200
Chloride	Ab	Ab	Ab

Table -2: Effect of coagulant dosage

Sample	Coagulant	Parameters	After treatment						
			5g	10g	15g	20g	25g	30g	35g
1	neem	pH	5.29	5.58	5.40	5.35	5.41	-	-
		Turbidity(NTU)	47	33	43	58	57	-	-
		Conductivity(mmhos/cm)	2.510	1.145	1.603	1.900	2.218	-	-
		Hardness (ppm)	20	8	15	23	32.5	-	-
		TSS(mg/l)	200	100	400	600	800	-	-
		Chloride	Ab	Ab	Ab	Ab	Ab	-	-
	Banana pith	pH	4.42	4.12	4.33	4.50	4.58	-	-
		Turbidity(NTU)	32	28	16	9	7	-	-
		Conductivity(mmhos/cm)	4.02	3.26	2.35	1.80	1.53	-	-
		Hardness(ppm)	25.3	18.2	8.35	6.3	3	-	-
		TSS(mg/l)	600	800	600	400	200	-	-
		Chloride	Ab	Ab	Ab	Ab	Ab	-	-
2	Neem	pH	6.37	6.43	6.22	5.89	5.87	-	-
		Turbidity(NTU)	14	13	17	21	31	-	-
		Conductivity(mmhos/cm)	4.3	1.531	2.28	2.63	3.72	-	-
		Hardness(ppm)	8.7	4	18.5	22	23	-	-
		TSS(mg/l)	800	400	600	1000	1400	-	-
		Chloride	Ab	Ab	Ab	Ab	Ab	-	-
	Banana Pith	pH	5.72	5.64	5.83	5.96	6.12	-	-

Efficiency Of Neem Leaf Powder And Banana Pith Powder As A Natural Coagulant

3		Turbidity(NTU)	23	18	10	8	7	-	-
		Conductivity(mmhos/cm)	4.65	3.95	4.03	3.26	2.77	-	-
		Hardness(ppm)	22.3	20.65	15.7	9.7	5.6	-	-
		TSS(mg/l)	800	400	600	400	200	-	-
		Chloride	Ab	Ab	Ab	Ab	Ab	-	-
	Neem	pH	5.95	6.36	6.28	5.93	5.89	-	-
		Turbidity(NTU)	46	35	38	49	51	-	-
		Conductivity(mmhos/cm)	3.142	1.986	2.320	2.62	2.843	-	-
		Hardness(ppm)	13.5	8	16.5	20.83	23	-	-
		TSS(mg/l)	600	200	600	400	800	-	-
		Chloride	Ab	Ab	Ab	Ab	Ab	-	-
	Banana Pith	pH	-	-	6.12	6.26	6.30	6.	6.30
		Turbidity(NTU)	-	-	28	26	18	22	26
		Conductivity(mmhos/cm)	-	-	4.23	3.16	2.47	3.03	3.102
		Hardness(ppm)	-	-	16.5	10.17	5.98	8.1	9.20
TSS(mg/l)		-	-	600	400	200	600	800	
Chloride		-	-	Ab	Ab	Ab	Ab	Ab	

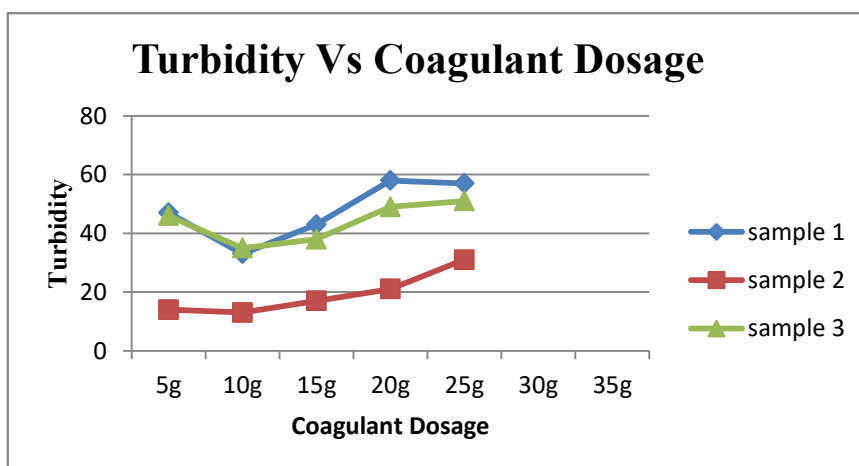


Fig 4: Turbidity Vs Coagulant dosage (Neem leaf powder) graph of canteen waste water

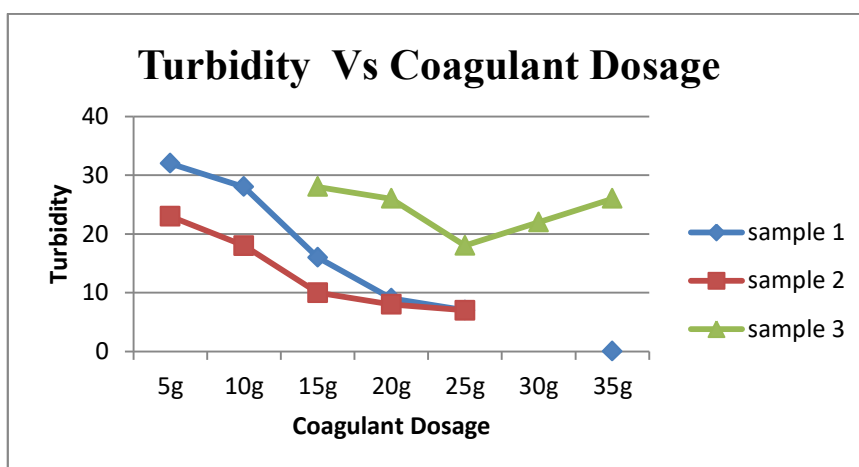


Fig 5: Turbidity Vs Coagulant dosage (Banana pith powder) graph of canteen waste water

Three samples of canteen waste water is collected and tested. Optimum dosage of neem leaf powder is obtained as 10g and optimum dosage of banana pith powder is 25g.

4.2 Results of Kallai River Water Treatment by Using Neam Leaf Powder and Banana Pith Powder

Table-3: Characteristics of river water before treatment

Parameters	Before treatment		
	Sample 1	Sample 2	Sample 3
Turbidity(NTU)	20	22	24
Conductivity(mmhos/cm)	23.2	25.8	25.90
Hardness(ppm)	Ab	Ab	Ab
TSS(mg/l)	1600	1400	1200
Chloride	Ab	Ab	Ab
DO	8.3	7.9	8.9
BOD	1.89	1.85	1.88

Table -4: Effect of coagulant dosage

Sample	Coagulant	Parameters	After Treatment						
			5g	10g	15g	20g	25g	30g	35g
1	Neem	Turbidity(NTU)	18	10	12	14	15		
		Conductivity(mmhos/cm)	23	21.5	21.9	22.2	22.4	-	-
		Hardness(ppm)	Ab	Ab	Ab	Ab	Ab	-	-
		TSS(mg/l)	800	200	400	600	800	-	-
		Chloride	Ab	Ab	Ab	Ab	Ab	-	-
		DO	9.6	10.8	9.4	9.1	8.7		
	Banana pith	Turbidity(NTU)	16	15	13	10	8	-	-
		Conductivity(mmhos/cm)	23	22.8	22.9	22.9	22.5	-	-
		Hardness(ppm)	Ab	Ab	Ab	Ab	Ab	-	-
		TSS(mg/l)	800	400	400	200	100	-	-
		Chloride	Ab	Ab	Ab	Ab	Ab	-	-
		DO	8.5	8.9	9.2	9.8	10.6		
2	Neem	Turbidity(NTU)	19	9	14	16	17	-	-
		Conductivity(mmhos/cm)	23.5	21.3	21.9	22.6	23.1	-	-
		Hardness(ppm)	Ab	Ab	Ab	Ab	Ab	-	-
		TSS(mg/l)	600	200	400	600	800	-	-
		Chloride	Ab	Ab	Ab	Ab	Ab	-	-
		DO	8.4	8.8	6.9	6.6	6.2	-	-
	Banana Pith	Turbidity(NTU)	20	17	15	9	12		
		Conductivity(mmhos/cm)	23.8	23.1	22.7	21.3	21.6		
		Hardness(ppm)	Ab	Ab	Ab	Ab	Ab		
		TSS(mg/l)	1000	800	600	200	400		
		Chloride	Ab	Ab	Ab	Ab	Ab		
		DO	8	8.2	8.5	10.3	9.5		
3	Neem	Turbidity(NTU)	17	9	12	14	14	-	-
		Conductivity(mmhos/cm)	22.30	20.32	21.03	23.60	23.15	-	-
		Hardness(ppm)	Ab	Ab	Ab	Ab	Ab	-	-

Efficiency Of Neem Leaf Powder And Banana Pith Powder As A Natural Coagulant

		TSS(mg/l)	600	200	400	1000	1200	-	-
		Chloride	Ab	Ab	Ab	Ab	Ab	-	-
		DO	9.3	10.2	9.5	9.3	8.6	-	-
Banana Pith		Turbidity(NTU)	-	-	15	9	13	11	12
		Conductivity(mmhos/cm)	-	-	22.4	21.8	21.9	21.96	21.98
		Hardness(ppm)	-	-	Ab	Ab	Ab	Ab	Ab
		TSS(mg/l)	-	-	600	400	600	200	200
		Chloride	-	-	Ab	Ab	Ab	Ab	Ab
		DO	-	-	9.2	10.55	9.72	9.2	8.5

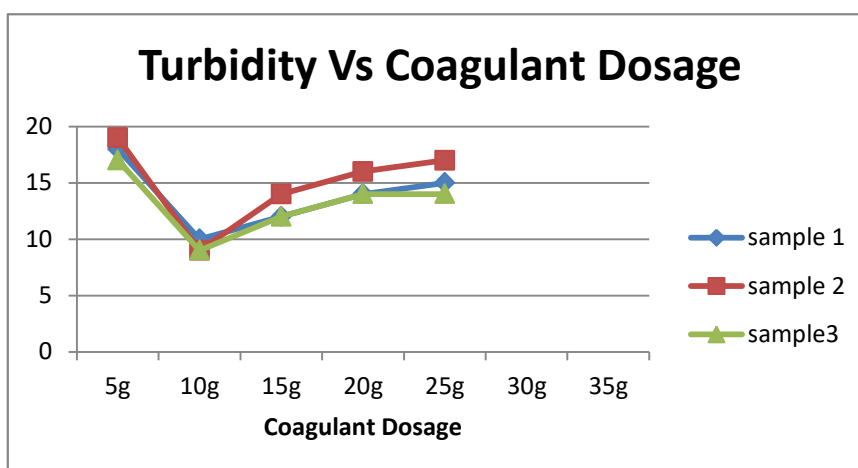


Fig 6: Turbidity Vs Coagulant dosage (Neem leaf powder) graph of Kallai River Water

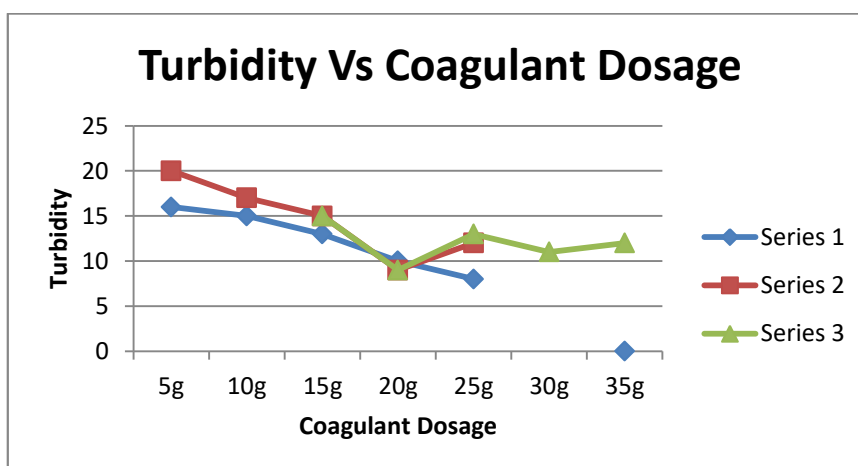


Fig 7: Turbidity Vs Coagulant dosage (Banana pith powder) graph of Kallai River Water

Three samples of Kallai River water was collected and tested. Optimum dosage of neem leaf powder for all three samples is 10g and optimum dosage of Banana pith powder for sample 1 is 25g and for sample 2 and 3 it is 20g .Hence optimum dosage of banana pith powder is taken as 20g.

V. CONCLUSIONS

A study of waste water treatment by using natural coagulants such as neem leaf powder and banana pith powder. Optimum dosage of neem leaf powder as a natural coagulant in treatment of canteen waste water and River Water is 10g and optimum dosage of banana pith powder as a natural coagulant in treatment of canteen waste water is 25g and River water is 20 g by removal of turbidity,pH,conductivity,hardness,TSS,Chloride,DO .

For canteen waste water, removal efficiency of turbidity is 58.75, 68.18, and 78.33 for three different samples by using neem leaf powder as natural coagulant and removal efficiency of 91.25, 83.63and88.33 by

using banana pith powder as a natural coagulant. According to the results obtained, for canteen waste water Banana pith powder is more efficient in reduction of various parameters of canteen waste water.

For Kallai river water ,removal efficiency of turbidity is 50,59.1and 62.5 three different samples by using neem leaf powder and removal efficiency of 60,59.09 and 62.5 by using banana pith powder as a natural coagulant .According to the result obtained ,for kallai river water both neem powder and banana pith powder is equally efficient in reduction of various parameters.

From the above results banana pith powder is more efficient as a natural coagulant for treatment of canteen waste water and kallai river water

Natural coagulants are also used in treatment of various other wastewaters such as tannery waste water, dairy waste water, textile waste water treatment etc. The use of these natural coagulants which are locally available was found to be environment friendly, more cost effective and safe method of treating waste water.

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Replacement of Coarse Aggregate in Geopolymer Concrete by using Demolished Waste

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ABSTRACT

The increase in the amount of CO₂ which is being released into the atmosphere due to the continuous production of cement in the construction industry is intensifying the problem of global warming which has an adverse effect on the environment. Therefore, the necessity of finding a more sustainable approach other than the existing admixtures used to replace conventional concrete has become highly exigent. That leads to the investigations on geopolymer concrete (GeoPC), which exhibit high strength and similar or better durability when compared to conventional concrete. GeoPC is a relatively new sustainable engineering concrete and it has the advantage of cement replacement with supplementary cementitious materials which are combined with alkali-activated solutions. Geopolymer concrete is also known as green concrete or cementless concrete which is produced by 100% replacement of cement with the waste materials obtained from the various industries. It is an innovative construction material that shall be produced by the chemical action of inorganic molecules such as fly ash, alccofine, and alkaline activators which are sodium hydroxide and sodium silicate. It is the complete replacement of cement in the concrete. It can be used as the best substitute for ordinary Portland cement (OPC). In this project, we are replacing the coarse aggregate used in geopolymer concrete with demolished concrete waste. For checking the efficiency of this concrete we have to do various tests like compressive strength test, split tensile test, flexural strength, slump test, etc. The demolished concrete can be used after crushing, sieving and cleaning.

Keywords-- Alccofine, Demolished Waste, Fly Ash, Geopolymer Concrete

INTRODUCTION

Concrete is globally used as the second most consumed construction material in the world due to its versatile mechanical properties which make it. Environmental hazards related to cement manufacturing are overcoming their benefits. The investigation and the studies show that geopolymer concrete is a suitable substitute for Portland cement concrete. It is produced by the complete replacement of cement with the waste products obtained from the various construction industries. The name geopolymer was first proposed by a French researcher, Joseph Davidovits in the 1970s. Cement-based materials like concrete are the major building material used for the construction of various infrastructures all over the world. The production of cement results in the generation of a high amount of CO₂ and other GHGs responsible for global warming which adversely affects the environment. To reduce the deleterious effects associated with the production and use of concrete, sustainable alternatives such as various waste materials obtained from various industries can be utilized in the production of cement. Thus, the use of such wastes results in a significant reduction in the GHGs emission, cost, and consumption of natural raw materials associated with cement. Geopolymer concrete is the result of 100 % replacement of cement in concrete with suitable alternatives. We are using fly ash-based geopolymer concrete with alccofine as a strength enhancer. Alccofine is a new generation microfine material used for high strength which is important regarding workability and particle size much finer than cement, fly ash, silica, etc. Here the cement content is partially replaced by alccofine. And the superplasticizers used here are sodium silicate and sodium hydroxide solution [1].

Nowadays, cost reduction and energy

savings are important concepts in the construction industry. And the cost of geopolymer concrete may be lower or higher compared to OPC concrete. Our project is to replace the coarse aggregate in the Geopolymer concrete with demolished aggregate waste specimens prepared as cubes and cylinders. Thus we can reduce the waste materials and hence reduce the cost [2]. Some tests are carried out to determine the strength of prepared concrete. The tests include compression strength tests, flexural strength tests, and split tensile strength tests also conducted as slump tests.

The materials used are fly ash, alccofine, fine aggregate, coarse aggregate and alkaline activators such as sodium hydroxide and sodium silicate. Fly ash plays the role of an artificial pozzolan as a cement replacement. Based on the chemical composition fly ash is classified as either Class C or Class F. Fine aggregates according to IS 383 -1970 a specific gravity of 2.32 and Water absorption of 1.5%. Fine aggregates can be passed through a sieve size of 4.75mm and retained in 75micron. We use natural coarse aggregate and demolished waste aggregate for a partial replacement. The natural coarse aggregate was taken from a locally available crusher and demolished aggregate was also collected from locally available demolished waste. The specific gravity of coarse aggregate is 2.6 and Water absorption is 0.8%. A maximum size of 20 mm metal is used. Alccofine 1203 is a mineral admixture produced by Ambuja Cement Ltd which is highly reactive, consists of high glass content as slag, and is obtained through the process of controlled granulation (ACL 2014) having a specific surface area of more than 12000 cm²/gm. In the present work Na₂SiO₃ and NaOH is used as alkaline activator for geopolymerization reaction. Sodium hydroxide is available in the form of pellets with 99% purity. The morality of NaOH was taken 8M. Compared to the use of only alkaline hydroxides, either sodium or potassium silicate is used, here we use Na₂SiO₃. The addition of sodium silicate solution to the sodium hydroxide solution as the alkaline activator enhances the reaction between the source material and the solution [3].

MATERIALS

1. Fly Ash

2. Fine Aggregate
3. Coarse Aggregate
4. Alccofine
5. Alkaline Activators

Fly Ash

Fly ash is produced by burning pulverized coal in electric generation power plants and steam generating plants. Fly ash is normally finer than lime and Portland cement as shown in Fig. 1 (Table 1).

Table 1: Composition of fly ash.

S.No.	FLY ASH COMPOUNDS	VALUES (%)
1.	Silicon dioxide (SiO ₂)	60.83
2.	Aluminum Oxide (Al ₂ O ₃)	26.63
3.	Iron Oxide (Fe ₂ O ₃)	4.19
4.	Magnesium Oxide (MgO)	0.80
5.	Calcium Oxide (CaO)	3.03
6.	Potassium Oxide (K ₂ O)	0.90



Figure 1: Flyash.

Fine Aggregate

M Sand is used as fine aggregate in this project. According to IS 383:1970 aggregates pass through IS sieve 4.75-mm and retain on 75µ sieve. They are locally available. The physical properties of aggregates are shown in Table 2 and Fig. 2.



Figure 2: Fine aggregate

Table 2: Physical properties of aggregate.

PHYSICAL PROPERTY	FINE AGGREGATE	COARSE AGGREGATE
Specific gravity	2.32	2.60
Fineness modulus	2.92	7.10
Water absorption	1.5%	0.8%

Coarse Aggregate

Here we use natural coarse aggregate and demolished waste aggregate for a partial replacement. The natural coarse aggregate was taken from a locally available crusher and demolished aggregate was also collected from

locally available demolished waste. The specific gravity of coarse aggregate is 2.6 and Water absorption is 0.8%. Maximum size of 20 mm, and 6 mm size metal is used. And the coarse aggregate is usable after sieve analysis [4]. The aggregates used for testing should be oven-dried as shown in Fig. 3 and 4.



Figure 3: Natural aggregate.



Figure 4: Demolished aggregate.

Alccofine

Alccofine consists of high glass content as slag and is obtained through the process of controlled granulation (ACL 2014) having a specific surface area of more than

12000cm²/gm. Alccofine helps in reducing the permeability of concrete since it is a super-pozzolanic material and thus, reduces the water content and eventually increases the compressive strength of concrete. Alccofine 1203 is used (Fig. 5).



Figure 5: Alccofine.

Alkaline Activators

Alkaline activators are performed by the mixture of sodium hydroxide and sodium silicate solutions. Sodium silicates are colourless crystalline solids or white powders which readily soluble in water and form alkaline solutions. And it is a binding agent in cemented products. Sodium hydroxide is also a white crystalline

solid that readily absorbs moisture until it dissolves. The molarity of NaOH was taken 8M. The heat evolved at the mixing of sodium hydroxide since it is an exothermic reaction. The mixing of NaOH is done one day earlier than casting to cool down the solution [5]. The higher concentration of NaOH yields higher compressive strength of geopolymer concrete (Fig. 6).



Figure 6: Alkaline Activators.

TEST ON RAW MATERIALS Specific Gravity

The specific gravity of aggregates is the indication of strength. The test is done to measure the quality or strength of the materials. It ranges from 2.5 to 3. Materials which having higher specific gravity have higher strength. Here we should test the specific gravity of fine aggregate, coarse aggregate, fly ash and alccofine

Grain Size Analysis

Grain size analysis is done to determine

the particle size distribution, fineness modulus, uniformity coefficient, etc. of aggregates. The maximum size of fine aggregate is limited to 4.75 mm gauge. And above 4.75 mm it is known as coarse aggregate. Should find the grain size analysis for the fine aggregate and coarse aggregate by sieve analysis apparatus.

Aggregate Crushing Value

It provides the resistance of an aggregate to crushing under a gradually applied compressive load. It is the percentage by weight of crushed material under the specified load. Here we have to measure the aggregate crushing

value for both natural aggregate and demolished waste aggregate.

MIX DESIGN

There is no codal provision for the mix design of geopolymer concrete according to Indian Standards. Therefore we use a mix design of geopolymer concrete as equivalent to M30. As per the proportions these materials are mixed into 2 methods one is GPC with normal aggregate and another one is GPC with replaced aggregate by demolished waste. These mixes are cast into the required specimen. After the curing

period, this specimen is tested.

METHODOLOGY

We are using fly ash-based geopolymer concrete with alccofine as a strength enhancer. The geopolymer concrete is formed by the reaction of silicon and aluminum oxides in the low-calcium fly ash with the alkaline liquid and that forms a paste that binds the loose coarse aggregates. The coarse aggregate and fine aggregates occupy nearly 75% to 80% of the mass of geopolymer concrete.



CONCLUSION

If the strength of GPC with demolished waste by replacing coarse aggregate is in an acceptable range as that of the strength of normal GPC, It will reduce the concrete waste and other waste materials in the construction industry (Since we use fly ash like inert materials). And also reduce the emission of CO₂ during the production of cement in the construction industry. And also helps in the conservation of natural resources and reduces the cost of construction. Thus the concrete becomes environmentally friendly. Geopolymer concrete is more resistant to fire and corrosion and it gains full strength quickly.

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Electrocoagulation of Car Wash Water Using Various Electrode Materials

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ABSTRACT

To reduce the polluted water from car wash service centres electrocoagulation process is introduced in order to treat the car wash water for reuse. This paper includes a study to determine the efficiency of 2 different electrode combinations that is Al-steel and Fe-steel electrode and also to determine the effectiveness at various voltage ranges that is, at 10v, 20V and 30V. car wash Sample is collected from a car wash service centre located at Calicut. A sample of 800 cubic centimetres are taken in the electrolytic cell and provide a treatment time of 1hr at different electrode combination and at different voltages. Different parameters like pH, turbidity, BOD, DO and TSS was considered to evaluate the treatment efficiencies. From the study, the result indicates that al-steel electrode is the best combination at 30V. The removal efficiency of pH, turbidity and TSS were 92.39%, 90.50%, and 89.32% respectively with al-steel combination.

Keywords- Carwash water, Cubic, Electrocoagulation, Electrodes, Voltmeter

INTRODUCTION

Electrocoagulation is an advanced wastewater treatment method. Wastewater includes water from major industries including steel and iron industry, fertilizer industries, automobile industry, battery manufacturing industries, food industry, electric power plants, mines etc. Wastewater generated from car wash stations leads to the majority of environmental contamination because of the chemical characteristics present in the car wash water [1].

From different studies conducted by many scholars and researchers. It is found that

electrocoagulation method is much more efficient than any other is. The main advantage of electrocoagulation is that electric current is directly applied to treat and flocculate contaminants without adding coagulants. Coagulating metal ions are introduced electrolytically from the sacrificial electrodes in a technique. Due to the increase in the population use of car and vehicles has being increased its usage cannot be decreased; the water used for the wash can be treated, recycled and reused. This paper compares the effectiveness of treatment of car wash water with the usage of various electrodes at different voltage range. The main objective of the study is to treat the wastewater and to achieve the maximum removal of pH, turbidity, TSS, DO and BOD.

METHODOLOGY

Materials Used

An electrolytic reactor was used in the study is a beaker cell type. A glass container of capacity 1L was used, to hold 800ml of water. Electrodes used are aluminium, iron and steel having dimension of 10*2.5*3cm. A plastic lid is provided. The electrodes are arranged in monopolar configuration. Voltmeter is provided to adjust the voltage range and Wires are provided to connect electrodes with voltmeter.

Equipment's Used

For electrocoagulation process, DC power supply is used to provide sufficient voltage. pH meter is used to determine the Initial and final pH of the solution. Initial and final value of turbidity is determined using nephelometer. BOD bottles and a BOD incubator were used to ascertain BOD during the testing of samples.

Experimental Setup

The electrocoagulation process (Fig. 1) was done in a glass beaker of capacity 1L. There is 2-electrode combination of same dimension (10x2.5x3cm) that is aluminium-steel electrode

and iron-steel electrode and the inter-cellular space between the two electrodes are 1.5cm. The electrodes are arranged in Monopolar configuration. NaCl was used as the electrolyte. Sufficient voltage is provided by using voltmeter [2].



Figure 1: Experimental setup of our study.

Procedure

First, for the process of electrocoagulation for the treatment of wastewater, the electrodes are placed vertically in the reactor and in the reactor; wastewater of 800 ml is taken after removing the coarse substances. The initial parameters are analysed before the treatment. There are two set of electrodes of same dimension (10x2x3cm) are used and the combination taken is of aluminium-steel and iron-steel. To the voltmeter electrodes are connected as shown in the fig 1 the voltage was adjusted to desired value. The spacing between the electrodes was 1.5cm. At the various voltages range that is at 10v, 20v and at 30v each sample was treated for both the combination that is

aluminium-steel and iron-steel respectively. After the treatment of 1 hour, the treated water is allowed to settle for an hour. Before and after the electrocoagulation process parameters are analysed. At the end of each run, electrodes were thoroughly washed with water to remove any solid residues on the surfaces [3-5].

RESULT AND ANALYSIS

The result and analysis of electrocoagulation of car wash water-using Aluminium – Steel and Iron – Steel electrodes at different voltages are as follows.

Initial raw characteristics are shown in the Table 1.

Table 1: Initial characteristics of raw water.

Parameters	Al-steel	Fe-steel
pH	5.39	5.20
Turbidity	317	450
TSS	800	650
DO	1.9	3.6
BOD	210	324

Effect of pH Analysis

Change in pH at 10V, 20V, 30V in 1-hour treatment time is shown below (Table 2).

Table 2: pH analysis.

	Aluminium-steel	Iron-steel
10 V	6.11	5.82
20V	6.49	5.90
30V	7.02	5.98

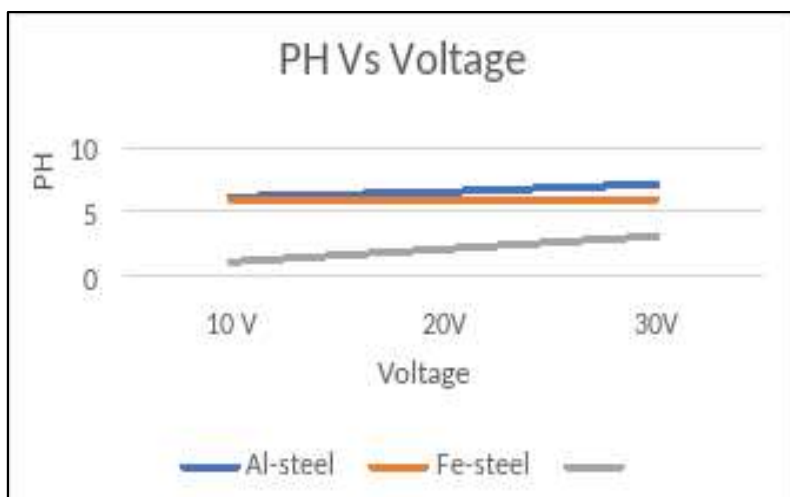


Figure 2: pH Vs voltage graph.

The initial pH of wastewater was around 5 (acidic region). Nevertheless, after treatment the pH can be brought to a value around 7 due to the formation of hydroxyl ions. At 30v, al-steel combination gives the best result (Fig. 2).

Turbidity

Change in Turbidity at 10V, 20V, 30V in 1-hour treatment time is shown below (Table 3).

Table 3: Turbidity analysis.

	Aluminium-steel	Iron-steel
10 V	290	300
20V	178	272
30V	72	170

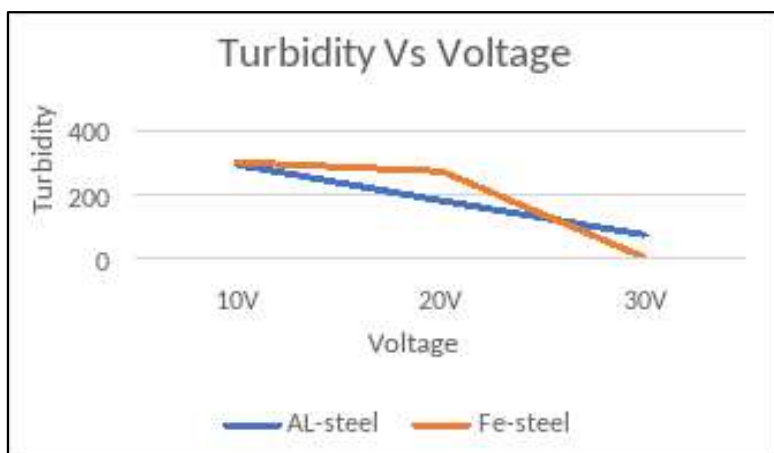


Figure 3: Turbidity vs voltage graph.

Initially, there is a high turbidity value but after the electrocoagulation process, the turbidity value is rapidly decreasing. Better result is obtained at 30v for al-steel electrode (Fig. 3).

Total Suspended Solids (TSS)

Change in TSS at 10V, 20V, 30V in 1-hour treatment time is shown below (Table 4).

Table 4: TSS analysis.

	Aluminium-steel	Iron-steel
10 V	400	610
20V	200	500
30V	180	520

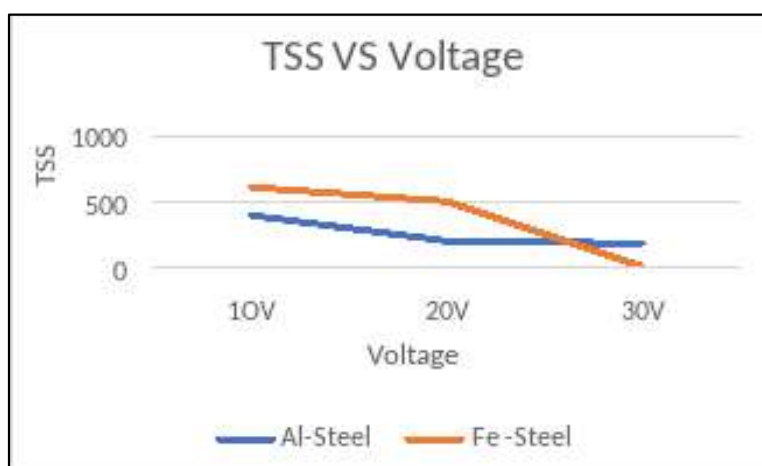


Figure 4: TSS vs voltage graph.

At initial stage, there is high TSS value after a treatment time of 1 hour a gradual change in TSS is obtained. A Good result is obtained at 30v for al-steel electrode combination (Fig. 4).

Dissolved Oxygen (DO)

Change in DO at 10V, 20V, 30V in 1-hour treatment time is shown below (Table 5).

Table 5: DO analysis.

	Aluminium-steel	Iron-steel
10 V	3.1	3.6
20V	4.1	3.8
30V	4.6	4.0

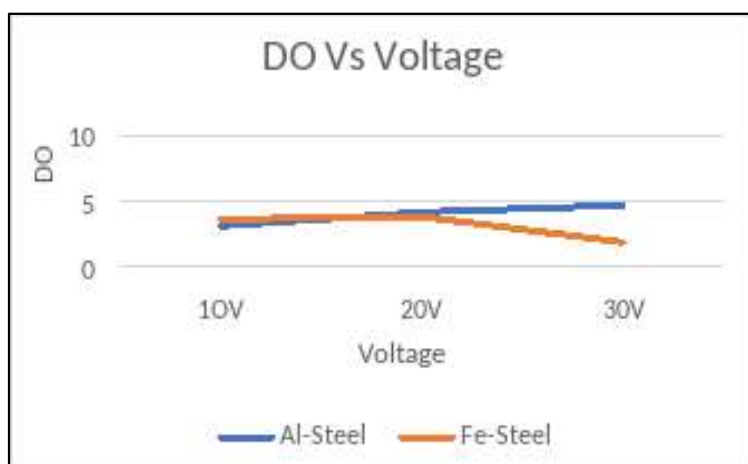


Figure 5: DO vs voltage graph.

Initially the value of DO is very low but after the electrocoagulation process, its value has been increased. Maximum increase in DO value is obtained at 30v for al-steel electrode combination (Fig. 5).

Biochemical Oxygen Demand (BOD)

Change in BOD at 10V, 20V, 30V in 1 hour is shown below (Table 6).

Table 6: BOD analysis.

	Aluminium-steel	Iron-steel
10 V	120	95
20V	100	86
30V	90	79

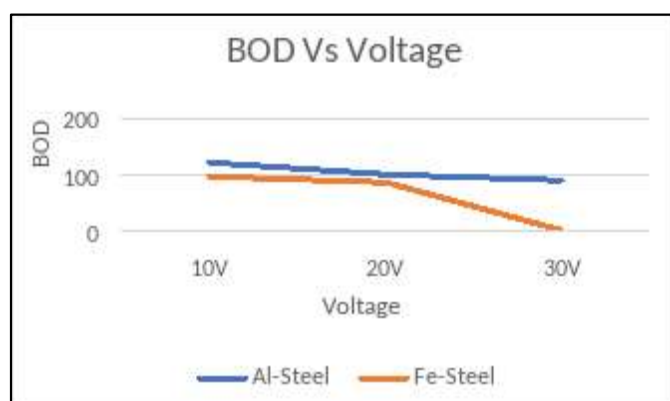


Figure 6: BOD vs voltage graph.

Initially the value of BOD is very high but after the electrocoagulation process, there is a drastic change in the BOD value. Better result

is obtained at 30v for the al-steel electrode combination (Fig. 6).

Comparison of Electrodes for Car Wash Water by Removal Efficiency

Table 7: Comparison of electrodes for car wash water at 30V.

Electrodes	Turbidity %	TSS %	BOD %
Al – Steel	92.39%	90.50%	89.32%
Fe - Steel	83.19%	80.26%	86.14%

CONCLUSION

Electrocoagulation is suitable for the removal of various pollutants from surface water and wastewater. It can produce high quality fresh water from highly coloured surface water having high concentrations of organic matter. Optimum BOD removal and low residual aluminium can be obtained simultaneously with EC, which could be of significant benefit to EC in surface water treatment compared to chemical coagulation. Aluminium seems to be a more suitable electrode material for EC applications because it produces Al (III) species. Metal ions and hydroxides that are produced by iron electrodes are less effective in the destabilisation

of pollutants because iron electrodes produce more soluble and less charged Fe (II) species. From our paper, it is found that the al-steel is the best electrode combination for the treatment. The removal efficiency of turbidity, TSS and BOD were 92.39%, 90.50% and 89.32% respectively (Table 7). At the voltage, range of 30v shows the best result that is increase in the current density improves the removal efficiency.

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Analysis and Design of Multistorey Building using ETABS

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Abstract—Structural Engineers are mainly concerned with finding out the behavior of a structure when subjected to horizontal forces and adequate stiffness is required for the buildings which are high rise in order to confront horizontal forces aroused by winds and earthquakes. To confront the horizontal forces i.e., lateral loads developed by earthquakes and to contribute more stiffness to the structure we use Shear walls, which are added to the interior of the proposed structure. The principle objective of this project is to Plan, analyse and design a multi-storeyed building [G + 4(3 dimensional frame)] using ETABS. The design involves analysing the whole structure by ETABS. The design methods used in ETABS analysis are Limit State Design conforming to Indian Standard Code of Practice. ETABS features a state-of-the-art user interface, visualization tools, powerful analysis and design engines with advanced finite element and dynamic analysis capabilities. From model generation, analysis and design to visualization and result verification, ETABS is the professional's choice. Initially it started with the analysis of simple 2 dimensional frames and manually checked the accuracy of the software with the results. The results proved to be very accurate for all possible load combinations [dead, live, wind and seismic loads].

Keywords—Analysis and designing, Etabs, commercial building

1. INTRODUCTION

Structural engineering is a wider discipline under the field of civil engineering. It is a vast topic with unlimited theories and practices. It's a field that is still developing with huge innovations and ideas. The roles and responsibilities of a structural engineer includes structural designing, selection of materials best suited for the structure, analysis of structures etc. The present project deals with the analysis and design of a multi storied commercial complex at Puthiyara, Kozhikode. Structural designing include calculating loads and stresses acting on the building, analysis for the loads, design of sections of structures to sustain the loads. So that the structure designed will withstand the load predicted safely.

Analysis of structure is presently carried out by software like ETABS, SAP, STAAD etc. As years pass new software are being developed for analysis of structures at different condition of loads like wind, earthquake etc. the results can be understood and interpreted from the software to know the validity of values provided as output.

Now a days framed structures are preferred for commercial buildings. The framed system of construction has mainly two advantages. Firstly, the walls, which are used for, are not load bearing ones and hence the thickness of the walls can be reduced to a considerable extent. This reduces weight of the building and the load transferred to the foundation will be lessened. Subsequently the construction materials can be saved. Secondly the floor area of the building can be increased

A structure is subjected to various types of loading such as permanent, movable and occasional. The permanent loads are due to self-weight of structure, semipermanent ones are due to fixtures, furniture, stationary etc. which are rarely moved and is considered as Imposed Loads or live loads. 2 Movable loads are due to moving vehicles, etc. The occasional loads are due to wind, earthquake or floods.

Earthquake has also become one of the natural challenging factor for the efficient construction work. It is one of the dominant constrains while designing the frame building in the earthquake prone zone. Earthquake is a natural phenomenon as old as history of earth itself and is considered to be the most unpredictable one among all other natural disasters. Now a days, designers and engineers are giving more emphasis towards the earthquake resistance while analyzing and designing any structure to minimize the seismic impact.

1.1 DESIGN PHILOSOPHIES

There are three philosophies for the design of reinforced concrete namely:

- 1) Working stress method
- 2) Ultimate load method
- 3) Limit state method

1.2 STAGES IN STRUCTURAL DESIGN

The process of structural design involves the following stages

- Structural planning.
- Estimation of loads.
- Analysis of structure.
- Member design.
- Drawing, detailing and preparation of structures.

2.OBJECTIVE

- To analyse and design a G+4 commercial building.
- To prepare the master plan for the commercial building
- To compare the result with ETABS

3. PLAN OF COMMERTIAL BUILDING

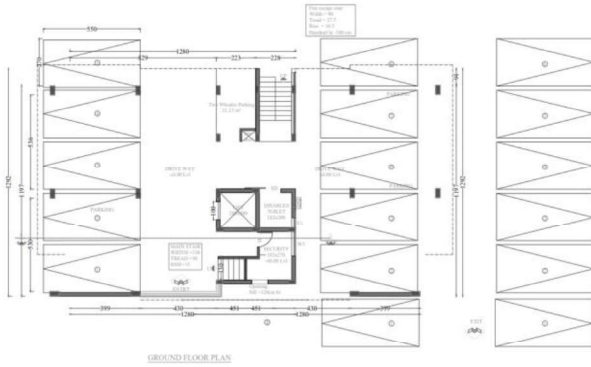


Fig :3.1 Ground Floor Plan

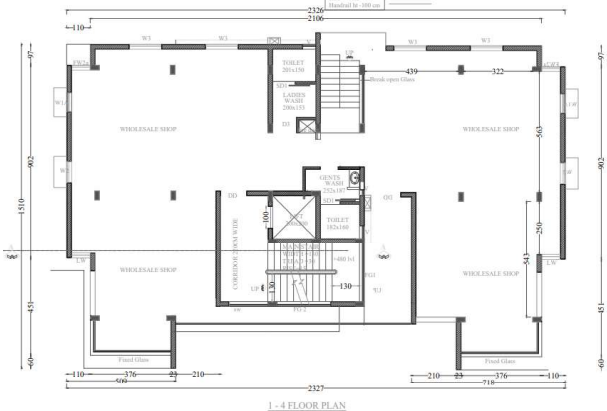


Fig 3.2. 1-4 Floor Plan

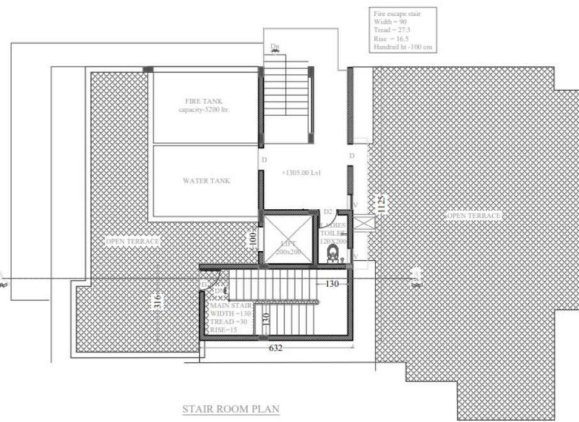
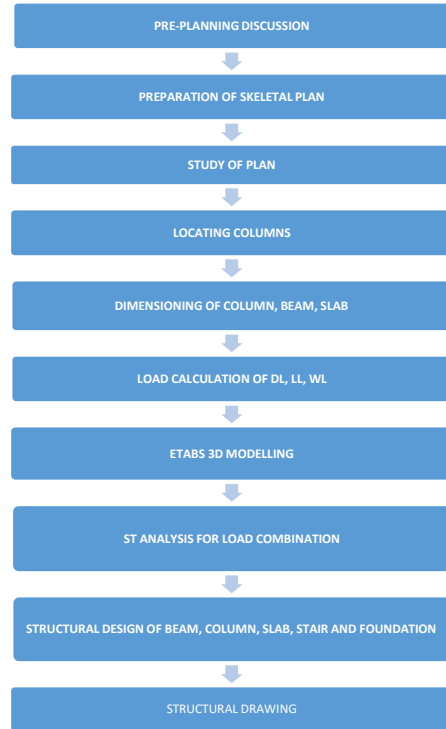


Fig 3.4 Stair Room Plan

4. METHODOLOGY



5. A BRIEF DESCRIPTION OF SOFTWARE’S USED IN TRAINING

5.1 ETABS 2017:

ETABS is an engineering software product that caters to multi-story building analysis and design. Modeling tools and details, and cross-sections may be generated for concrete and steel structures. ETABS provides an unequalled suite of tools for structural engineers designing buildings, whether they are working on one-story industrial structures or the tallest commercial high-rises. Immensely capable, yet easy-to-use, has been the hallmark of ETABS since its introduction decades ago, and this latest release continues that tradition by providing engineers with the technologically-advanced, yet intuitive, software they require to be their most productive

5.2 AUTO-CAD 2016:

All the drawing and detailing works for this training were done by making use of AutoCAD 2007, developed by M/s. AUTODESK, USA. As such, this is the pioneering software in CAD. AutoCAD is a vector graphics drawing program. It uses primitive entities such as lines, poly-lines, circles, arcs and text as the foundation for more complex objects. AutoCAD’s native file format, DWG, and to a lesser extent, its interchange file format, DXF has become the standards for interchange of CAD data..

6. MODELING IN ETABS

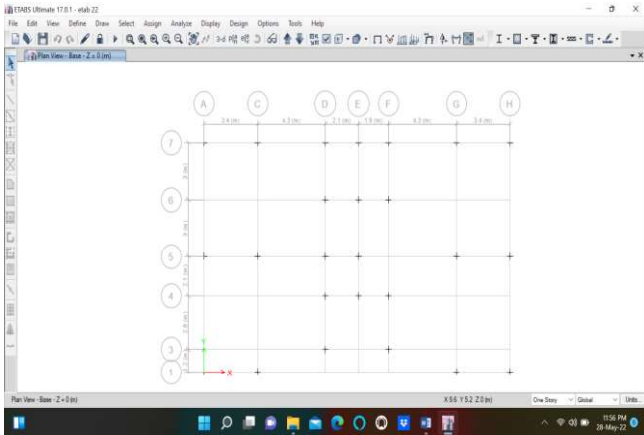
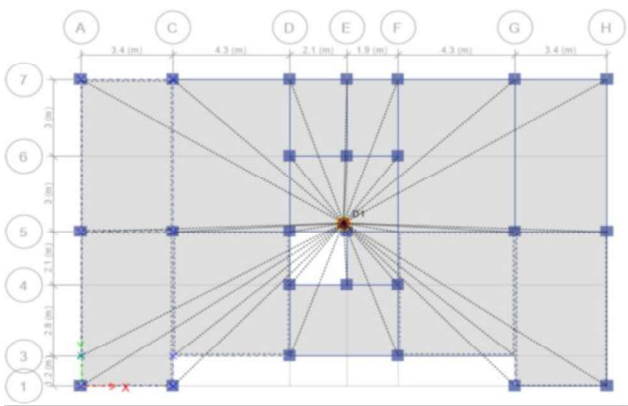


Fig 6.1 Importing of Floor Plan from Auto-cad:



Column locating

7. STRUCTURE DATA

This chapter provides model geometry information, including items such as story levels, point coordinates, and element connectivity

Story Data

Table 7.1 - Story Data

Name	Height mm	Elevation mm	Master Story	Similar To	Splice Story
Story6	3300	19600	Yes	None	No
Story5	3300	16300	Yes	None	No
Story4	3300	13000	No	Story5	No
Story3	3300	9700	No	Story5	No
Story2	3300	6400	No	Story5	No
Story1	3100	3100	No	Story5	No
Base	0	0	No	None	No

Grid Data

Table 7.2 - Grid Systems

Name	Type	Story Range	X Origin m	Y Origin m	Rotation deg	Bubble Size mm	Color
G1	Cartesian	Default	0	0	0	1250	ffa0a0a0

Mass

Table 7.3- Mass Source

Name	Include Elements	Include Added Mass	Include Loads	Include Lateral	Include Vertical	Lump at Stories	IsDefault
MsSrc1	Yes	Yes	No	Yes	No	Yes	Yes

Groups

Table 7.4 - Group Definitions

Name	Color
All	Yellow

7.1 Properties

This chapter provides property information for material frame sections ,shell sections and links.

Materials

Table 1-Material Properties- Summary

Name	Type	E MPa	v	Unit Weight kN/m³	Design Strengths
A416Gr270	Tendon	196500.6	0	76.9729	Fy=1689.91 MPa, Fu=1861.58 MPa
A615Gr60	Rebar	199947.98	0.3	76.9729	Fy=413.69 MPa, Fu=620.53 MPa
A992Fy50	Steel	199947.98	0.3	76.9729	Fy=344.74 MPa, Fu=448.16 MPa
Concrete M25	Concrete	25000	0.2	24.9926	Fc=25 MPa
Steel HYSD415	Rebar	200000	0	76.9729	Fy=415 MPa, Fu=485 MPa

Frame Sections

Table 2 - Frame Sections - Summary

Name	Material	Shape
Beam 250x450	Concrete M25	Concrete Rectangular
Column 450x450	Concrete M25	Concrete Rectangular
ISWB550	A992Fy50	Steel I/Wide Flange

Shell Sections

Table 3 - Shell Sections - Summary

Name	Design Type	Element Type	Material	Total Thickness mm
Slab 150	Slab	Membrane	Concrete M25	150

Reinforcement Sizes

Table 4 - Reinforcing Bar Sizes

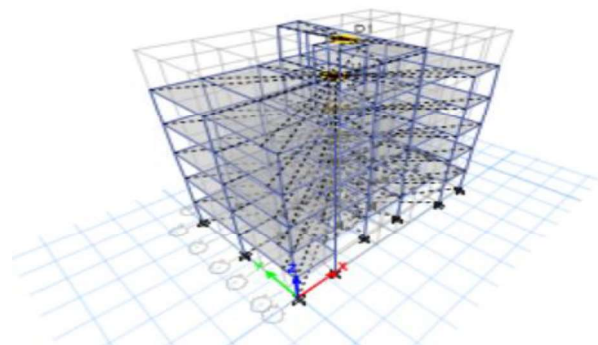
Name	Diameter mm	Area mm²
10	10	79
18	18	255
20	20	314

Tendon Sections

Table 5 - Tendon Section Properties

Name	Material	StrandArea mm²	Color
Tendon1	A416Gr270	99	Blue

7.2 Framing Of Model



8. ANALYSIS IN ETABS

This chapter provides loading information as applied to the model.

Load Patterns

Table 4.1 - Load Patterns

Name	Type	Self Weight Multiplier	Auto Load
Dead	Dead	1	
Live	Live	0	
EQ X	Seismic	0	IS 1893:2016
EQ Y	Seismic	0	IS 1893:2016
WL X	Wind	0	Indian IS875:1987
WL Y	Wind	0	Indian IS875:1987

Load Cases

Table 6 - Load Cases - Summary

Name	Type
Dead	Linear Static
Live	Linear Static
EQ X	Linear Static
EQ Y	Linear Static
WL X	Linear Static
WL Y	Linear Static

8.1 Auto Wind Loading

Indian IS875:1987 Wind Load Calculation

Lateral wind loads for load pattern WL X according to Indian IS875:1987, as calculated by ETABS

Exposure Parameters

Exposure From = Diaphragms

Structure Class = Class B

Terrain Category = Category 2

Wind Direction = 0 degrees

Basic Wind Speed, V_b

Windward Coefficient, $C_{p,wind}$

Leeward Coefficient, $C_{p,lee}$

Top Story = Story6

Bottom Story = Base

Factors and Coefficients

Risk Coefficient, k_1 [IS 5.3.1]

Topography Factor, k_3 [IS 5.3.3]

$$k_1 = 1$$

$$k_3 = 1$$

Lateral Loading

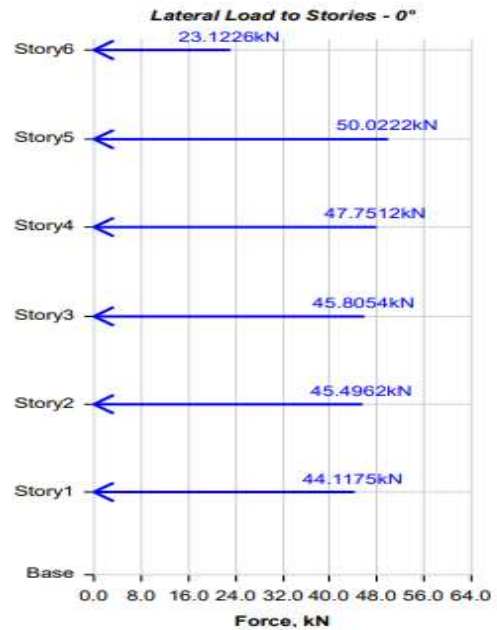
Design Wind Speed, V_z [IS 5.3]

$$V_z = V_b k_1 k_2 k_3 \quad V_z = 40.837095$$

Design Wind Pressure, p_z [IS 5.4]

$$p_z = 0.6 V_z^2$$

Applied Story Forces



Story	Elevation m	X-Dir kN	Y-Dir kN
Story6	19.6	23.1226	0
Story5	16.3	50.0222	0
Story4	13	47.7512	0
Story3	9.7	45.8054	0
Story2	6.4	45.4962	0
Story1	3.1	44.1175	0
Base	0	0	0

Lateral wind loads for load pattern WL Y according to Indian IS875:1987, as calculated by ETABS

Exposure Parameters

Exposure From = Diaphragms

Structure Class = Class B

Terrain Category = Category 1

Wind Direction = 90 degrees

Basic Wind Speed, V_b

Windward Coefficient, $C_{p,wind}$

Leeward Coefficient, $C_{p,lee}$

Top Story = Story6

Bottom Story = Base

Include Parapet = No

Factors and Coefficients

Risk Coefficient, k_1 [IS 5.3.1]

Topography Factor, k_3 [IS 5.3.3]

Lateral Loading

Design Wind Speed, V_z [IS 5.3]

$$V_z = V_b k_1 k_2 k_3 \quad V_z = 42.787095$$

Design Wind Pressure, p_z [IS 5.4]

$$p_z = 0.6 V_z^2$$

$$V_b = 39 \text{ meter/sec}$$

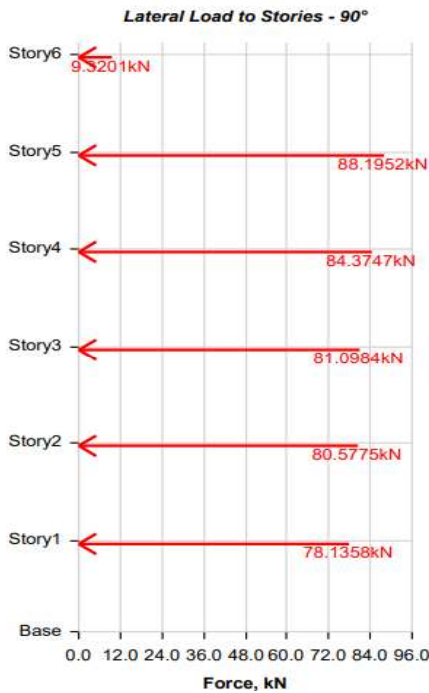
$$C_{p,wind} = 0.8$$

$$C_{p,lee} = 0.5$$

$$k_1 = 1$$

$$k_3 = 1$$

Applied Story Forces

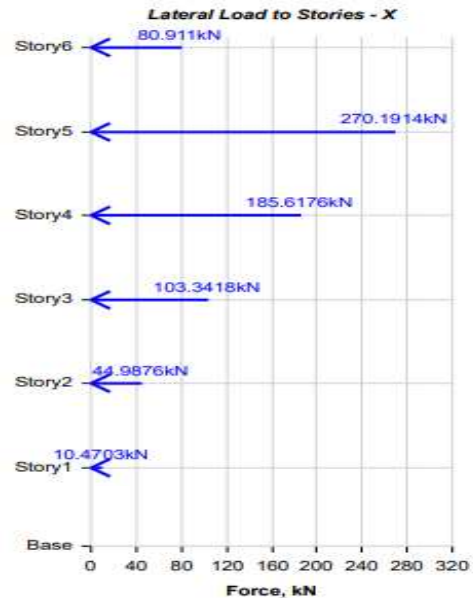


Story	Elevation m	X-Dir kN	Y-Dir kN
Story6	19.6	0	9.3201
Story5	16.3	0	88.1952
Story4	13	0	84.3747
Story3	9.7	0	81.0984
Story2	6.4	0	80.5775
Story1	3.1	0	78.1358
Base	0	0	0

Calculated Base Shear

Direction	Period Used (sec)	W (kN)	V _b (kN)
X	0.567	8061.532	695.5196

Applied Story Forces



Story	Elevation m	X-Dir kN	Y-Dir kN
Story6	19.6	80.911	0
Story5	16.3	270.1914	0
Story4	13	185.6176	0
Story3	9.7	103.3418	0
Story2	6.4	44.9876	0
Story1	3.1	10.4703	0
Base	0	0	0

8.2 Auto Seismic Loading

IS 1893:2016 Seismic Load Calculation

Lateral seismic loads for load pattern EQ X according to IS 1893:2016, as calculated by ETABS

Direction and Eccentricity

Direction = X

Structural Period

Period Calculation Method = Program Calculated

Factors and Coefficients

Seismic Zone Factor, Z [IS Table 3] Z = 0.36

Response Reduction Factor, R [IS Table 9] R = 5

Importance Factor, I [IS Table 8] I = 1

Site Type [IS Table 1] = II

Seismic Response

Spectral Acceleration Coefficient, Sa /g [IS 6.4.2]

Sa g = 1.36 T Sa g = 2.396565

Equivalent Lateral Forces

Seismic Coefficient, Ah [IS 6.4.2] Ah = Z I Sa g 2 R

lateral seismic loads for load pattern EQ Y according to IS 1893:2016, as calculated by ETABS.

Direction and Eccentricity

Direction = Y

Structural Period

Period Calculation Method = Program Calculated

Factors and Coefficients

Seismic Zone Factor, Z [IS Table 3] Z = 0.36

Response Reduction Factor, R [IS Table 9] R = 5

Importance Factor, I [IS Table 8] I = 1

Site Type [IS Table 1] = II

Seismic Response

Spectral Acceleration Coefficient, Sa /g [IS 6.4.2]

Sa g = 1.36 T Sa g = 2.10472

Equivalent Lateral Forces

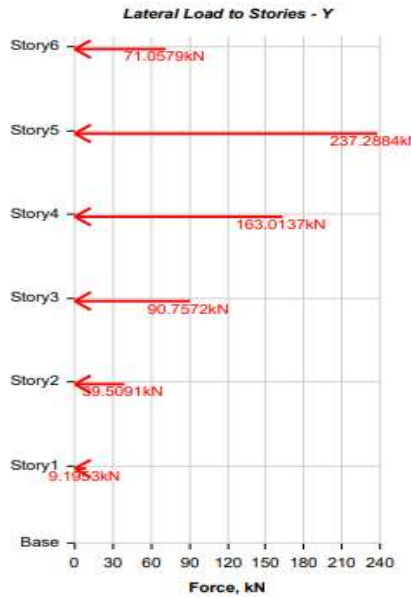
Seismic Coefficient, Ah [IS 6.4.2]

Ah = Z I Sa g 2 R

Calculated Base Shear

Direction	Period Used (sec)	W (kN)	V _b (kN)
Y	0.646	8061.532	610.8216

Applied Story Forces



Story	Elevation m	X-Dir kN	Y-Dir kN
Story6	19.6	0	71.0579
Story5	16.3	0	237.2884
Story4	13	0	163.0137
Story3	9.7	0	90.7572
Story2	6.4	0	39.5091
Story1	3.1	0	9.1953
Base	0	0	0

9. LOAD COMBINATIONS

Design of the structures would have become highly expensive in order to maintain either serviceability and safety if all types of forces would have acted on all structures at all times. Accordingly the concept of characteristics loads has been accepted to ensure at least 95 percent of the cases, the characteristic loads are to be calculated on the basis of average/mean load of some logical combinations of all loads mentioned above. IS 456:2000, IS 875:1987 (Part-V) and IS 1893(part-I):2002 stipulates the combination of the loads to be considered in the design of the structures. The different combinations used are:

Table 4.10 - Load Combinations

Name	Load Case/Combo	Scale Factor	Type	Auto
DSIbU1	Dead	1.5	Linear Add	Yes
DSIbU2	Dead	1.5	Linear Add	Yes
DSIbU2	Live	1.5		No
DCon1	Dead	1.5	Linear Add	Yes
DCon2	Dead	1.5	Linear Add	Yes
DCon2	Live	1.5		No
DCon3	Dead	1.2	Linear Add	Yes
DCon3	Live	1.2		No
DCon3	WL X	1.2		No
DCon4	Dead	1.2	Linear Add	Yes
DCon4	Live	1.2		No
DCon4	WL X	-1.2		No
DCon5	Dead	1.2	Linear Add	Yes
DCon5	Live	1.2		No
DCon5	WL Y	1.2		No
DCon6	Dead	1.2	Linear Add	Yes
DCon6	Live	1.2		No
DCon6	WL Y	-1.2		No
DCon7	Dead	1.5	Linear Add	Yes
DCon7	WL X	1.5		No
DCon8	Dead	1.5	Linear Add	Yes
DCon8	WL X	-1.5		No
DCon9	Dead	1.5	Linear Add	Yes
DCon9	WL Y	1.5		No
DCon10	Dead	1.5	Linear Add	Yes
DCon10	WL Y	-1.5		No
DCon11	Dead	0.9	Linear Add	Yes
DCon11	WL X	1.5		No
DCon12	Dead	0.9	Linear Add	Yes
DCon12	WL X	-1.5		No
DCon13	Dead	0.9	Linear Add	Yes
DCon13	WL Y	1.5		No
DCon14	Dead	0.9	Linear Add	Yes
DCon14	WL Y	-1.5		No
DCon15	Dead	1.2	Linear Add	Yes
DCon15	Live	1.2		No
DCon15	EQ X	1.2		No
DCon16	Dead	1.2	Linear Add	Yes
DCon16	Live	1.2		No
DCon16	EQ X	-1.2		No
DCon17	Dead	1.2	Linear Add	Yes
DCon17	Live	1.2		No
DCon17	EQ Y	1.2		No
DCon18	Dead	1.2	Linear Add	Yes
DCon18	Live	1.2		No
DCon18	EQ Y	-1.2		No
DCon19	Dead	1.5	Linear Add	Yes
DCon19	EQ X	1.5		No
DCon20	Dead	1.5	Linear Add	Yes
DCon20	EQ X	-1.5		No

DCon21	Dead	1.5	Linear Add	Yes
DCon21	EQ Y	1.5		No
DCon22	Dead	1.5	Linear Add	Yes
DCon22	EQ Y	-1.5		No
DCon23	Dead	0.9	Linear Add	Yes
DCon23	EQ X	1.5		No
DCon24	Dead	0.9	Linear Add	Yes
DCon24	EQ X	-1.5		No
DCon25	Dead	0.9	Linear Add	Yes
DCon25	EQ Y	1.5		No
DCon26	Dead	0.9	Linear Add	Yes
DCon26	EQ Y	-1.5		No
DCon27	Dead	1.5	Linear Add	Yes
DCon28	Dead	1.5	Linear Add	Yes
DCon28	Live	1.5		No
DCon29	Dead	1.2	Linear Add	Yes
DCon29	Live	1.2		No
DCon29	WL X	1.2		No
DCon30	Dead	1.2	Linear Add	Yes
DCon30	Live	1.2		No
DCon30	WL X	-1.2		No

DCon31	Dead	1.2	Linear Add	Yes
DCon31	Live	1.2		No
DCon31	WL Y	1.2		No
DCon32	Dead	1.2	Linear Add	Yes
DCon32	Live	1.2		No
DCon32	WL Y	-1.2		No
DCon33	Dead	1.5	Linear Add	Yes
DCon33	WL X	1.5		No
DCon34	Dead	1.5	Linear Add	Yes
DCon34	WL X	-1.5		No
DCon35	Dead	1.5	Linear Add	Yes
DCon35	WL Y	1.5		No
DCon36	Dead	1.5	Linear Add	Yes
DCon36	WL Y	-1.5		No
DCon37	Dead	0.9	Linear Add	Yes
DCon37	WL X	1.5		No
DCon38	Dead	0.9	Linear Add	Yes
DCon38	WL X	-1.5		No
DCon39	Dead	0.9	Linear Add	Yes
DCon39	WL Y	1.5		No
DCon40	Dead	0.9	Linear Add	Yes

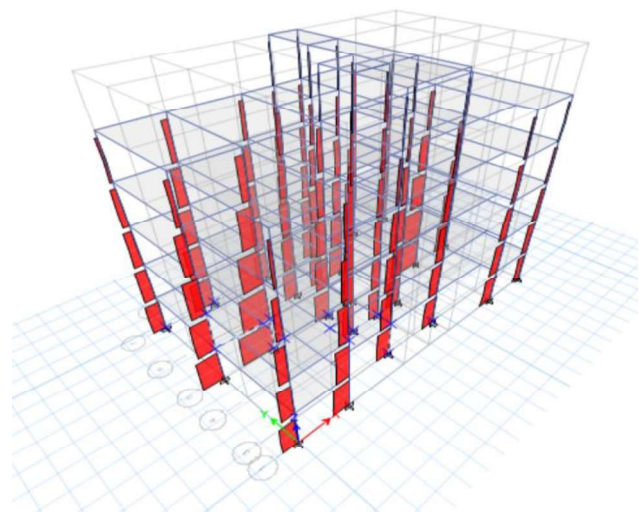
DCon41	Dead	1.2	Linear Add	Yes
DCon41	Live	1.2		No
DCon41	EQ X	1.2		No
DCon42	Dead	1.2	Linear Add	Yes
DCon42	Live	1.2		No
DCon42	EQ X	-1.2		No

DCon43	Dead	1.2	Linear Add	Yes
DCon43	Live	1.2		No
DCon43	EQ Y	1.2		No
DCon44	Dead	1.2	Linear Add	Yes
DCon44	Live	1.2		No
DCon44	EQ Y	-1.2		No
DCon45	Dead	1.5	Linear Add	Yes
DCon45	EQ X	1.5		No
DCon46	Dead	1.5	Linear Add	Yes
DCon46	EQ X	-1.5		No
DCon47	Dead	1.5	Linear Add	Yes
DCon47	EQ Y	1.5		No
DCon48	Dead	1.5	Linear Add	Yes
DCon48	EQ Y	-1.5		No
DCon49	Dead	0.9	Linear Add	Yes
DCon49	EQ X	1.5		No
DCon50	Dead	0.9	Linear Add	Yes
DCon50	EQ X	-1.5		No
DCon51	Dead	0.9	Linear Add	Yes
DCon51	EQ Y	1.5		No
DCon52	Dead	0.9	Linear Add	Yes
DCon52	EQ Y	-1.5		No

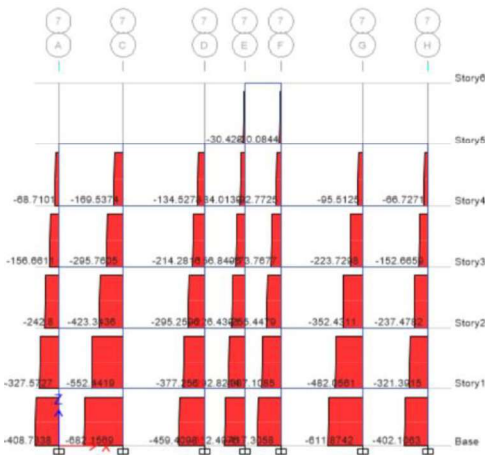
10 ANALYSIS RESULTS

The structure was analysed as ordinary moment resisting space frames in the versatile software Etabs 2015. Joint coordinate command allows specifying and generating the coordinates of the joints of the structure, initiating the specifications of the structure. Member incidence command is used to specify the members by defining connectivity between joints. The columns and beams are modelled using beam elements. Member properties have to be specified for each member. From the analysis, maximum design loads, moments and shear on each member was obtained. From these values, we design the structure

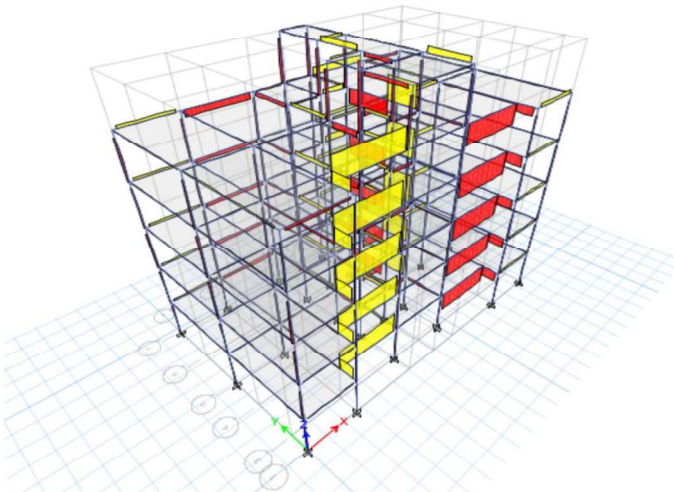
10.1 Axial Force.



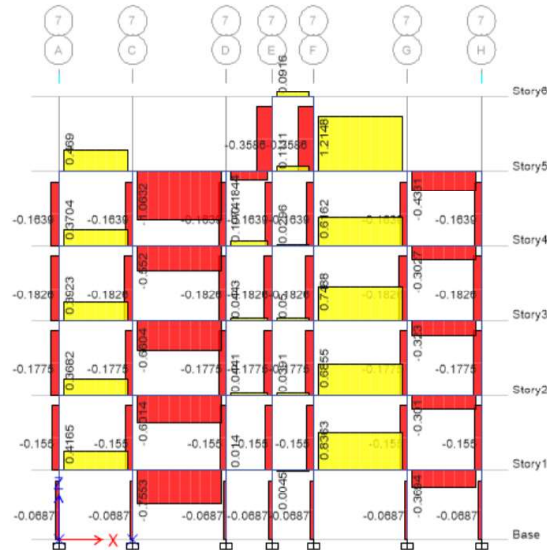
10.2 Elevation view of axial force diagram



10.3 Torsion diagram



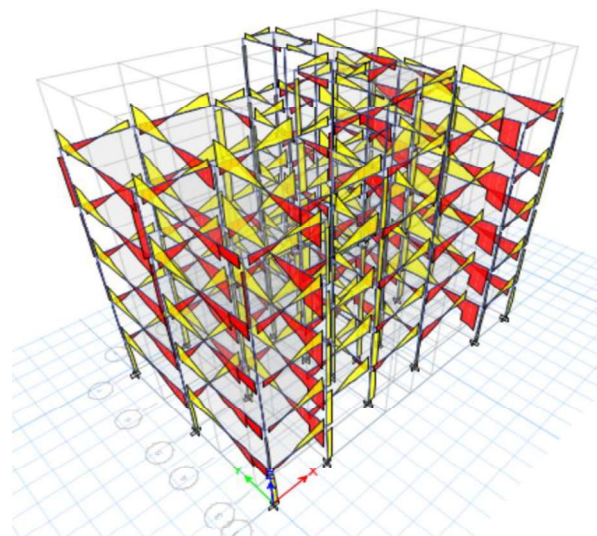
10.4 Elevation view of torsion diagram



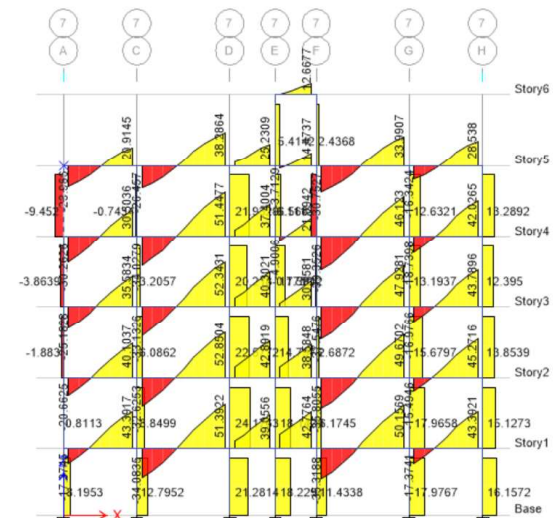
10.5 plan view of torsion diagram



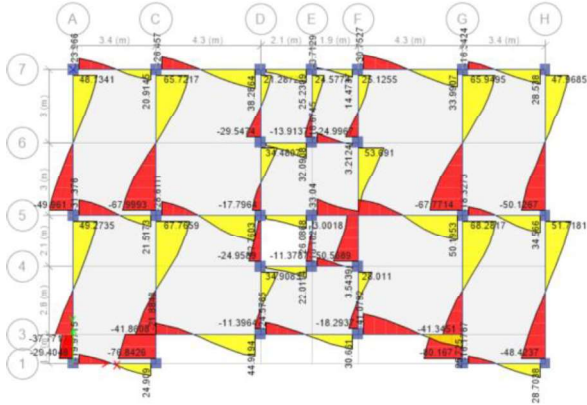
10.6 Shear force diagram



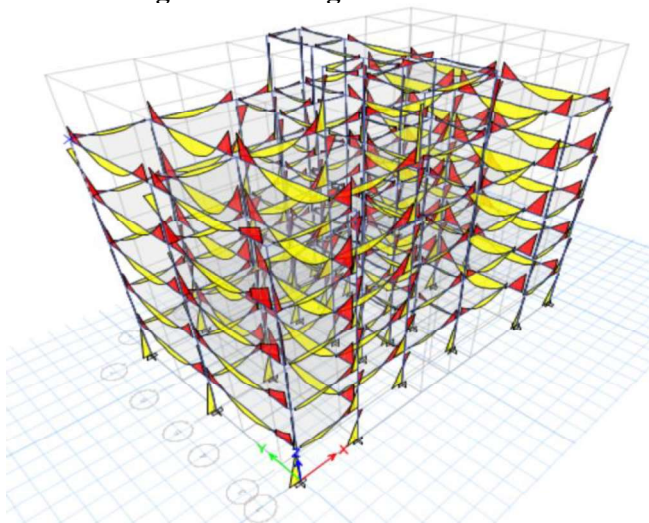
10.7 Elevation view of shear force diagram



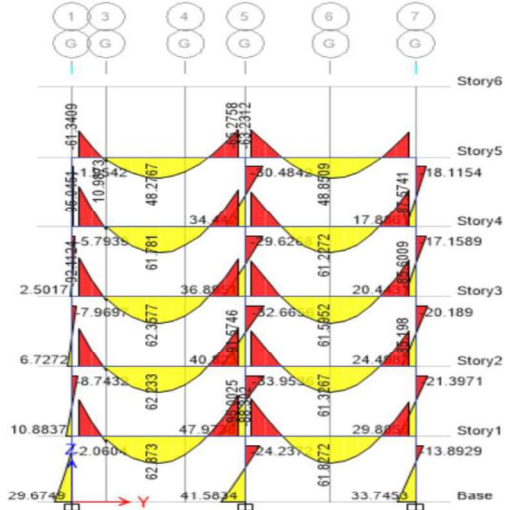
10.8 Plan view of shear force diagram



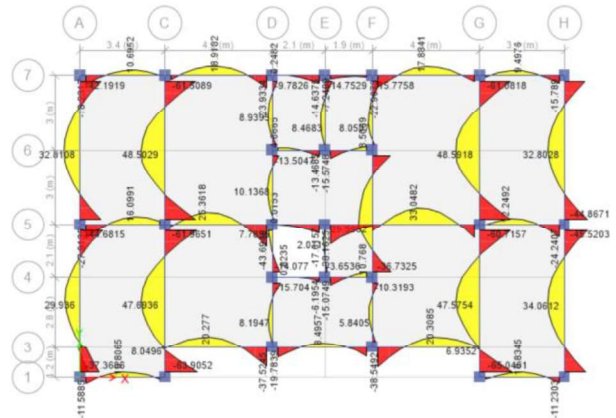
10.9 Bending moment diagram



10.10 Elevation view of bending moment diagram



10.11 Plan view of bending moment diagram



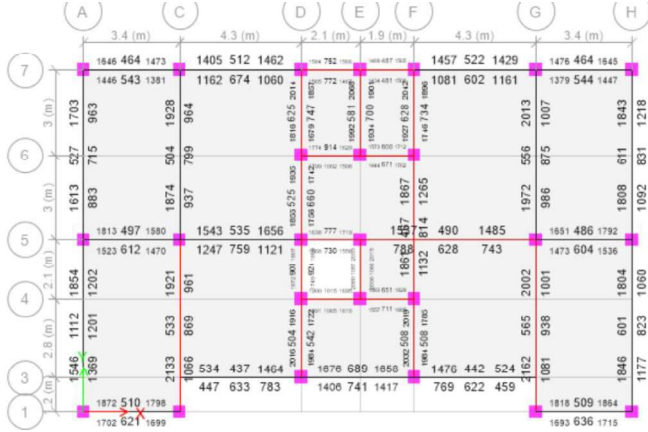
11 DESIGN OF RC BUILDING

General The aim of structural design is to achieve an acceptable probability that the structure being designed will perform the function for which it is created and will safely withstand the influence that will act on it throughout its useful life. These influences are primarily the loads and the other forces to which it will be subjected. The effects of temperature fluctuations, foundation settlements etc. should be also considered. The design methods used for the design of reinforced concrete structures are working stress method, ultimate load method and limit state method. Here we have adopted the limit state method of design for slabs, beams, columns and stairs. In the limit state method, the structure is designed to withstand safely all loads liable to act on it through its life and also to satisfy the serviceability requirements, such as limitation to deflection and cracking. The acceptable limit of safety and serviceability requirements before failure is called limit state. All the relevant limit states should be considered in the design to ensure adequate degrees of safety and serviceability. The structure should be designed on the basis of most critical state and then checked for other limit states.

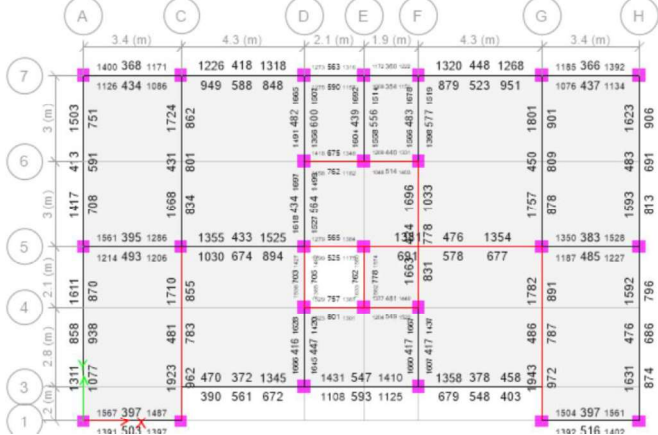
Plan view of 1st floor



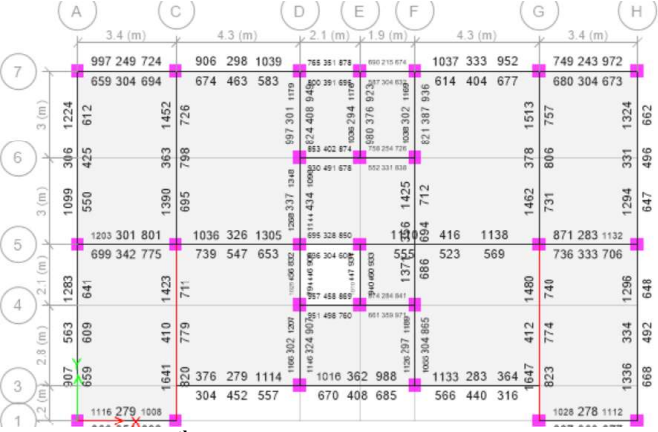
Plan view of 2nd floor



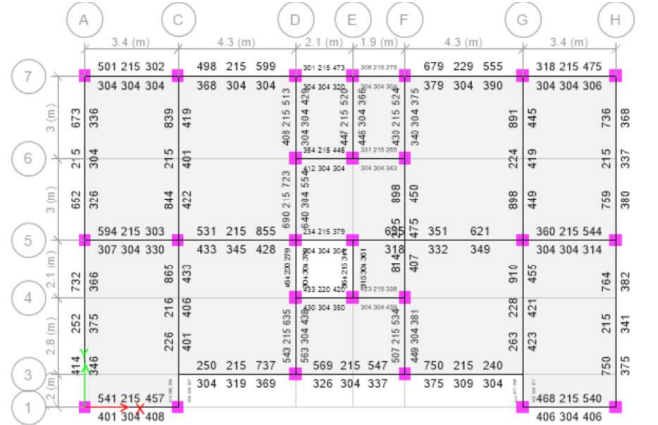
Plan view of 3rd floor



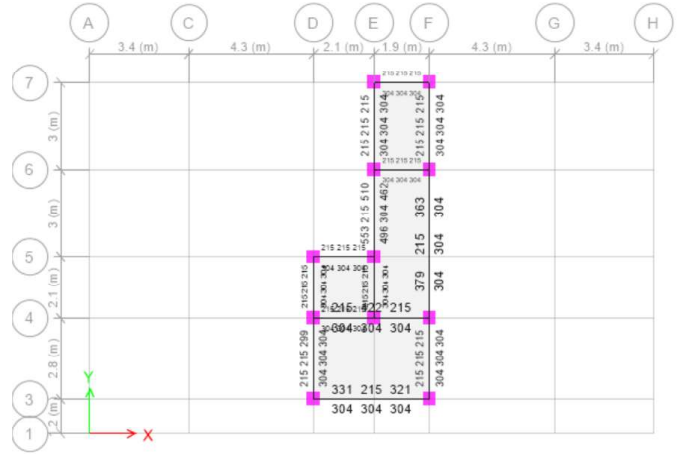
Plan view of 4th floor



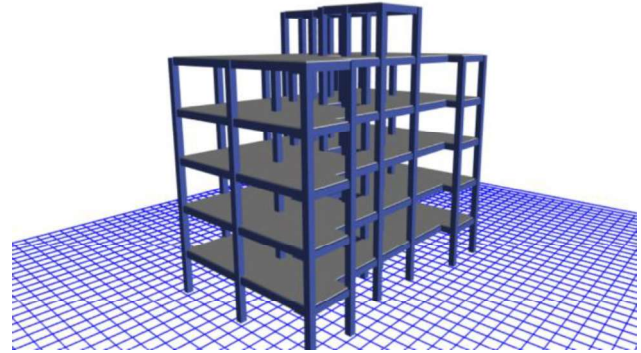
Plan view of 5th floor



Plan view of 6th floor



Rendered view



RESULT AND CONCLUSION:

Analysis and design of an apartment building having G+10 storeys is done. Analysis is done by using the software ETABS V15.2, which proved to be premium of great potential in analysis and design of various sections. The structural elements like RCC frame, shear wall and retaining walls are also provided. As per the soil investigation report, an isolated footing is provided. The design of RCC frame members like beam and column was done using ETABS. The analysis and design was done according to standard specifications to the possible extend. The various difficulties encountered in the design process and the various constraints faced by the structural engineer in designing up to the architectural drawing were also understood.

FUTURE SCOPE:

- Dynamic analysis can also be done using ETABS.
- Slab and footing can be designed using SAFE.
- In ETABS 2017 different types of slabs can be designed.
- The sections designed in ETABS can also be designed by conventional methods or STAAD-PRO and its result can be compared.
- The irregular structures subjected to different load cases can also be analyzed and designed in ETABS.

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Electrocoagulation of Canteen Waste Water using various Electrodes

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Abstract: Electrocoagulation is a process of applying electric current to treat and flocculate contaminants without adding coagulants. In this study, electrocoagulation of canteen wastewater was done using two different combinations of electrode materials. Aluminium and iron are taken as anode materials and stainless steel was taken as the cathode. A sample of 800 cubic centimeters is taken in the electrolytic cell and is made to run at different volts (10V, 20V, 30V). The combination effect of volt on the efficiency of the electrocoagulation process of the removal of PH, turbidity, TSS, DO and BOD was considered to evaluate the treatment efficiencies. From the study, the aluminum-steel combination was determined as the best electrode material for the treatment. The removal efficiency of turbidity, TSS, and BOD were 91.49%, 94.80%, and 90.23% respectively with Aluminium-steel combination. The electrocoagulation process can be recommended as an efficient wastewater technology.

Index Terms: electrodes, electrocoagulation.

I. INTRODUCTION

Electrocoagulation is a modern technology for the removal of pollutants from raw waters and wastewaters. Electrocoagulation is a mode of treatment method in which coagulating metal ions are introduced electrolytically from the sacrificial electrodes. An anode is oxidized and the cathode gets reduced. The applied electric field dissolves the sacrificial anodes, releasing cations. This induces the neutralization of the surface charge of the particles and coagulation takes place. The electrocoagulation process is much more effective than chemical coagulation due to various reasons.

The water sample we used here is canteen wastewater. The sample was collected from our college premises.

METHODOLOGY

Sample Collection

Sample wastewater is collected in bottles from our college canteen. The collected sample is passed through filter paper that removes coarse material from water, but concentrations of colloidal and dissolved material are not affected.

Materials used

An electro coagulator was made of a beaker of 1L capacity. A plastic lid is placed at the top of the beaker. Aluminium, iron and steel are used as electrode materials. On the top lid are made grooves are provided for the insertion of electrodes having the dimension 10x2.5x3 cm. Electrodes are connected in parallel with monopolar configuration. Holes are provided on the plates for connecting wires. Electric current is applied to the plates which are projected on the top of the electrolytic cell.

Equipment's used

A DC power supply is used to provide sufficient voltage for electrocoagulation. Initial and final PH of wastewater were found by using a PH meter. Initial and final turbidity of wastewater were found by using nephelo turbidity meter. Initial and final conductivity is measured by using a conductivity meter. BOD bottles and a BOD incubator were used to find out BOD during the testing of samples.

Experimental setup

A schematic diagram of electrocoagulation and laboratory experimental setup is shown below



Fig1. Schematic diagram of the experimental setup

The electrocoagulation process was done in a beaker of 1 liter capacity as shown in fig.1. There are 2 monopolar electrodes of the same dimension. The aluminum, iron and steel are made of plate dimensions of 10x2.5x3cm and the intercellular spacing between the electrode was 2cm. NaCl was used as the electrolyte. DC power supply is used to provide sufficient voltage for electrocoagulation.

Procedure

In this study of using electrocoagulation for the treatment of waste water, the electrodes are placed vertically in the reactor and waste water of 800 ml volume is poured into the reactor after removing the coarse substances, if any. The initial parameters are analyzed before the treatment. There are two set of monopolar electrodes of same dimension (10x2.5x3cm) of combination of aluminum-steel and iron-steel. These are connected with voltmeter; the voltage was adjusted to desired value. The spacing between the electrodes was 2cm. the sample was treated for each voltage of 10v, 20v, 30v for aluminum-steel and iron-steel combination respectively. After a treatment of 1 hour, the treated water is allowed to settle for an hour. Parameter analysis should be done before and after treatment. At the end of each run, electrodes were washed thoroughly with water to remove any solid residues on the surfaces.

II. RESULT AND DISCUSSION

The following are the result for electrocoagulation of canteen waste water using aluminum-steel and iron-steel combination of electrodes.

Effect of pH concentration

Change in pH at 10V, 20V, 30V in 1 hour is shown below.

Table-1: pH analysis

	Aluminum-steel	Iron-steel
10V	5.43	5.82
20V	5.96	5.90
30V	6.20	5.98

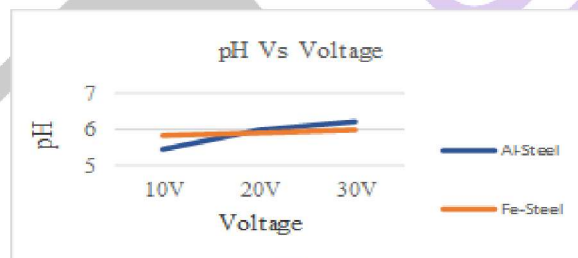


Fig.2 pH Vs Voltage graph

The initial pH of waste water was 5.43(acidic region). But after treatment the pH can be brought to a value around 6.00 due to the formation of hydroxyl ions. At 30v best result obtained.

Turbidity

Change in turbidity at 10V, 20V, 30V in 1 hour is shown below.

Table-2: Turbidity analysis

	Al-Steel	Fe-Steel
10V	290	340
20V	178	272
30V	72	178

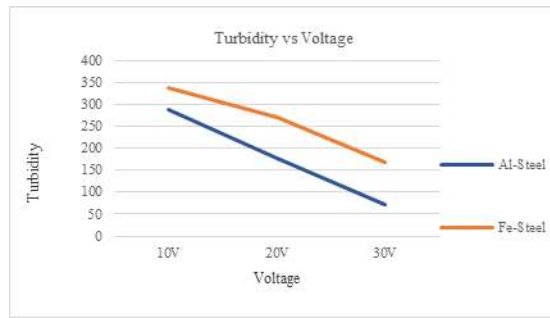


Fig 3 Turbidity Vs Voltage graph

At initial stage there is a slight decrease of turbidity. At 30V there is a gradual change in turbidity due to the formation of some iron complexes. Best result obtained at 30v

Total Suspended Solids (TSS)

Change in TSS at 10V, 20V, 30V in 1 hour is shown in below

Table-3: TSS analysis

	Aluminum-steel	Iron-steel
10V	700	774
20V	200	500
30V	180	320

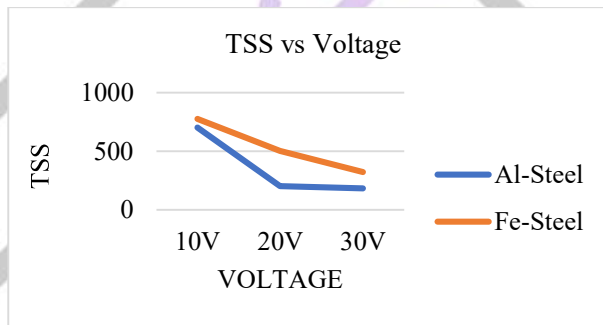


Fig 4 TSS Vs Voltage graph

At initial stage, that is from 10v to 20v there is a gradual change in TSS. The best result is obtained at 30v.

Dissolved Oxygen (DO)

Change in dissolved oxygen at 10V, 20V, 30V, in 1 hour is shown below.

Table-4: DO analysis

	Aluminum-steel	Iron-steel
10V	3	2.4
20V	4	3.21
30V	4.8	3.86

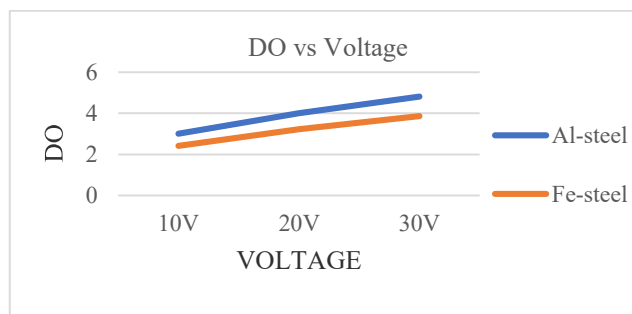


Fig.5 DO V.s Voltage

There is a gradual increase in DO value and at 30V best result obtained.

Biochemical Oxygen Demand (BOD)

Change in BOD at 10V, 20V, 30V in 1 hour is shown below

Table-5: BOD analysis

	Aluminum-Steel	Iron-Steel
10V	100	185
20V	80	115
30V	70	98

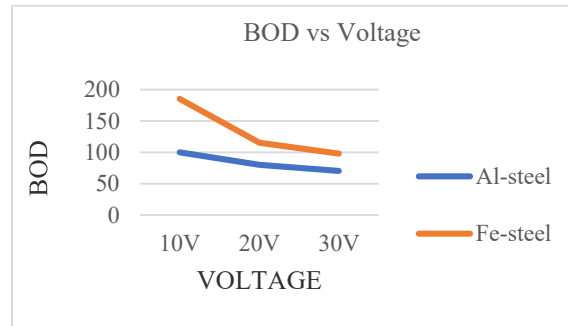


Fig 6 BOD Vs Voltage graph

In BOD value is there is a gradual change and 30v it shows the best result.

Comparison of electrodes for canteen waste water by removal efficiency

TABLE 6: Comparison of electrodes for canteen waste water at 30V

ELECTRODES	TURBIDITY %	TSS %	BOD %
Al – Steel	91.49%	94.80%	90.23%
Fe - Steel	84.19%	81.23%	85.34%

For canteen wastewater Aluminium – steel electrodes at 30V shows the best removal efficiency. Among the two, Aluminium – Steel is more recommendable.

III. CONCLUSION

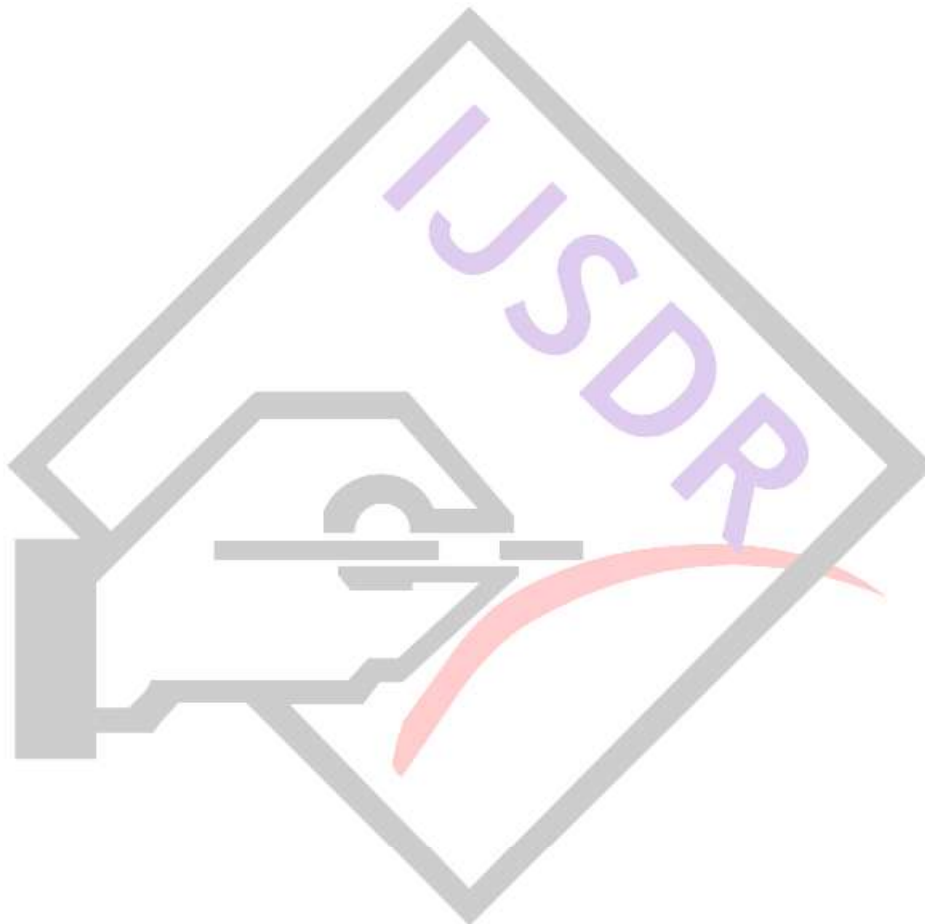
A study of waste water treatment with electrocoagulation process was carried out using aluminum-Steel and Iron-Steel electrodes. A treatment time of one hour and settlement of one hour is used.

From our experimental study, the aluminum-steel combination was determined as the best electrode material for the treatment. The removal efficiency of turbidity, TSS, and BOD were 91.49%, 94.80% and 90.23% respectively with aluminum-steel combination. The obtained result shows that both the combination shows high removal efficiency but Aluminium shows better result than Iron. The increase of current density improves the removal efficiency i.e., maximum removal efficiency is obtained at 30V.

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Analysis of Groundwater Potential Zone using ArcGIS

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Abstract: Changes in climate over the years Over-exploitation of groundwater have imposed immense pressure on the global groundwater resources. As demand of potable water increases, the need to evaluate the groundwater potential increases. The main aim of the project is to analyze the groundwater potential zone of the Kunnamangalam Panchayat, in Kozhikode district in the state of Kerala in India using the software ArcGIS. To achieve these seven layers of data of geology, geomorphology, land use land cover (LULC), drainage density, lineament density, soil and slope are prepared and using the analytical hierarchy process each of the layer is given a weightage importance and the layers and then superimposed in the software to get the groundwater potential zones.

Index Terms: Groundwater potential zone, ArcGIS, Analytical hierarchy process.

I. INTRODUCTION

Groundwater is a reliable source of resource and it serves as a source of water for industrial, domestic and agricultural uses and other developmental initiatives. The growing demand of water for meeting human requirements and developments has imposed immense pressure on this limited freshwater resource. The traditional method used to identify, delineate and map the groundwater potential zones are mainly based on ground surveys, knowledge of pre dug wells and modern tools like magnetometers which are generally expensive and time consuming. This is where the ArcGIS software comes in, it is a software which helps to identify the groundwater potential zones of any region without having to go to the field, using satellite images and digital elevation models which are freely accessible online along with other required data such as geology and geomorphology which are also available online.

In our project, a combination of Analytical Hierarchy Process (AHP) and GIS techniques will be used for delineating the groundwater potential zones. The AHP is a tool for dealing with complex decision making in groundwater. This tool is useful for decreasing complex decisions to a series of pair-wise comparisons and then synthesizing the results. Moreover, the AHP tool is a suitable technique for evaluating the consistency of the result, consequently reducing the bias in the decision-making process. Considering all these, we examined the case of Kunnamangalam Panchayat in Kozhikode district in Kerala.

II. STUDY AREA

Kunnamangalam is a growing census town located about 14 km east of Kozhikode city on the Calicut-Bangalore National Highway. The geographical area is 27.23 km² and the geographical co-ordinates 11°18'23"N latitude and 75°52'44"E longitude. In Kunnamangalam, the dry season is partly cloudy, and it is hot and the wet season is overcast. Over the course of the year, the temperature varies from 73°F to 94°F and is rarely below 70°F or above 99°F. This region experiences extreme seasonal variation in monthly rainfall. The rainy period lasts for 9.2 months, from March 13 to December 20, with a sliding 31-day rainfall of at least 0.5 inches. The month with the most rain is June, with an average rainfall of 19.3 inches. The draughty period lasts for 2.8 months, from December 20 to March 13. The month with the least rain is January, with an average rainfall of 0.1 inches.

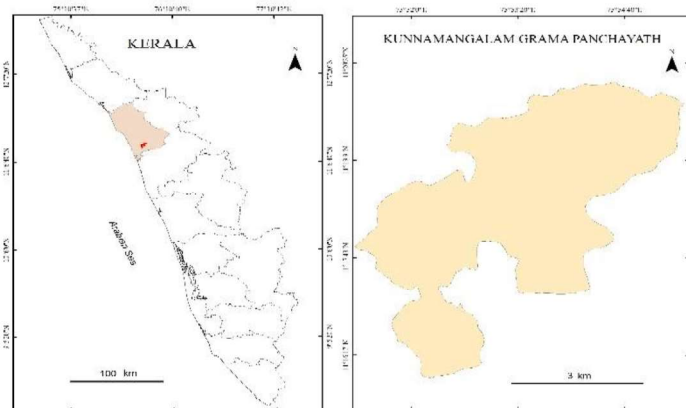


Fig1. Location map of study area- Kunnamangalam Panchayat

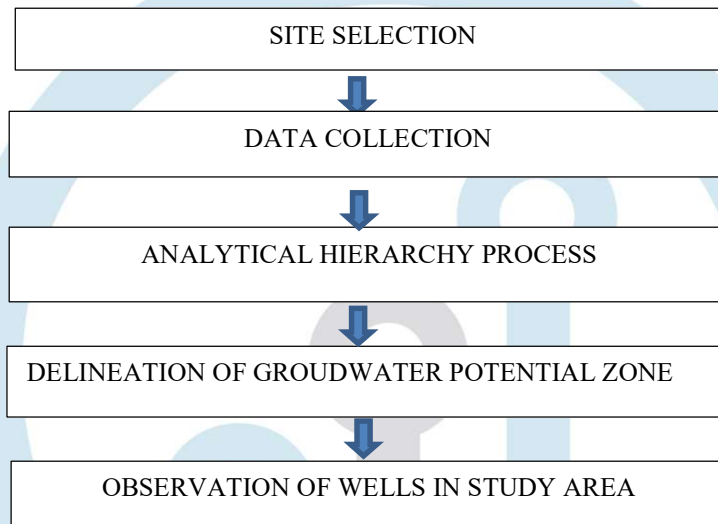
III. DATA COLLECTION

The project was attempted by considering seven different layers such as geology, geomorphology, drainage density, lineament density, land use land cover, soil and slope. These data were collected from different sources and are processed in the GIS

technology to create the data-base. The map of land use land cover, geomorphology and slope were obtained from National Remote Sensing Centre (NRSC). Drainage was extracted from SRTM and lineament was extracted from IRS LISS-III data. From the drainage and lineament, the density was prepared using the density in spatial analyst tool in GIS software. The map of geology and soil were collected and digitized from Geological Survey of India and National Bureau of Soil Survey, respectively.

IV. METHODOLOGY

Geospatial techniques were applied in our project to delineate the groundwater potential zones of the Kunnamangalam Panchayat using knowledge-based factor analysis of a total of seven layers of information of the area such as geology, geomorphology, land use land cover (LULC), drainage density, lineament density, soil and slope. Geographical Information Techniques were carried out using ArcGIS 10.4 software. Analytical hierarchy calculator was obtained to calculate the percentage importance or weights to each layer. Based on the various journals read the comparison values were given to each layer in the calculator. Then the calculator gives the output of importance of various layers. The georeferenced maps were assigned weights computed by the analytical hierarchy process.



Analytical Hierarchy Process

Analytical Hierarchical Process (AHP) is the most common and well-known GIS based method for delineating groundwater potential zones. This method helps integrating all seven thematic layers. A total of seven different thematic layers were considered for this study. These seven thematic layers are supposed to control factor of flow and storage of water in the area. The association of the influencing factors are weighted according to their reaction for groundwater occurrence and expert opinion. A parameter with a high weight represents a layer with high impact and a parameter with a low weight illustrates a small impact on groundwater potential. The weightages of each parameter were allocated according to Saaty's scale (1–9) of relative importance value. Further, the weights were allocated with consideration of the review of past studies and field experience. The Saaty's scale of relative importance value shows that, the value of 9 indicates extreme importance, 8 very very strong, 7 very extreme importance, 6 strong plus, 5 strong importance, 4 moderate plus, 3 moderate importance, 2 weak and 1 equal importance. As per the classification, weights are assigned to the seven thematic layers based on their importance and water holding capacity. To initiate groundwater potential zone map of Kunnamangalam Panchayat, all seven thematic layers were integrated with weighted overlay analysis method in GIS platform. We have given more percentage influence to geology and geomorphology as 25 and 20 respectively, land use land cover as 15, the least percentage influence is given to soil, slope, drainage density and lineament density as 10.

Table-I: Categorization of Factors Influencing Groundwater Potential Zone

FACTOR	ASSIGNED WEIGHT	DOMAIN OF EFFECT	RANK
Geology	25	Charnockite rock	3
		Basic rocks	3
Geomorphology	20	Plateau	5
		Pediplain	6
		Water body	9
Land use and Land cover	15	Built up	2
		Waste land	2
		Agriculture	5
		Wetland	7
		Water bodies	9
Drainage density	10	Low	6

		Medium	4
		High	3
Lineament density	10	Low	4
		Medium	6
		High	9
Soil	10	Clay	6
		Gravelly clay	8
Slope	10	0-5%	8
		5-15%	6
		15-35%	3
		35% & above	2

V. RESULTS AND ANALYSIS

Geology

Geologic setting plays a vital role in the occurrence and distribution of groundwater in any terrain. The published geological map of the Geological Survey of India was used for delineating different geological units of the study area. Majority area of study area occur basic rocks, figure shows sky blue in colour and occurrence of charnockite is also noticed in the area which shows dark in colour.

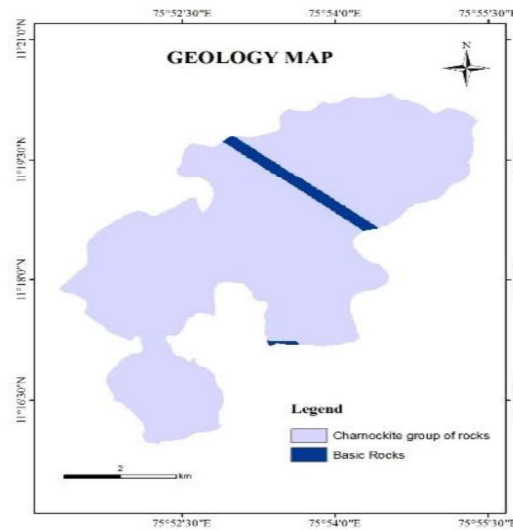


Fig 2. Geology Map of Study Area

Geomorphology

Geomorphology represents the landform and topography of an area, and is one of the main factors used for the delineation of groundwater potential zones. It gives detail information about the distribution of various landform features as well as processes like temperature changes, geochemical reactions, movement of water, freezing and thawing. The geomorphologic features in the study area were plateau, water body and pediplain. The main geomorphic feature of the study area is the plateau. The high weight is assigned for water bodies and low weight for plateau and pediplain.

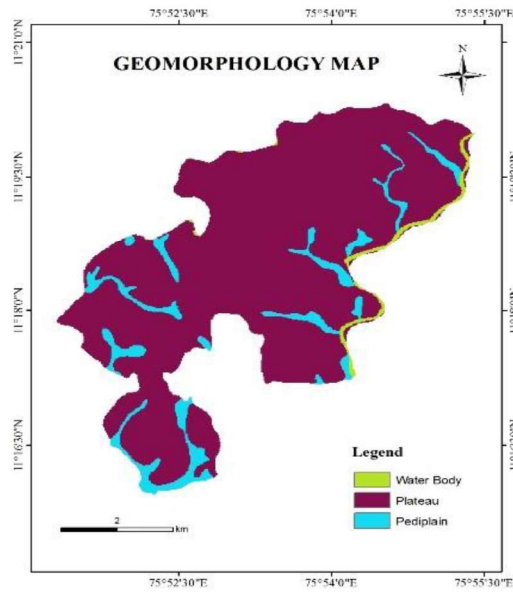


Fig 3. Geomorphology Map of Study Area

Land Use Land Cover

Land use Land cover gives the essential information on infiltration, soil moisture, groundwater, surface water etc, in addition to providing indication on groundwater requirements. The Kunnamangalam Panchayat exhibits a spectrum of land use categories which include agriculture land, built up land, wet land, waste land and water bodies. The high weight is assigned for water bodies, wet land and agriculture land and the low weight is assigned for the built-up land and waste land.

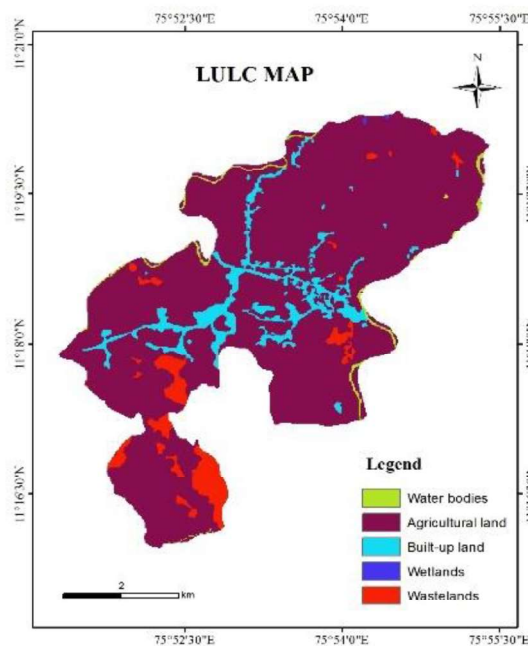


Fig 4. Land Use Land Cover Map of Study Area

Drainage Density

Drainage density plays a very crucial role in groundwater availability and contamination. The drainage network depends on lithology and also it provides an important index of infiltration rate. Drainage density is an inverse function of permeability. Therefore, it is a dominant parameter in the delineation of the groundwater potential zone. High drainage density illustrates less infiltration and hence do not favour much on the groundwater potential of the area. Low drainage density represents high infiltration and hence impart more to the groundwater potential. The regions were classified as low (0- 3.71 km/km²), medium (3.71- 7.43 km/km²) and high (7.43- 11.14 km/km²) drainage density zones. The low weight is assigned for high density and the high weight is assigned for low density.

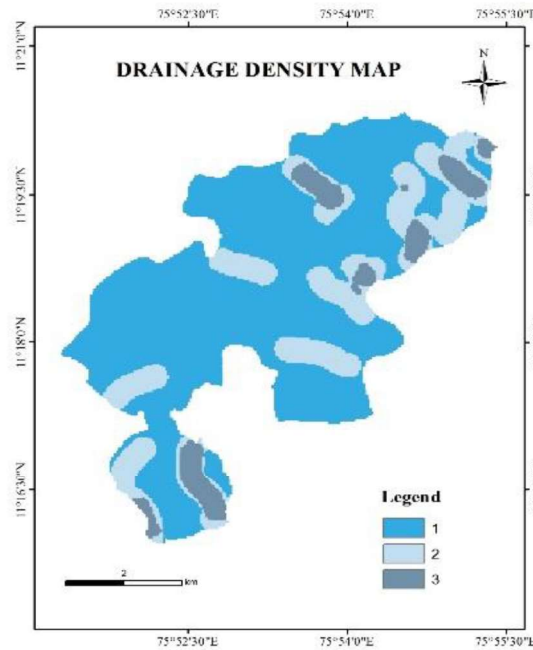


Fig 5. Drainage Density Map of Study Area

Lineament Density

Lineaments are structurally controlled linear or curvilinear features and it represent the zones of faulting and fracturing resulting in increased secondary porosity and permeability. The lineament density map was prepared using line density in GIS software. By carefully examining the values obtained, the data were reclassified into three categories - Low (0- 2.39 km/ km²), Medium (2.39- 4.78 km/km²) and High (4.78- 7.18 km/km²). The weightages are given for lineament density based on proximity of lineaments. It is disclosed that the intensity of groundwater potential decreases with increasing distance from the lineaments. For the ground water potential zonation, high weight is assigned for high density and low weight for low density classes.

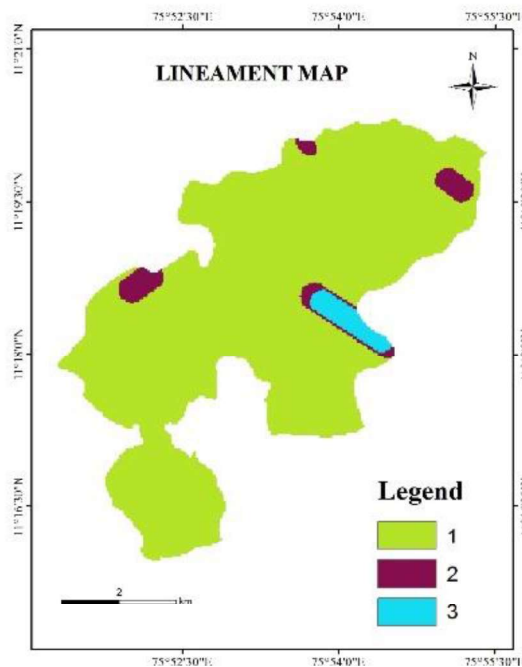


Fig 6. Lineament Density Map of Study Area

Soil

Soil types play an important role on the amount of water that can infiltrate into the subsurface formations and hence influence groundwater recharge. The soil texture and hydraulic characteristics are the main factors considered for estimation of rate of infiltration. Fig-7 depicts the soil map of the Kunnamangalam Panchayat. Soil types include gravelly clay and clay. The high weight is assigned for gravelly clay and the low weight is assigned for clay.

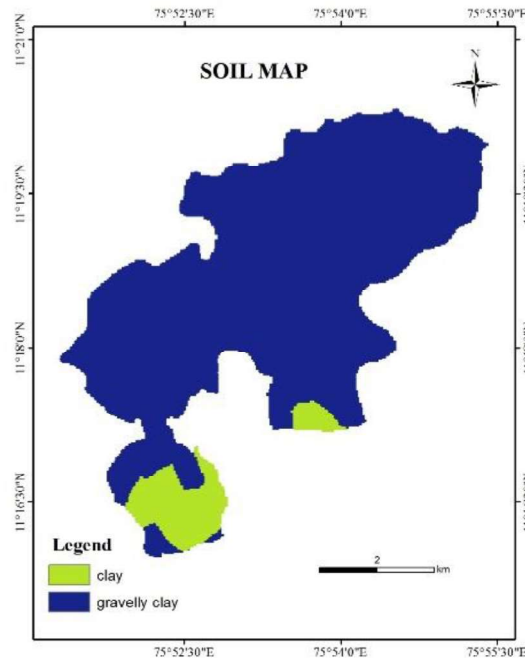


Fig 7. Soil Map of Study Area

Slope

The slope is a significant terrain characteristic which express the steepness of the ground surface. Slope gives necessary information on the nature of the geologic and geodynamic processes operating at regional scale. Surface runoff and rate of infiltration are influenced essentially by slope of the surface. Larger inclination produces smaller recharge because the water received from precipitation flows rapidly down a steep slope during rainfall. Therefore, it does not have enough residence time to infiltrate and recharge the saturated zone. Fig-8 depicts the slope map of the Kunnamangalam Panchayat. The slope values were reclassified and categorized into four classes such as flat (0- 5%), gentle (5- 15%), medium (15- 35%) and steep (35% & above). The high weight is assigned for gentle and flat slopes and the low weight is assigned for steep slope.

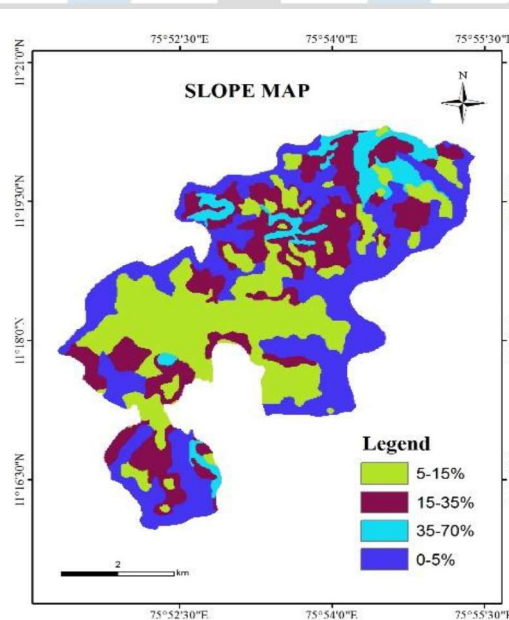


Fig 8. Slope Map of Study Area

Groundwater Potential Zone

Groundwater is a replenishable resource, but due to several criteria such as increased population, urbanization, and industrialization and various kinds of anthropogenic activities and skewed developments, recharge of this precious life sustaining resource has been reduced significantly. A better understanding of the groundwater potential is more important for planning and sustainable development of an area. Such information is essential for the design and implementation of structures for corrective

measures to improve the groundwater recharge processes. The parameters considered here are geology, geomorphology, LULC, lineament density, drainage density, soil and slope. These thematic layers were created in GIS background and the appropriated ranks and weights determined by the AHP method were assigned to them for the overlay process. According to the importance of each layer, weight was given to respective layers in weighted overlay analysis tool in the software to obtain groundwater potential zones. The result obtained were categorized into three classes- low, medium and high, the aerial spread of these categories are 4.42 km², 21.68 km² and 0.84 km² respectively. The total area of study is 26.94 km².

The Groundwater Potential Zones delineated are cross - validated with the results of the observation well data. A total of 7 observation wells are located in the area and all these wells were analyzed for the purpose. It is found that, the wells located in the low groundwater potential zones have low water yielding capacity. However, the wells located in moderate groundwater potential zones have moderate water yielding capacity and the wells located in high groundwater potential zones have high water yielding capacity while comparing with others. By the observation of well the obtained results have a better correlation with actual field data.

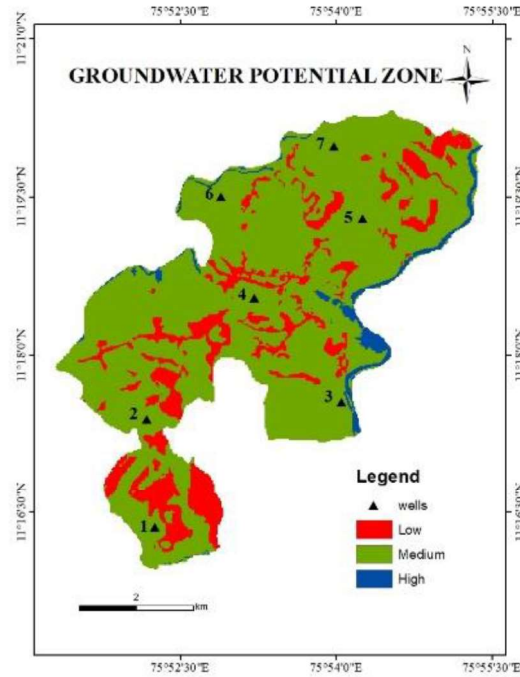


Fig 9. Groundwater Potential Zone of Study Area

VI. CONCLUSION

The present study is an attempt to delineate the groundwater potential zones using a combination of AHP and GIS techniques in study area, Kunnamangalam Panchayat, which is located in east of Kozhikode city on the Calicut-Bangalore National Highway. A total of 7 thematic layers such as Geology, Geomorphology, LULC, Soil, Lineament Density, Drainage Density, Slope were used in this study to delineate the groundwater potential zones. According to the final output map, the study area could be classified into three distinct ground water potential zones such as high, moderate and low. Moderate groundwater potential zone spreads over the catchment area and covers 80.4% of the study area. High and low groundwater potential zones cover an area of 3.1% and 16.4% respectively. From this study, it can be concluded that the GIS and AHP based techniques of delineation of Groundwater Potential Zones adopted herein is a useful method that can be used for the identification of ground water prospect area, evaluation of its sustainability, evaluation of its quality, identification of locations for site-specific recharge structures, development of wells, construction of recharge structures etc.

Table-II: Area of Groundwater Potential Zone

Sl. No	Category	Area (in km)	Area (in %)
1	Low	4.42	16.4
2	Medium	21.68	80.4
3	High	0.84	3.1
		26.94	100

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COMPARATIVE STUDY OF GYPSUM PANELS REINFORCED WITH SISAL FIBRE AND COIR FIBRE

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Abstract: In this current era there are some concerns of using synthetic fibres in regards to their impact on the environment, since they are non-recyclable and non-degradable. There are many attempts by various groups of engineers and researchers use natural fibres in engineering applications, in the hope of replacing synthetic fibres with natural fibres. In this study, the potential of utilizing natural fibres in construction substances is studied such as compressive strength and water absorption. Gypsum boards are reinforced using sisal fibres for the industrial and construction applications. The sisal fibre has been washed by fresh water and treated with concentration of NaOH (6%), to achieve a real interfacial adhesion between the gypsum and sisal fibre. Due to porous nature of sisal fibre-gypsum composites, as the presence of air voids work as traps and impeded the heat transfer, sisal fibre-gypsum composites performs better than glass fibre-gypsum composites as an insulation material. Hence in the project, we used sisal fibre and coir fibre as reinforcement in gypsum board by studying the mechanical behaviour of plain gypsum board. The optimum percentage of sisal fibre and coir fibre is found out by conducting test at different percentages. Experimental study is conducted to evaluate the compressive strength characteristics of sisal fibre and coir fibre reinforced gypsum board. Also water absorption of the optimum is also found out.

Index Terms: Sisal fibre, Coir fibre, Gypsum powder

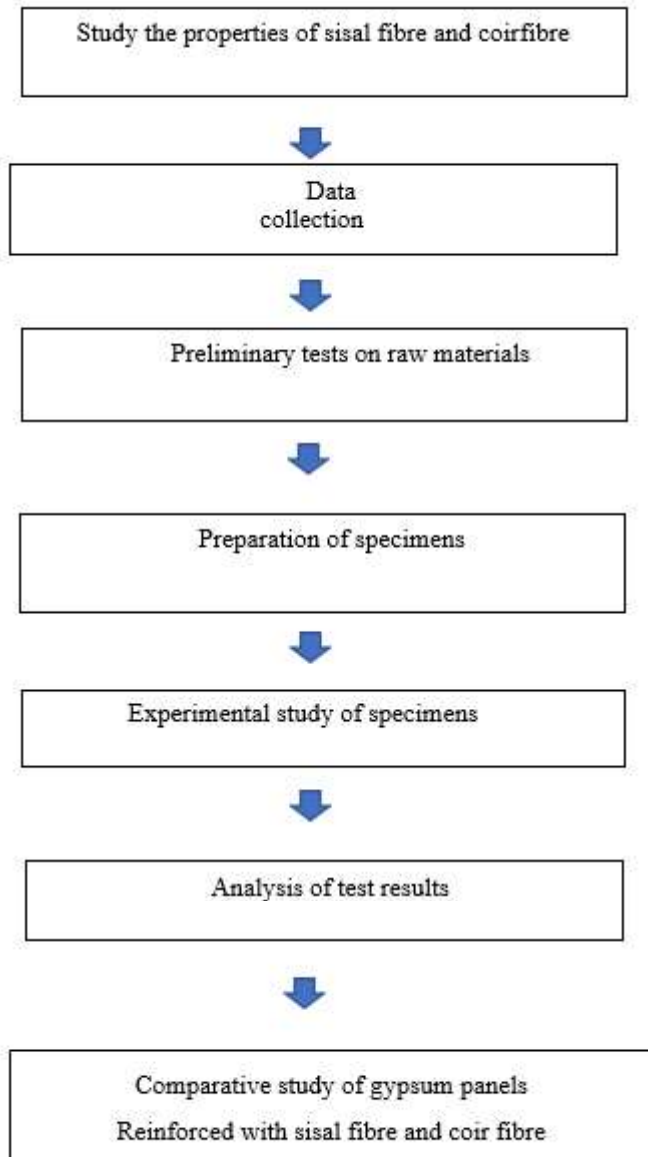
I. INTRODUCTION

Prefabricated gypsum boards have been commonly used in residential, industrial and commercial buildings. Facade panels, internal partitions and dry wall boards due to their low cost, light weight, thermal or acoustic insulation and fire resistance. Moreover, recycled gypsum, derived from gypsum waste plasterboard has recently been utilised as one of the wastes for ground improvement in desperate projects such as embankments, highways and significantly in geotechnical applications along with decreasing the Cost of ground improvement, this has many environmental benefits. Even though, the gypsum plaster itself has a compressive strength as high as 68.9 N/mm² at low water/plaster ratio. Gypsum plaster is weak in tension and it has low impact strength compared to another. In recent years glass fiber is reinforced in gypsum. Because it has light weight, versatility and strength. But application of a fiber as reinforcement in gypsum could also be beneficial in terms of cost efficiency, energy savings and environmental protection. In recent years, there has been an increasing interest in the substitute of synthetic fibers in many civil engineering fields of natural fibers such as coir, sisal, etc

Sisal is one of the natural fibers which better than other natural fibers in many ways including its higher strength, variation in its properties and quality due to growing, poor crimp property so on. The sisal plant has a 7-10-year life span and typically produces 200-250 commercial usable leaves. Each contains an average of around 1000 fibers. Traditionally sisal has been leading material agricultural twine because of its strength, durability, ability to stretch, affinity for certain dry stuffs and resistance to deterioration in salt water. Apart from ropes twine, sisal has been utilised as an environmentally friendly strengthening agent to replace asbestos fiberglass in composite material in various uses.

Coir fibre is also a natural fibre which have high durability and high strength. It is suitable for green building material. The name coir comes from the word kayer. Floor mats, doors, brushes and mattress-like materials made up of natural fibres are extracted from the outer coconut husk. Coir is the hardest internal shell. Mechanical properties of material that exhibits its elastic and flexible (plastic) behaviour. In this study the mechanical properties such as transverse strength, compressive strength and water absorption of gypsum using sisal fiber and coir fibre as reinforcement and compared with those properties of plane gypsum board.

METHODOLOGY



Materials required

- i. Gypsum
- ii. Sisal fibre
- iii. Coir fibre

Gypsum

Gypsum is a soft sulfate mineral composed of calcium sulfate dihydrate, with the chemical formula $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$. It is widely mined and is used as a fertilizer and as the main constituent in many forms of plaster, blackboard/sidewalk chalk, and drywall. A massive fine-grained white variety of gypsum is called as alabaster. And it has been used for sculpture by many cultures including Ancient Egypt, Mesopotamia, Ancient Rome etc. Gypsum is crystallized into translucent crystals of selenite. It also forms as an evaporite mineral and as a hydration product of anhydrite.



Fig 1. Gypsum powder

Sisal fibre

It is one of the most widely used natural fibre and it is easily cultivated. It is obtained from the plant known as *Agave sisalana*. These plants produce rosettes of sword-shaped leaves which start out toothed, and gradually lose their teeth with maturity. Each leaf of sisal plant contains a number of long, straight fibres. It can be removed by a process called as decortication. The leaves are beaten to separate the pulp and plant material, leaving the tough fibers behind during decortication. The sisal fibers can be drawn out and twisted into thread for the production of twine and textile or it can be pulped to make paper product. In sisal agriculture there are no pesticides and chemical fertilizers used. It is a stiff fiber traditionally used in making twine, rope. It is used in automotive friction parts (brakes, clutches), where it imparts green strength to performs, and for enhancing texture in coatings application.



Fig 2. Sisal fibre

Coir fibre

Coir fibre is also a natural fibre which has high durability and high strength. It is suitable for green building material. The name coir comes from kayer Floor mats, doors, brushes and mattress-like materials made up of natural fibres are extracted from the outer coconut husk. Coir is the hardest internal shell. Mechanical properties of a material that exhibits its elastic and flexible (plastic) behaviour.

Fig 3. Coir fibre



Tests on raw materials

Tests on gypsum are conducted to analyze its characteristics. Consistency test and setting time test are conducted on the specimens as per IS 2542 part 1– 1981. The tests conducted on Gypsum are,

- a) Consistency test on Gypsum
- b) Setting time of gypsum

Casting of specimens

Specimens having 12 mm thickness are casted for different tests as per IS I 2542

- a) Water absorption test : 175mm x 75 mm
- b) Compressive strength test : 70.71 x 70.71 x 70.71 mm

Tests on specimens

Water absorption test and compressive strength test are conducted on the specimens as per IS 2542 part 2 – 1981.

Analysis of result

After the tests are conducted the results are analyzed to find out the optimum content of fiber and gypsum combination.

Experimental test procedure

To meet objectives of the project, a detailed experimental study was carried out. The study on the sisal fibre and coir fibre reinforced gypsum boards were checked out through detailed investigation of its strength properties by casting boards in different fibre proportions.

Tests on materials used for experiment

Tests on material used for experiment are normal consistency of gypsum plaster as per IS : 2542 (Part 1/Sec 1) -1978 and setting time of plaster as per IS : 2542 (Part 1/Sec 3) – 1978.

Normal consistency of gypsum plaster

In this experiment first clean the plunger, mould and base plate of the modified Vicat apparatus. Apply a thin coat of a petroleum jelly or other suitable lubricant on the upper surface of the base plate in order to prevent leaks during the test. Sift a weighed quantity

of the sample (200 to 300 g as required to fill the mould) into a known volume of water. If the plaster is unretarded, add to the mixing water 0.1 g of commercial retarder per 100 g of sample.

After allowing the sample to soak for 2 minutes, stir the mixture for 1 minute to an even fluidity. Pour this sample into the vicat mould, work slightly to remove air bubbles, and then strike off flush with the top of the mould. Wet the plunger of the modified vicat apparatus and lower it to the surface of the sample at approximately the centre of the mould. Read the scale and release the plunger immediately. After the rod has settled read the scale again. Readings are reproducible on a retarded mix, and therefore, in order to eliminate error 2 or 3 determinations should be made on each mix, care being taken to have the mould completely filled and the plunger clean and wet.



Fig 4. Consistency test on gypsum

Setting time of plaster

Mix 200 g of the sample in such quantity of water as will give a paste of normal consistency (using the method of mixing given in Part I/Section 1, except that no retarder shall be used when conducting the test), pour into the Vicat mould, shake a few times to remove the air entrapped and level off flush with the top of the mould. Allow the needle to sink into the paste and remove it to the original position. After each penetration, wipe the needle clean and move the mould slightly so that the needle will not penetrate at the same point twice. Depending upon the character of the material, test the sample frequently at such intervals as are necessary to determine whether it complies with the requirements for time of setting for the product tested. Set shall be considered complete when the needle no longer penetrates to the bottom of the paste. Until set, store the test specimens in a cabinet at a temperature of $27 \pm 2^\circ\text{C}$ in an atmosphere having a relative humidity of 85 to 100 percent. Record as the time of setting of the sample the elapsed time in minutes from the time when the sample was first added to the water to the time when set is complete.

Casting of test specimens

Panels and cubes are casted for testing water absorption test and compression test respectively. For water absorption test the size of test specimen is 175 x 75 x 12mm. For compressive strength test the size of test specimen is 70.71 x 70.71 x 70.71mm.

Mix proportion

Various mix proportions were calculated for different percentage of fibres and corresponding mass of gypsum and fibres were taken.

Batching

Batching is the process of measuring and combining the ingredients as per mix design. Batching accuracy is very important. It can be done by 2 methods.

- i. Volume batching
- ii. Weight batching

We have used weight batching for our tests.



Fig 5. Batching

Mixing

Mixing is done to control the workability of the mix. All mixing were done manually. Gypsum powder and fibres are mixed thoroughly and then it is mixed with water until a uniform mix is formed.



Fig 6.Mixing

Casting

After mixing it is introduced into the mould with proper compaction. The surface of the gypsum was smoothed, specimens were demoulded 1 day after casting.



Fig 7. Casting



Fig 8. casted specimen

Tests on specimen

The tests on specimens are water absorption test (IS : 2542 (Part II/Sec 6 1981) and compression test (IS : 2542 (Part II/Sec 5 1981)).

Water absorption test

In this test the specimens shall be completely immersed in water at 27 ± 2 °C for a period of 24 hours, with at least 30 mm height of water over the top of the specimen which shall be so positioned that it does not lie flat on the bottom of the container. These shall be taken out and weighed (W1) after removing surplus moisture with a damp cloth. The specimens shall then be placed in an air-oven capable of being raised to 105°C and then maintained at that temperature constantly. The specimens shall be dried until constant mass (within ± 0.1 percent of the mass of the specimens) is attained and the mass (W2) shall be recorded for each specimen.



Fig – 9 : Specimen immersed in water

The percentage absorption shall be calculated as follows:

$$\text{Percentage absorption} = \frac{(W1-W2)}{W2} \times 100$$

Where,

W1= Mass of specimen after absorption

W2=Mass of specimen after heating

Compressive strength test

Mix sufficient quantity of gypsum, fibre and water at normal consistency to produce mortar and cast into three specimen moulds. Coat the moulds with a thin film of mineral oil or other mould release agent and place on an oiled glass or metal plate. Fill the mould with mortar and compact it to expel air bubbles . As soon as the mortar or paste has set, cut off the excess to a plane surface flush with the top of the mould, using a stiff broad knife or similiar implement. Place the filled moulds in moist air (90 to 100 % relative humidity). Remove the cubes from the moulds at any time after they are thoroughly hardened, but retain in the moist air for not less than a total of 16 h. Test the cube using compression testing machine.



Fig – 10 : Compression testing

II . RESULT AND DISCUSSION

Consistency test

It is the amount of water required to mix a given amount of plaster to a state of fluidity. The required amounts are expressed as milliliters of water for 200g of gypsum. For the gypsum we have used for the test the consistency is 90 ml (that is 44%) of water for 200g of gypsum.

Setting time test

When the powder is mixed with water, the time that elapses from the beginning of the mixing until the material hardens is known as setting time.

Initial setting time : 5 minutes

Final setting time : 30 minutes

Water absorption test

The water absorption of gypsum board reinforced with sisal fibre is found to be 61.23%, 58.86%, 63.66% and 68.89% for 0%, 1%, 1.5% and 2% respectively, And the water absorption of gypsum board reinforced with coir fibre is found to be 61.23%, 61.43%, 66.32% and 60.87% respectively.

Table-1: Water absorption test results

Sisal fibre content in (%)	Weight after 24 hr immersion in water (w1), g	oven dried weight (w2),g	Water absorption in (%)	Avg.
0%	220	136	61.76	61.23
	225	140	60.71	
1%	250	157	59.23	58.86
	252	159	58.49	
1.5%	225	138	63.04	63.66
	230	140	64.28	
2%	225	133	69.17	68.89
	231	137	68.61	

Table- 2: Water absorption test results

Coir fibre content in (%)	Weight after 24 hr immersion in water (w1), g	oven dried weight (w2),g	Water absorption in (%)	avg
0%	220	136	61.76	61.23
	225	140	60.71	
1%	219	136	61.01	61.43
	212	131	61.83	
1.5%	237	143	61.73	66.32
	232	139	66.91	
2%	239	137	74.45	70.2
	234	141	65.95	

Result obtained is, for 1 % of sisal fibre reinforced in gypsum board is found to have a water absorption of 58.86. And for 2 % of coir fibre reinforced in gypsum board is found to have a water absorption of 70.2 .

Compressive strength test

Table – 3 : Compressive strength test result

SI no	Sisal fibre content(%)	compressive strength (MPa)
1	0%	5
2	1%	5.3
3	1.5%	6
4	2%	7.2

Table – 4 : Compressive strength test results

SI no	Coir fibre content(%)	compressive strength (MPa)
1	0%	5
2	1%	5.15
3	1.5%	5.6
4	2%	6.2

Compressive strength goes on increasing while adding different percentage of fibres in gypsum.

III CONCLUSIONS

From the obtained test results it can be concluded that the sisal and coir can effectively used as fibre reinforcement for Gypsum. Gypsum absorbs more water than expected this can be overcome by using water proof coatings. Gypsum board can be used as substitution material against conventional partition wall system.

The water absorption of board is found to be optimum when adding 1 % of sisal fibre.

As we recommend this as inner partition wall system so the risk of water absorption is almost negligible. Further study have to done in this area to overcome this drawback.. Compression strength goes on increasing when fibre is added.

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Planing And Design of A Prestressed Over Bridge At Eranhipalam

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Abstract— In this project we are doing planning, analysis and design of prestressed over bridge. A bridge is a structure providing passage over an obstacle without closing the way beneath the obstacle. It's used to cross may be a river or a road, In other words, bridge is a structure for carrying the road traffic or other moving loads over a depression or obstruction such as channel, road or railway. Superstructure or Decking, Bearings, and Substructure are the components of bridge. Prestressing is a method for overcoming concrete's natural weakness in tension. It can be used to produce beams, floors or bridges with a longer span than is practical with ordinary reinforced concrete

Keywords—*Key Words: Prestressed flyover, Superstructure, Decking, Bearing, Substructure*

1.INTRODUCTION

Our project deals with the design of prestressed concrete over bridge at Eranhipalam junction, Calicut with an objective of reducing traffic congestion and there by reduces the number of accidents. Flyovers are the key elements in any road network. Use pre-stressed concrete flyover is gaining popularity in bridge engineering fraternity because of its better stability, serviceability, economy, aesthetic appearance and structural efficiency

1.1 DESIGN PHILOSOPHIES

There are three philosophies for the design of reinforced concrete namely:

- 1) Working stress method
- 2) Ultimate load method
- 3) Limit state method

1.2 OBJECTIVE

- Analyse need of flyover at the proposed site.
- Designing the flyover manually.

1.3. BRIDGE

A bridge is a structure providing passage over an obstacle without closing the way beneath. The required passage may be for a road, a railway, pedestrians, a canal or a pipeline. The obstacle to be crossed may be a river, a road, In other words, bridge is a structure for carrying the road traffic or other moving loads over a depression or obstruction such as channel, road or railway.

1.3.1. Components of bridge

The bridge structure comprises of the following parts.

- Foundation
- Piers and Abutments
- Substructure
- Bearings
- Wing walls and Returns

1.4. PRESTRESS

Prestressing is a method for overcoming concrete's natural weakness in tension. It can be used to produce beams, floors or bridges with a longer span than is practical with ordinary reinforced concrete. Prestressing tendons (generally of high tensile steel cable or rods) are used to provide a clamping load which produces a compressive stress that balances the tensile stress that the concrete compression member would otherwise experience due to a bending load.

1.4.1. Advantages of prestressed concrete

- Section remains un-cracked under service loads.
- Reduction of steel corrosion, thereby increase durability
- Full section is utilized
- Less deformation
- Suitable for use in pressure vessels, liquid retaining structures
- Larger spans possible with pre stressing
- For the same span, less depth compared to reinforced concrete member
- Reduction in selfweight
- More economical section
- Suitable for precast construction

2. LOCATION OF SITE

- This project deals with the design of prestressed concrete over bridge at Eranhipalam junction, Calicut.
- The junction is connected to 2 highways, namely NH-47 and NH 766
- The proposed overbridge is across NH 766

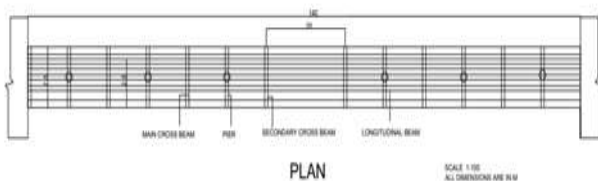


3. LOAD SPECIFICATIONS

A load is considered primary or secondary according to the part of the flyover which shall be designed. Wind loads are secondary loads in designing the main girders and primary load in designing the wind bracings.

Primary loads includes dead load, live load impact load and centrifugal forces. Secondary loads includes wind pressure, breaking force, lateral shock effect, temperature effect, frictional resistance at movable bearing, forces due to settlement of supports and effect of shrinkage and creep of concrete.

4. PLAN



5. MANUAL DESIGN

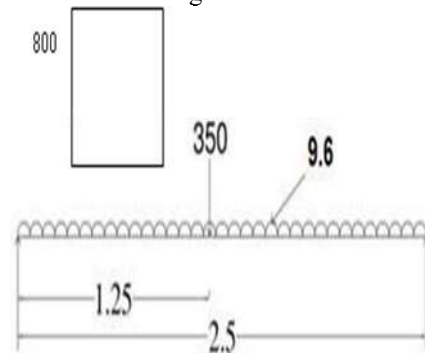
5.1. Design Of Interior Panel

Interior dimensions of interior panel
 Width=2m
 Length=10m
 Thickness of wearing coat=80mm
 Width of support=50cm
 Effective clear width of panel=2.5m
 Effective length of panel=10.5m
 Weight of slab=6.25KN
 Weight of wearing coat=1.76KN
 Total dead load=8.01KN/M²
 Factored dead load=12.015KN/M²
 Here $l_y/l_x > 2$ therefore it is a one way slab.
 Dead load shear=15.018KN
 Loading-IRC Class AA Loading
 Short span bending moment=40.21kNm
 Long span bending moment=11.5kNm
 IRC Class A loading:
 Short span bending moment=6.54kNm
 Long span bending moment=1.87kNm
 Maximum short span bending moment=40.21kNm
 Total max short span bending moment=69.69kNm

IRC Class AA:
 Total bending moment=85.8kNm
 IRC Class A loading:
 Total bending moment=21.86kNm
 Using M20 concrete and Fe415 steel,
 μ limit=85800000
 Effective depth=200mm
 Area of steel A_{st} =1388.94mm²
 Assuming 16 mm diameter bars,
 Spacing=140mm
 DISTRIBUTION STEEL
 Bending moment=19.96kNm
 Area A_{st} =284.98mm²
 Spacing for 10mm diameter bars=250mm

5.2. Design Of Intermediate Cross Beam

A cross beam is a long thick bar of wood, metal or concrete that is placed between two walls or other structures in order to support the roof of a building.



Bending moment =226.25kNm
 Shear force=187kNm
 Using limit state method of design
 For Fe 415 steel, f_y =415N/mm²
 For M₂₀ concrete, f_{ck} =20N/mm²
 MR constant $R=2.76$
 Computation of design bending moment and shear force
 Bending moment=339.3kNm
 Shear force=280.5KN
 Computation of effective depth
 For a balanced section
 Depth =554.43mm²<760
 Steel reinforcement
 Area of steel=1132.51mm²
 Using 20mm dia bars
 No. of bars=4nos
 Actual area of steel=1256.63mm²
 Required moment, M_{ur} =315.24*10⁶Nmm
 Ultimate moment, M_{Ulim} =637.67*10⁶Nmm
 $M_{ur} < M_{Ulim}$ the design is ok
 Check for shear
 V_u =280.5*10³N
 Nominal shear stress=0.922N/mm²
 Permissible shear stress
 Percentage of steel=0.41%
 From IS 456, table 19
 Provide shear reinforcement
 V_{us} =149780N
 Spacing for 2 legged 10mm stirrups

$S_v=287.77\text{mm}$

Say 250mm c/c

Check for minimum steel area

$S_v=354.4\text{mm}>250\text{mm}$

Hence safe.

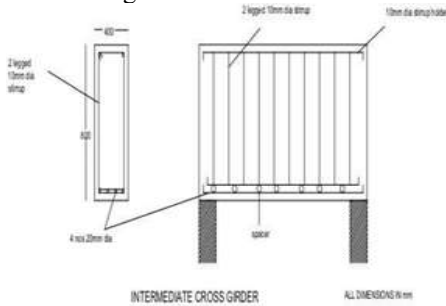
Space occupied=160mm<400mm

Check for deflection

Span/effective depth=20 for simply supported

But,span /effective depth provided=3.2<20

Hence design is safe.



6.CONCLUSION

This project concludes the planning and design of flyover structures. This structure reduces the traffic control and enhances the driving. The structure is designed as per IRC class AA loading. This project helps to reduce traffic conjunction.

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DESIGN AND TREATABILITY STUDIES OF GREYWATER

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Abstract - This paper presents the design of laboratory scale grey water treatment system, which is restricted to four stages of physical operations. The continuous flow-based constructed bio-bed filter for grey water treatment is a technique for reusing the domestic grey water. The system has been found as more effective for treating the Physico-chemical parameters such as pH, electrical conductivity, TSS, TDS, BOD, COD. The results reported the removal efficiency in the biological oxygen demand (86.2%), chemical oxygen demand (81.1%). Consequently, this biofiltration method is natural, simple, and low cost-effective treatment.

Key Words: Grey water, biofiltration, Recycling.

1. INTRODUCTION

Grey water can be defined as the wastewater generated from the baths, showers, hand basins, washing machines, laundries and kitchen sinks. The main objectives of the biofiltration greywater treatment system are to provide a better way for greywater disposal, issues of greywater treatment odors around the treatment plants[26]. The present study is focuses on the theoretical and modelling aspects of developed bio-filter and to investigate the performance of the bio-filter in removing organics, nutrients from grey water.

1.1 Treatment of Greywater

Greywater treatment includes physical, chemical and biological processes, and followed by pre-treatment and disinfection, respectively. Coarse sand, soil and membrane filtrations are the commonly applied physical processes. Greywater treatment is essentially required to reduce the organic load, nutrients and pathogenic microorganisms. Untreated greywater discharged in to any ecosystem is unsafe and hence proper treatment is required for safe discharge of greywater.

2. METHODOLOGY

The easily available and natural materials were used as filter media in the laboratory scale biofiltration unit such as sand, gravel, activated carbon and plants. The samples were collected from storing tank at every 10th day for the analysis. These samples were analysed by standard method at laboratory. The parameter such as pH, EC, Total suspended solids (TSS), Total dissolved solids (TDS), Chemical oxygen demand (COD) and Biochemical oxygen demand (BOD) were

determined of raw and treated water sample for the performance study of the grey water treatment system.

2.1 Collection of Greywater Sample

Grey water sample was collected from home kitchen, wash basin, washing machine. It was stored in tank of 30 litre capacity. Containers are filled with water, transported to the laboratory investigation of grey water before treatment and refrigerated. However, maximum effort was taken to get the samples analysed within 24 hrs of the storage.

2.2 Designing of Bio-bed Filter

The plastic containers were used for the construction of four same rectangular bio-beds with proper dimensions [35 cm (l) x 14 cm (b) x 19 cm (h)]. Four experimental setups were designed for grey water treatment and their structures are given as follows. Fig.2.1 shows bio filtration experimental setup. The first bio-bed contains gravel and sand. coir waste and sand were filled one above the other in the bio-bed horizontally in second bio-bed. Gravel, soft clay, red soil and humus were filled in third bio-bed. The filter bed four was filled charcoal and sand.

2.3 Determination of Filtration Performance

The treated grey water samples were collected in a well cleaned container and stored in a tank. The grey water samples from tank were collected at regular intervals and physico-chemical parameters were determined for raw and treated grey water samples. The parameters such as pH, EC, TDS, TSS, BOD, and COD were measured in the laboratory using the standard procedure.

3. RESULTS AND DISCUSSION

The effectiveness of the developed bio-bed filters determined by carried out physio-chemical analysis on the filter-treated water samples at regular intervals of ten days. In the physico-chemical analysis, three different greywater samples were used.



Fig -1: Bio-bed filter setup

Table -1: Water test results after filtration

PARAMETER	UNITS	DAY 10	DAY 20	DAY 30
pH	-	8.02	7.92	7.8
EC	μS/m	950	630	540
TDS	mg/L	870	756	515
TSS	mg/L	215	185	135
BOD	mg/L	97	68	35
COD	mg/L	285	174	87.2

3.1 Calculation of Removal Efficiency

The removal efficiency of the following physico-chemical parameters is analyzed and the values are tabulated below. Sample II showing the maximum removal efficiency of various parameters. Removal efficiency was found to be 63.7 % for TDS 51.7 % for TSS and in bio-bed filter. Also, the removal efficiency for BOD and COD were found to be 86.2 % and 81.1 %.

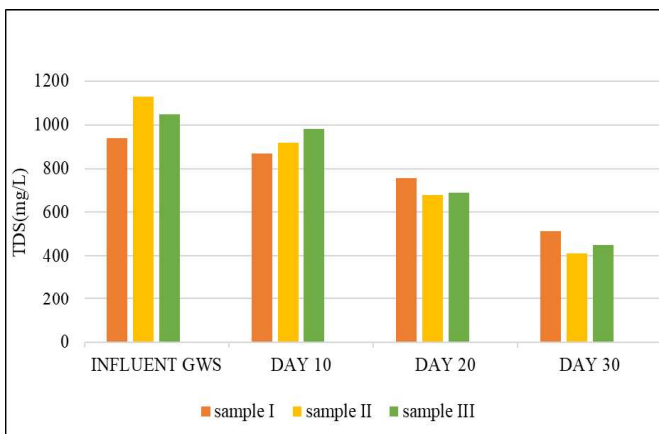


Chart -1: Variation in TDS value

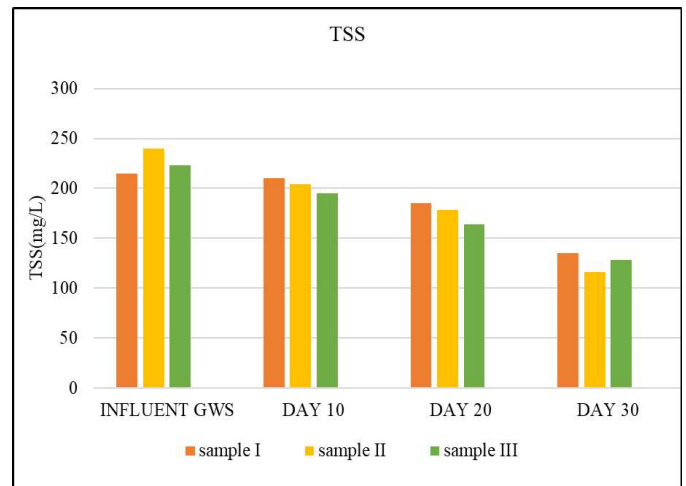


Chart -2: Variation in TSS value

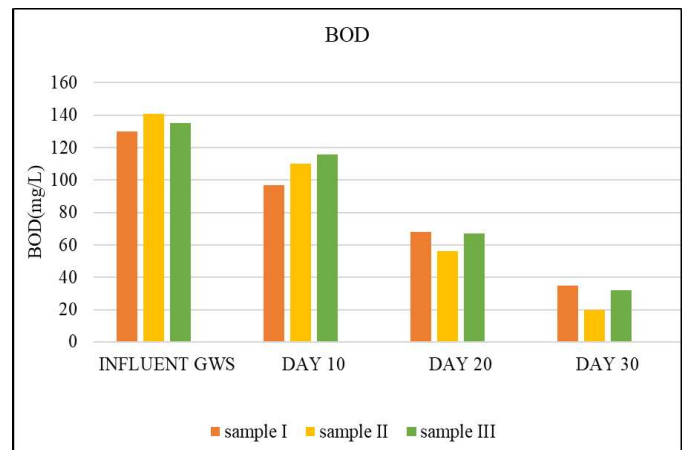


Chart -3: Variation in BOD value

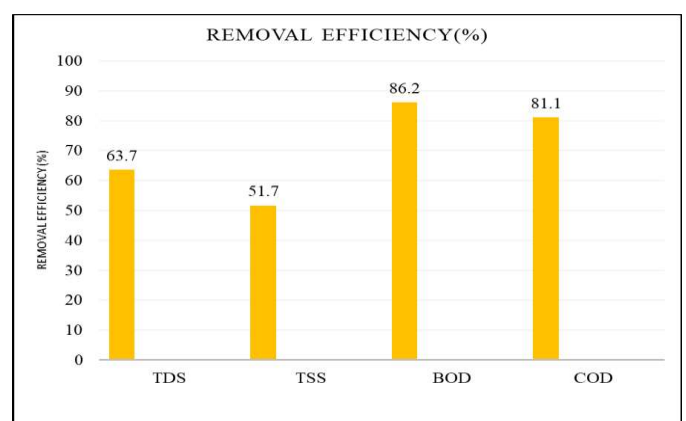


Chart -4: Variation in removal efficiency

4. CONCLUSIONS

The designed low-cost technology for grey water treatment was found to produce grey water characterized by high potential for BOD, COD, TSS and TDS. The materials used in this system such as sand, gravel, clay, red soil, humus, coir

waste, charcoal used in the grey water treatment were found to be effective purifiers. Hence, this method is environment friendly, without chemical operation, less time consuming, low energy demand, less operating and maintenance cost, highly effective purification, and less area occupied. Treated grey water becomes reusable after treatment and can be used for irrigating the garden or flushing the toilet.

ACKNOWLEDGEMENT

I express my heartfelt and sincere gratitude to God the Almighty for allowing the successful completion of this work without any disruption. For the project work there were many dedicated and highly qualified persons to help me. I avail this opportunity to express our gratitude and indebtedness to all who directly or indirectly had an impact on me for the project.

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CERAMIC WATER FILTER FOR DRINKING WATER TREATMENT

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Abstract – One of the greatest threats to human health in developing countries is the drinking water contamination. Ceramic water filters (CWFs), manufactured from naturally sourced materials and manufactured by local labor are one of the most socially acceptable for drinking water treatment technologies because of their effectiveness, low-cost and ease of use. Ceramic water filtration has been greatly improved to remove most of the microbial contamination in water. In past, the developed ceramic filters are not able to treat chemical contaminants in water. Therefore, aim of this project is to develop a ceramic water filter that could remove certain chemical contamination in water at the household level. This review also summarizes the critical factors that influence the performance of CWFs, including CWF manufacturing process (raw material selection, silver impregnation), and initial water quality before treatment.

Key Words: Ceramic water filter; silver coated calcium hydroxyapatite; Burn out materials

1. INTRODUCTION

In the early 2022, the world population has reached 7.9 billion. It is estimated that 884 million people, that is 1 in 9 do not have access to clean drinking water sources. The World Health Organization reported that 80% of gastrointestinal disease is caused by the use of contaminated drinking water. *Vibrio cholera*, *Escherichia coli*, and *Shigella dysenteriae* are some of the pathogens that are commonly found in drinking water in developing communities and can cause diseases such as diarrhoea, that could lead to dehydration, malnutrition or even death. Nearly, 99.8% child deaths resulting from gastrointestinal infections is happening in developing countries. The major causes of these infections and the resulting deaths are lack of access to drinking water and exposure to waterborne diseases from unsafe drinking water. Finally, all water related diseases are caused due to the lack of provision of sufficiently pure water for the basic needs of the community.

1.1 Development of Ceramic Water Filter

A filter is defined as a device, which removes something from whatever passes through it. Therefore, ceramic water filtration is defined as the process in which a porous ceramic (fired clay) medium is used to filter microbes or other contaminants from water. Ceramic water filters (CWFs) are simple and effective devices made from naturally available materials for providing safe drinking water. This technology

is currently used in more than 50 countries as a cheap and effective point-of-use water treatment option. The size of pores in the ceramic medium is small enough to trap anything bigger than a water molecule. From the ancient times to the present, water filters have developed of necessity, initially to remove materials that affect appearance, then to improve unacceptable tastes and then to remove contaminants that can cause disease and illness.

1.2 Ceramic Filtration System

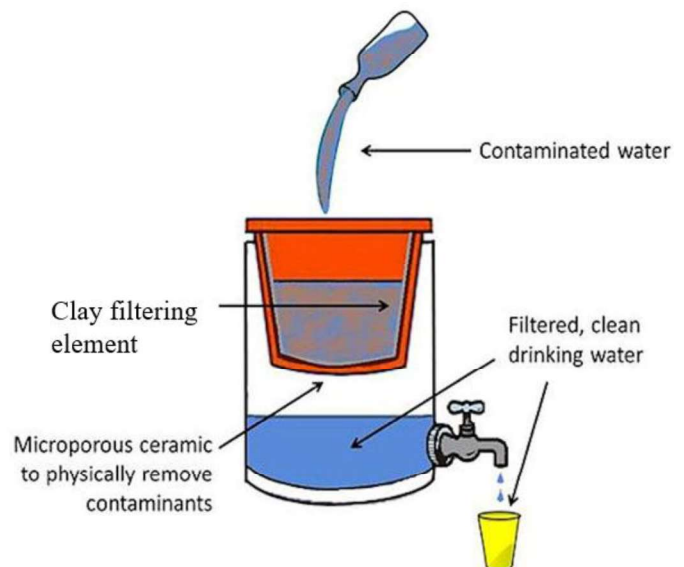


Fig -1: Ceramic water filtration system

Usually, ceramic pot filters are made which is kept above a plastic or clay receptacle. Water to be filtered is poured into the ceramic filter. A lid is provided at top to prevent further contamination of water. The water will flow through the minute pores of the filter into the receptacle placed below. During this path of flow contaminants gets trapped in these nano-micro pores and thus removing bacterial and chemical contaminants. And finally filtered water will reach the receptacle which can be taken out using a plastic faucet placed outside the bottom of the receptacle.

2. METHODOLOGY

CWFs are fabricated from a mixture of clay and organic combustible materials (e.g., rice husks or sawdust) also known as burn-out materials. Porous structure of ceramic filter is created as a result of the burn-out during the firing

process. Manufacturing of conventional ceramic filter includes raw material selection and processing, mixing and pressing, drying and firing, as well as quality testing. The clay that was used in this study was obtained from potters. The combustible materials used are sawdust and activated carbon. The sawdust is collected from Sawmill. Activated carbon is prepared from wood charcoal using lime. Both sawdust and activated carbon subjected to a 500-µm sieving. Silver coated calcium hydroxyapatite were used as obtained from the suppliers. It consists of a white powder (average particle size of 5µm) of Ca₃(PO₄)₂ having silver coating.

2.1 Processing of Ceramic Water Filters

Four ceramic water filters were made from a mixture of clay, combustible material as sawdust, without silver coated calcium Hydroxyapatite and one filter is made with the addition of silver coated calcium Hydroxyapatite. The sawdust was used as a pore forming agent to trap some contaminants, while hydroxyapatite was used for the substitution of chemical contaminants. Collected clay was crushed into powdered form, which is then mixed with the sawdust in four proportions. Initially, Sieved clay powder and combustible materials were mixed dry and then wetted by adding water, then wedged and rolled into a smooth homogenous mixture. The resulting paste were molded into shape of a pot in a plastic cup. They had an internal base diameter of 90 mm, internal lid diameter of 110 mm, and internal height of 110 mm, with a thickness of 15 mm for the base and 10 mm for the sides. After pressing, the filters were air-dried for 8 days and fired for 3-4 hours. The percentage of sawdust which give optimum filtration and mechanical performance is found.

2.2 Characterization of Structure

The porosity of the filters was measured by water absorption. Compute the weight of dry filter, W_d . Immerse the filter completely in water for 24 hours. In air after wet-wiping take the wet weight of the filter, W_w . Finally, the mass of the samples was measured under water (i.e., hydrostatic weighing) W_h . Porosity can be calculated as follows:

$$\text{Porosity} = \frac{W_w - W_d}{W_w - W_h}$$

Compare the porosities of filters having different percentage of sawdust and filter having optimum porosity was found.

2.3 Collection of Contaminated Water

Three sampling points having contaminated open well water is traced. Collection of water samples were done from each of these sites. Water samples were collected from these open wells using sterile plastic bottles. Containers are filled with water, transported to the laboratory and refrigerated.

2.4 Determination of Hydraulic Performance

The hydraulic performance of the samples was determined by water discharge. Usually a receptacle was placed under the ceramic water filters. The mass of water discharged from the filters to the receptacle was recorded as a function of time. The water discharge was then obtained by dividing the mass of water discharged by the density (1 g/cm³). Finally, the flow rate was regarded as equal to the slope of the curve water discharge as a function of time. The filter having optimum flowrate is found and flowrate of 2 to 3 litre per hour is considered as optimum.

2.5 Determination of Filtration Performance

The effectiveness of the developed filters was determined by carrying out physio-chemical and microbial analysis on raw and the filter-treated water samples. Three localities having contaminated open well drinking water were traced. Water samples were collected from each of these sites. Physiochemical and bacterial analysis before and after filtration were done. The contaminant removal efficiency of the filter was calculated.

3. RESULTS AND DISCUSSION

The results show that the developed filters are effective in the treatment of physio-chemical as well as bacterial contaminants detected in the water samples. It can be seen that the removal efficiency increases with increase in percentage of clay content in the filter composition.

3.1 Estimation of porosity and flowrate

Table 1 shows the estimated porosity and flowrate of various filters having different sawdust concentration. Filter C 70 has High porosity (58.3%). This is the resultant of high clay to sawdust ratio. Porosity increases with increase in sawdust content. Filter C 85 has the lowest porosity (38.7%). The flowrate testing result shows a similar pattern as that of porosity. Filter C 70 has the highest flowrate (2000ml/h) and C 85 has the lowest flowrate (250ml/h).

Table -1: Estimated porosity and Flowrate of filters

Filter code	Clay Sawdust ratio	Porosity (%)	Flowrate (ml/h)
C 70	70 : 30	58.3	2000
C 75	75 : 25	52.5	1200
C 80	80 : 20	46.8	400
C 85	85 : 15	38.7	250
CS 75	75 : 25	54.7	1300

3.2 Filtration Performance

In the microbiological analysis, three different raw water samples based on their sources were used. The analysis involved testing for bacterial counts, total coliform and fecal coliform counts.

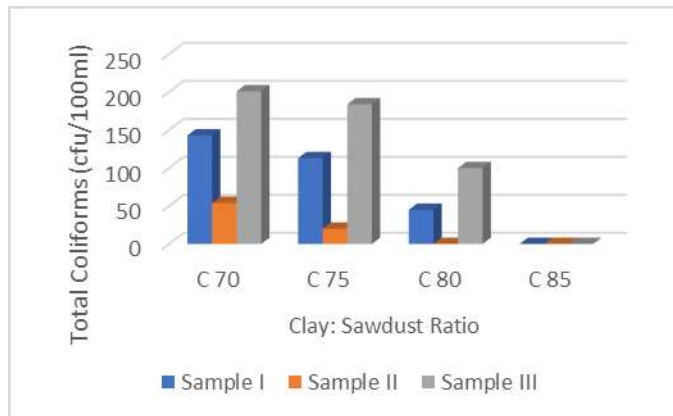


Fig - 2: Total Coliform variation for different sawdust content

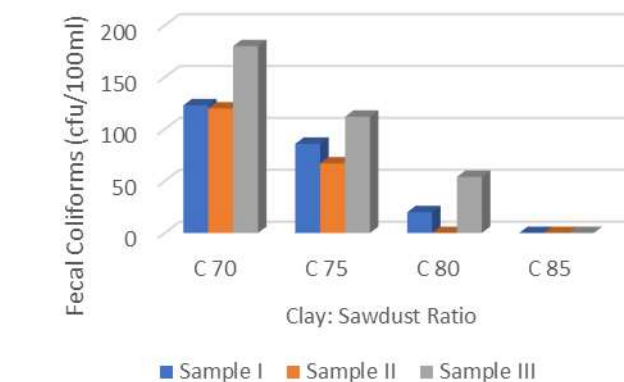


Fig - 3: Fecal Coliform variation for different sawdust content

The results of the open well and borehole samples indicated recontamination in the treated water samples. But based on the initial results, filter C 75 was observed to have given the best treatment with percentage reductions in bacterial counts of up to 70% in the well samples and 80% reduction in the borehole samples. Filter sample C 85 gave a 100% reduction of coliform in the well water samples. For the physio-chemical analysis, three different raw water samples based on their sources were used. They were the open well and borehole raw water sources. The results show that all the filtered samples improved iron and nitrate upto 90%. While the filtered samples increased TDS and electrical conductivity. This is due to the leaching of some clay minerals into the sample water.

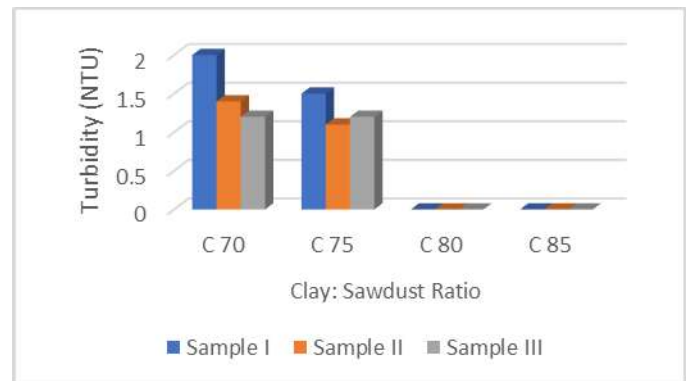


Fig - 3: Turbidity variation for different sawdust content

The results show that there is no sufficient variation in the pH value of the samples. While there is 99% reduction in the turbidity content. The turbidity values are less than one for all samples filtered using C 80 and C 85 filters.

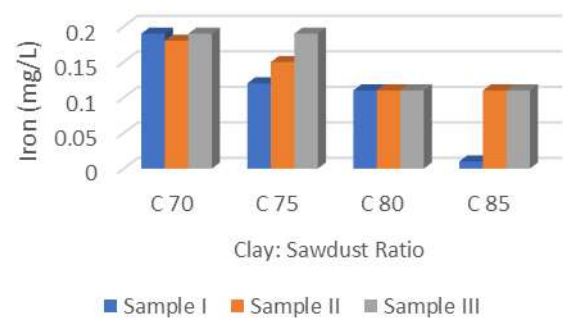


Fig - 4: Iron variation for different sawdust content

The samples preliminary analysis results show that iron content is beyond permissible limit (0.3mg/l). After filtration, the iron content has reduced to a lower value far less than permissible limit. Greater removal of iron has been seen in filters C 80 and C 85.

4. CONCLUSIONS

Ceramic water filtration is one of the recent low-cost water treatment methods made from locally available materials, is an affordable, effective, low-maintenance and sustainable technology appropriate for POU household water treatment in developing areas. According to this study the developed ceramic filters have the ability to treat both chemical and microbial contaminants in water. This study is expected to extend the use of ceramic filters in the household by reducing the existing limitations of the ceramic filters to cover the treatment of chemical impurities in water as well as the microbial and thus making it a complete solution to household water treatment needs.

ACKNOWLEDGEMENT

I express my heartfelt and sincere gratitude to God the Almighty for allowing the successful completion of this work without any disruption. For the project work there were many dedicated and highly qualified persons to help me. I avail this opportunity to express our gratitude and indebtedness to all who directly or indirectly had an impact on me for the project.

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TREATMENT OF LANDFILL LEACHATE USING ALGAE

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Abstract - The study focuses on the treatment of landfill leachate using Algae. The algae used is *Chlorella vulgaris*. Generation of landfill leachate become an important problem and it should be treated thoroughly. Leachate is the highly toxic waste water which is formed due to precipitation entering landfill. The amount of Nitrate, Ammonia, TDS, Chemical Oxygen Demand etc. will be very high. Leachate not only pollutes the ground water but also it generates lot of toxic gases and also it may damage the reinforcement of the nearby buildings by corroding it. The binding strength of concrete is also affected. In this study, optimum dosage and optimum time for the algae *Chlorella* based on their removal efficiency is main focus in this project.

Key Words: Leachate, *Chlorella*

1. INTRODUCTION

MSW after being disposed off in landfills degrade and increases release of gaseous products and liquid products, the latter is known as landfill leachate. Leachate is a liquid waste water flowing over a landfill due to precipitation (rainfall and snow), ground-water intrusion, moisture content of waste (particularly significant when sludge or liquids are disposed off), evaporation rate (daily cover during the filling period and final cover design). The leachate is formed when soluble components are dissolved or leached out by water percolation. The amount and composition of leachate generated varies over time to time. This depends on several factors such as the amount of rainfall, solubility, and moisture content of disposed waste, size of landfill, and the quantity of waste contained in it, and the age of landfill sites.



Fig 1 Leachate production

1.1 Objectives

Specific objectives of this project can be outlined as follows:

- To evaluate the feasibility of Algae in the treatment of leachate.
- To determine the removal efficiency Algae in various parameters of leachate such as Chemical oxygen demand (COD), Nitrate and Ammonia nitrogen
- To find out the optimum contact time and optimum dosage of algae.

1.2 Scope of the study

Solid waste generation have been exposed to increase worldwide. Presently, the most applied methodology to dispose solid waste is landfilling. However, these landfill sites, over time releases a significant amount of leachate, which can possess serious environmental issues, including contamination of water sources. There exist many physicochemical and biological landfill leachate treatment methods with varying degrees of success. With an increasing focus on sustainability, there has been an increasing demand for developing eco-friendly, green treatment programmes for landfill leachates with viable resource recovery and minimum environmental footprints. Microalgae-based techniques can be a potential scheme for such a treatment scenario. The scale-up aspect of microalgae technology has been discussed, and the related critical factors have been evaluated.

2. METHODOLOGY

Treatment materials include Algae and is to be cultured in laboratory. Treatment of landfill leachate include raw material selection and processing, culturing and preparation, mixing and treatment, as well as quality testing.

2.1 Raw materials

Algae is used for leachate treatment. The Algae used is *Chlorella vulgaris*. The use of algae for the purpose of water or leachate treatment is termed as phycoremediation.

Treatment of leachate using algae is a promising method. Algae to be used is *Chlorella* and is to be cultured in lab.

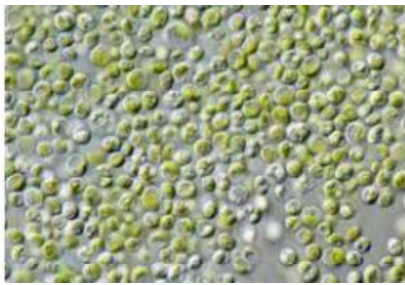


Fig -2: Chlorella vulgaris

2.2 Field experiment

2.2.1 Collection of sample

leachate samples were collected from landfill sites located at Njeliyamparambu. Njeliyamparambu is a place on the outskirts of the city of Kozhikode in Kerala, India. It is located 6km away from Kozhikode and has gained prominence for being a dumping ground for entire Kozhikode city.



Fig 3: Landfill site at Njeliyamparambu

2.2.2 Culture of Chlorella

Take a sterilized bucket and fill half to two-third of the bucket with distilled water. Add the chlorella powder into the water in the bucket with a spoon. Also add urea fertilizer as a nutrient for the growth of algae. Place the bucket on a sunny spot inside, near a windowsill is probably perfect. Also attach a thermometer to monitor the temperature of the water in the bucket if needed.

2.2.3 Preliminary Analysis of Leachate

The characteristics of leachate samples, Chemical Oxygen Demand(COD), Ammonia and Nitrate is tested before treatment in order to compare the results after treatment.

2.2.4 Treatment process (Adsorption using Magnetic Stirrer)

1. 80ml of leachate sample is taken in a 100ml standard flask.

2. Chlorella is taken and weighed.

3. It is then added to the sample (Dosage 1000mg/L).

4. Then dissolve the Chlorella and then make up to 100ml.

5. Transfer the contents into a 250ml beaker and shake using magnetic stirrer at 150rpm for initially 5min.

6. The process is continued for different contact time (10, 15, 20 min).

7. The efficiency is evaluated and the optimum contact time is obtained.

2.2.5 Analysis of Treated Leachate

The characteristics of leachate samples including Chemical Oxygen Demand(COD), Ammonia and Nitrate is tested after treatment in order to compare the results before treatment.

2.2.6 Results and Discussion

Finally results based on various samples, dosages, contact time are found out and compare the results of characteristics before and after treatment. And then report is prepared.

3 RESULTS AND DISCUSSION

Table -1: Values obtained after preliminary analysis of leachate

Sl no	parameter	APHA method	Unit	Obtained values	CPCB Disposable limits
1	COD	5520 B	mg/L	28220	Max 250
2	Ammonia	4500 NH ₃ B	mg/L	23	Max 30
3	Nitrate	4500 NO ₃ B	mg/L	875	No limit

3.1 Treatment with Chlorella (varying contact time)

Treatment with chlorella is done with varying contact time.

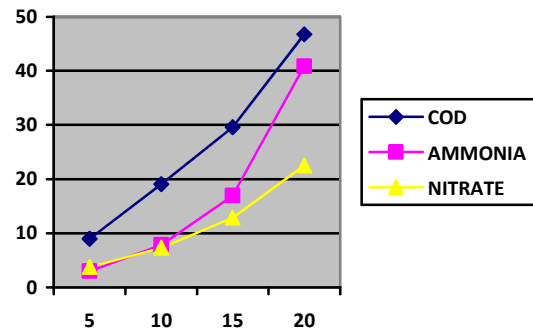


Fig 4 : Leachate before and after treatment with chlorella vulgaris

The dosage taken is 1000 mg/L and the initial contact time taken was 5 min. Contact time is then varied to 10 min, 15 min and finally to 20 min. The values obtained were noted down for each contact time.

Table -2: Values obtained after 5 minutes contact time with chlorella vulgaris

Sl no	parameter	APHA method	Unit	Obtained values	CPCB Disposable limits
1	COD	5520 B	mg/L	25660	Max 250
2	Ammonia	4500 NH ₃ B	mg/L	22.2	Max 30
3	Nitrate	4500 NO ₃ B	mg/L	845	No limit



Contact time in minutes

Chart -1: Removal efficiencies obtained for various parameters under varying contact time

Table -3: Values obtained after 10 minutes contact time with chlorella vulgaris

Sl no	parameter	APHA method	Unit	Obtained values	CPCB Disposable limits
1	COD	5520 B	mg/L	22840	Max 250
2	Ammonia	4500 NH ₃ B	mg/L	21.3	Max 30
3	Nitrate	4500 NO ₃ B	mg/L	810	No limit

Table -4: Values obtained after 15 minutes contact time with chlorella vulgaris

Sl no	parameter	APHA method	Unit	Obtained values	CPCB Disposable limits
1	COD	5520 B	mg/L	19762	Max 250
2	Ammonia	4500 NH ₃ B	mg/L	19.3	Max 30
3	Nitrate	4500 NO ₃ B	mg/L	763	No limit

Table -5: Efficiencies obtained (in %) with varying contact time (with Chlorella)

	5 min	10 min	15 min	20 min
COD	9	19.09	29.61	46.73
Ammonia	3.04	7.86	16.95	40.86
Nitrate	3.77	7.31	12.91	22.51

4. CONCLUSIONS

The optimum contact time is 20 minutes and optimum dosage is 1000 mg/l.

Chlorella is found to be efficient, and also the maximum removal efficiency is attained at 20 min contact time.

Removal efficiency for COD, ammonia, nitrate are 46.73%, 40.86%, 22.51% respectively for a dosage of 1000mg/L and contact time 20 min.

Hence the use of Algae can be mentioned as a promising method for the treatment of leachate.

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AIR POLLUTION IMPACT ON ENVIRONMENT IN KOZHIKODE CITY

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Abstract - The strong demographic explosion, the production of waste from urban areas, the automobile and industries largely exploded and resulted in the increase in air pollution. The man-made activities are the leading root for the damage of air quality and are the donors of anthropogenic oxides. This project studies to a greater extent, on the exit of dangerous air problems in the city of Kozhikode. This thesis with the help of Pollution Control Board (PCB) also includes the various evolution of air in Kozhikode city in the past and in the current scenario. It also comprises of an air quality assessment based on the covid19 lockdown scenario as well as arranging the data based on daily activities.

Key Words: Pollution, Air Pollutants, Air Quality Index, Vehicular Emission, Pandemic

1. INTRODUCTION

Air pollution can be explained as the presence of excess amount of chemicals, oxides, particulate matter, or other harmful materials in the wide range of atmospheres that cause harm or discomfort to humans or other living organisms and may even harm the natural environment. Pollutants are mainly classified into primary and secondary. And again, air pollution can be classified into anthropogenic and non-anthropogenic origin. World Health Organization (WHO) has a proper definition for the air pollution, "Substances that put into air by the interest of mankind into concentration sufficient to cause very harmful effect to human health, vegetables, properties or interfere with enjoyment of human property".

Air quality and pollution is one of the greatest threats to the planet, fueled primarily by the rapid population growth, continuous hike in energy consumption, deforestation, and increases in the vehicle density, especially in the urban cities. The wave of lockdowns in India, especially in major cities, following the covid19 pandemic has forced the people to stay at their own homes. All transport services such as roads, railways and air transport were disrupted to run and were not allowed to operate with an anomaly of essential and emergency systems. Thus, promoting to a decrease in traffic, industrial activities and other pollution transmitting works. Thus, ultimately to the decline in the air pollution for a small amount.

1.1 Scope

An air pollutant is mainly in the characteristics of a solid (large or small molecules), liquid or gas. Air Pollution may be set up from a natural or anthropogenic source or from both origins. Air pollution causes health issue to living beings, damage of materials and ecosystems, and poor visibility. Climate impact or change is characterized by the lengthy alteration of the weather and the temperature in the atmosphere. The biomass and fossil fuels that cause air quality deterioration can also have affected the warming of the earth's atmosphere mainly by the release of greenhouse gases (GHGs). This evaluation is almost based on the air pollutants that effect environment in the wide range.

This research interest come up with increasing the assess of response to air pollution in our country to address this universal problem responsibly. Pressure groups can use this research activity data to enforce certain environmental and industrial agendas on politicians and political campaigns. Places with soaring levels of air quality damage should get entangled in air pollution research to provide health policy founders with baseline data for future action. This project therefore makes it possible to collect, then to assemble and issue technical and statistical data relating to air pollution. And mainly to provide technical assistance, support and advice to the Pollution Control Board (PCB) Committee. This project work thus suggests possible prevention and control program and abatement of air pollution. This can help many countries motivate academics and researchers to create research venues to monitor the air quality and level at the national level of air pollution and can be seen a step forward that must be taken by all countries for an adequate climate and standard of living.

2. MATERIAL AND METHODOLOGY

2.1 Air Pollutants

The air borne emitted from countless factories or industries and are a cause of major concern. These discharges are of three vital forms, they are solid particles, liquid and gaseous emissions. Thus, air pollutants can be in the form of solid particles, liquid droplets, or gases. They can be natural or manmade. Major air pollutants discussed are particulate matter, oxides of nitrogen, oxides of Sulphur, carbon monoxide, ammonia and ground level ozone.

Table -1: Air Pollutants

PARAMETER	ORIGIN	HEALTH CONSEQUENCES
Particulate matter	Industries, vehicles	Eye irritation, Cancer, cardiovascular damage
NO _x	Vehicular emission	Respiratory reactions
SO ₂	Petrol and coal factory	Respiratory reactions
Oxides of carbon	Vehicular emission	Heart impairment
Ammonia	Agriculture, sewage	Skin distress
Ozone	vehicle	lung damage, eye and throat irritation

mainly based on vehicle density assuming vehicle density is much large and industrial activities.

Pre lockdown data 2019 will be clustered with respect to seasons to see impact of seasons on air. The above data is further clustered with respect to time of the day (8am, 4pm, 12am) to see the impact of vehicle density and industrial activities. The same will be verified for containment and post-containment in 2020 and 2021 respectively. Graphs of each parameter is made separately under each cluster heading.

2.2 Study Area

The rapid development in the urban Kerala has resulted in a tremendous increase in the number of industries and motor vehicles. Vehicles are the main root of urban air quality damage and are increasingly main contributors of anthropogenic oxides. Industries also contribute significantly to environmental pollution. The city of Kozhikode is the selected area

Table -2: Study Area

District	Site
Kozhikode	Palayam bus stand
Kozhikode	Children’s Hospital
Kozhikode	Nallalam

2.3 Methodology

The main parameters accumulated for the air quality analysis from Pollution Control Board (PCB) are are particulate 10 (PM10), particulate 2.5 (PM2.5), SO₂, NO_x, NH₃, CO_x and ozone. The area chosen for the thesis includes Kozhikode Palayam Bus Stand, Kottam Children's Hospital and Nallalam. Plot different graphs and diagrams.

Data collection is executed on parameters PM2.5, PM10, SO₂, NO_x, CO_x, O₃, NH₃ from PCB Kozhikode during February 2022. The initial visit to the PCB befall in December 2021. Data of the years 2019, 2020 and 2021 are collected.

Data collection and analyses were based on covid-19 lockdown scenario. Data is grouped into pre lockdown, lockdown and post lock down sets. Again, the data scrutinized based on a diurnal basis. The overall analysis is



-1



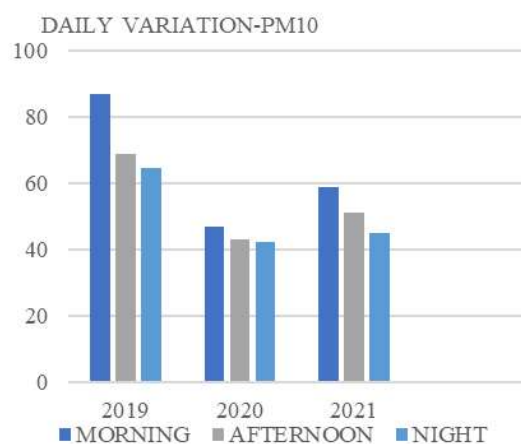
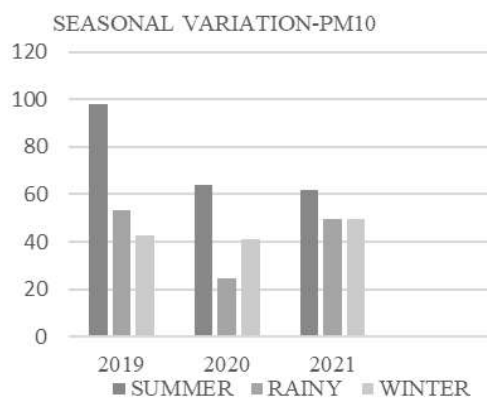
Fig -2: Site visit-Kottam Hospital

Table -3: Air Quality Standards from CPCB site

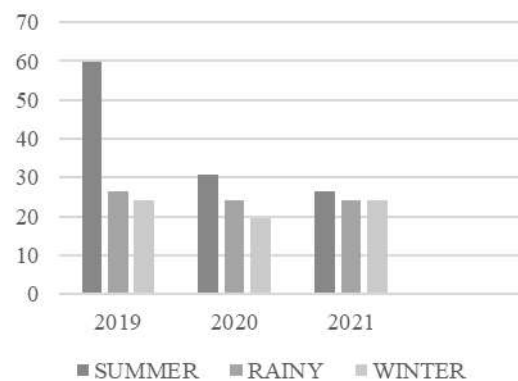
NATIONAL AMBIENT AIR QUALITY STANDARDS					
PARAMETER	UNIT	PERMISSIBLE VALUE			
		RESIDENTIAL AND INDUSTRIAL AREA		ECOLOGICALLY SENSITIVE AREA	
		Annual	24hrs	Annual	24hrs
PM2.5	µg/m ³	40	60	40	60
PM10	µg/m ³	60	100	60	100
SO ₂	µg/m ³	50	80	20	80
NO _x	µg/m ³	40	80	30	80
CO _x	µg/m ³	2	4	2	4
O ₃	µg/m ³	100	180	100	180
NH ₃	µg/m ³	100	400	100	400

3. CALCULATIONS

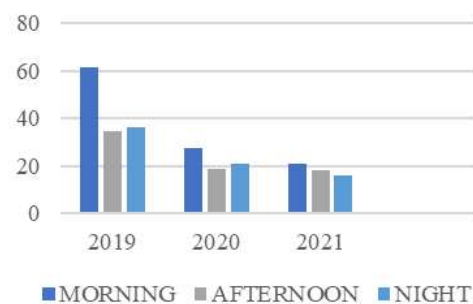
3.1 Graphical Representation



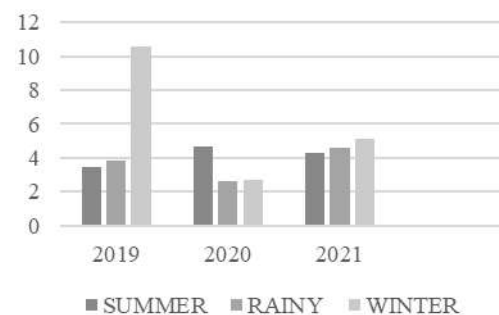
SEASONAL VARIATION-PM2.5



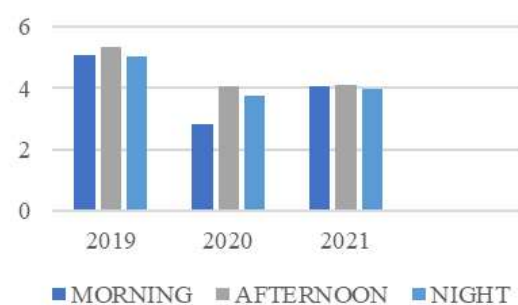
DAILY VARIATION-PM2.5



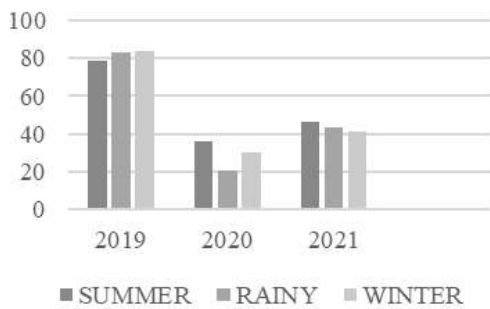
SEASONAL VARIATION-SO₂



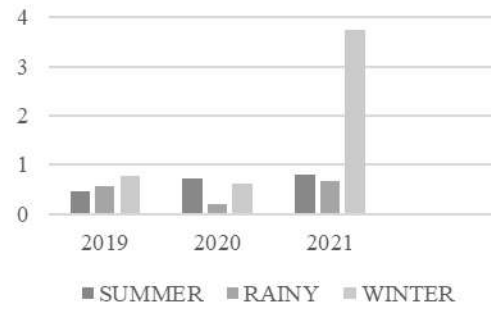
DAILY VARIATION-SO₂



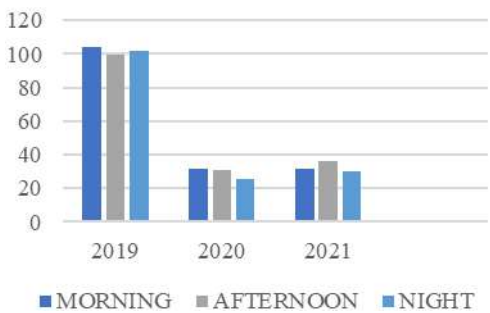
SEASONAL VARIATION-NO_x



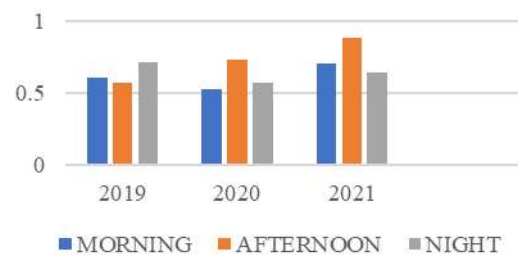
SEASONAL VARIATION-CO



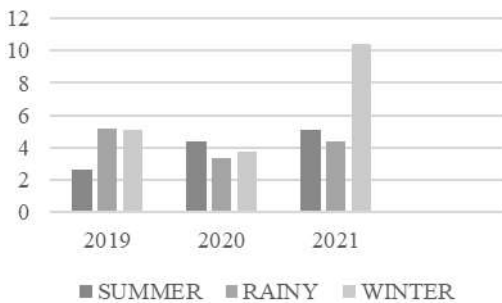
DAILY VARIATION-NO_x



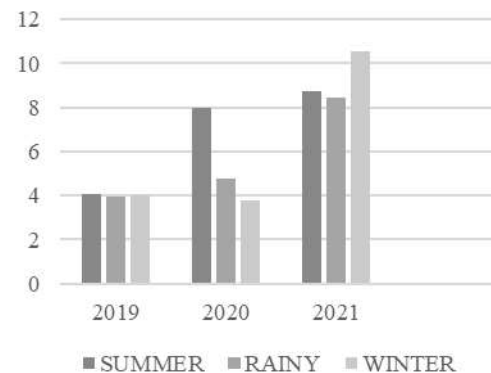
DAILY VARIATION-CO



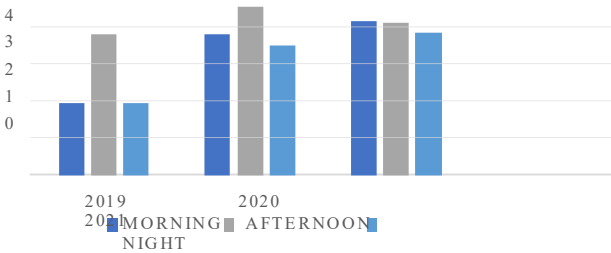
SEASONAL VARIATION-NH₃



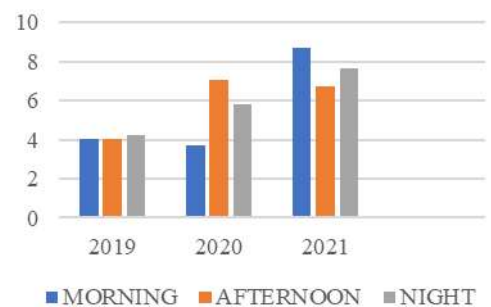
SEASONAL VARIATION-O₃



DAILY VARIATION-NH₃



DAILY VARIATION-O₃



4. CONCLUSION

Air pollution is a major threat in urban areas and should manage with almost as much care. From the study, Kozhikode city shown mixed results. PM10 emissions gradually decreased during lockdown and gradually increased with a normal lifestyle. Summer season had shown greater emission when compared to other seasons. PM2.5 shows that the summer season had a higher emission. Fewer problems during the lockdown period compared to the previous year. SO₂ and NO_x emissions also decreased during the lockdown. Thus, concluded that vehicles and industries have a great hand on clean and fresh air.

- Encourage the use of electric and ecological vehicles
- Industries should reduce their reliance on coal power
- Switch to renewable source of energy

ACKNOWLEDGEMENT

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PRODUCTION OF ECO-BRICK FROM INDUSTRIAL WASTES

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Abstract - Production of eco-friendly bricks from industrial wastes has been investigated in this project. A partial replacement of clay is obtained by adding of industrial wastes like waste water treatment (WWT) sludge, and ash with the admixtures of lime and NaOH. By using these admixtures alkali activation process is occurred and a chemical reaction takes place between alumino-silicate materials and the alkali activator. The product formed after this reaction is the alumino-silicate hydrate gel. They have cementing and binding properties. So in this method of brick manufacturing process, there is no burning process is needed. And the cost of casting can be reduced. By the utilization of industrial wastes and the exclusion of kiln burning, this method is an environmental friendly. A sustainable method of construction is obtained by this technique.

Key Words: bricks, sludge, Boiler ash, alkali-activation technology, compressive strength, water absorption

1. INTRODUCTION

Waste materials generated from many industries, treatment plants etc. are create a major environmental problem. The prime objective of the waste management is to diminish the amount of unwanted materials and to prevent potential health and environmental hazards. The wastes generated around the industries are difficult to dispose. The conventional methods of waste disposal like incineration, land filling, dumping to the water resources is not suitable to the environment. They create pollution on that area. So a suitable method of waste disposal is an essential thing. For this, reuse the waste materials from industries to the construction of other materials in a sustainable manner is a best method.

House is a dream for every person, but the cost of housing is high and which is not easy for an average people. To address this situation, study on the low cost building material is essential. Brick are building components composed of inorganic nonmetallic materials. Therefore the sludge and boiler ash developed from the different treatment plants and with some admixtures like lime (CaO) and sodium hydroxide (NaOH) as alkaline activator are suitable for the brick manufacturing as a partial replacement of soil. The cost of making bricks is reducing by using these materials and which limit the problems of industries for the disposal of wastes generated. This is also reducing the environmental problems like CO₂ emissions by the un- burnt process and unlimited use of top fertile soil.

1.1 Objective of the work

- To limit extraction of top fertile soil
- To reduce the construction cost and develop a carbon neutral building material
- To determine a sustainable method of waste disposal by utilization of the wastes in brick making process
- To compare the durability, efficiency, strength and other characteristics of the eco brick with available types of bricks
- To limit the harmful gas emissions while burning

1.2 Scope of the work

- It reduces the contamination of wastes near the treatment and boiler plants
- It reduces the pollution of environment
- The brick is used as a building material
- Cost effective construction is provided
- Energy saving is practiced
- Sustainable development of the building

2. METHODOLOGY

2.1 Raw Materials Collection

The raw materials for the production of brick are collected from various sites. They are clay soil, sludge, boiler ash, lime, sodium hydroxide, water etc.

2.1.1 Clay Soil

Clay is a type of fine grained natural soil that contains clay minerals such as silica, alumina, manganese, iron etc. When adding water they exhibit plastic property. The best suited soil for making of brick is the silted clay or weathered clay. Because, these soils have sufficient strength and cohesion property. The soil is taken from the wall- tech brick site at Areacode.

2.1.2 Sludge

Sludge is a byproduct of all treatment plants. The disposal of sludge is a facing problem of the industries. The conventional disposal methods like, incineration, land filling, dumping to water resources is harmful to the environment.

For this study, the sludge is collected from the different sewage treatment plants in Malappuram. This sludge is an aerobic sludge with darkish colour.



Fig -1: Sludge

2.1.3 Boiler Ash

Boiler ash is the bottom ash, which is a part of non-combustible product of the firing process. This is get from power plant, boiler, furnace, incinerator etc. They are grey colour powdered form. For this research, the boiler ash is collected from the paper mill located at Kavanoor, in Malappuram district.



Fig -2: Sieved Boiler Ash, Soil and Sludge

2.1.4 Admixtures

Lime and NaOH are used as admixtures. By using these admixtures alkali activation process is occurred and a chemical reaction takes place between alumino-silicate materials and the alkali activator.

2.2 Casting process

2.2.1 Preparation of the Raw Materials

In this step the soil is excavated and then laid on leveled ground. Then the soil is cleaned by removing impurities such as vegetation matter, stones or pebbles etc. After removing impurities it is provided to weather for few days. Then after drying they are powdered and sieved through 300 µm sieve. Sludge, ash etc. are also dried, powdered and sieved in similar manner, before mixing.

2.2.2 Mixing

All the raw materials with required proportions are mixed together with adding sufficient amount of water to get uniform mixture. Then the mixture is kept for 2 to 4 hours. After that they are again mixed by adding water. The mixing was done manually. The table -1 shows the amount of each material taken in percentage.

Table -1: Percentage of Raw materials added

Brick	Clay %	Sludge %	Boiler ash %	Lime %	NaOH %
1	80	10	6	3	1
2	70	15	9	4	2
3	60	20	12	5	3
4	50	25	15	6	4
5	40	30	18	7	5

2.2.3 Moulding

After mixing the materials will be pressed into the mould and then bricks are placed on wooden pallets and will be kept as it is for two days. Before filling, the mould should be cleaned, oiled with sand along the sides to easy unmoulding. The mould used for this study is the wooden mould with size 19 x 9 x 9 cm.

2.2.4 Curing

After removing the mould, the bricks are transported in to an open space and they are cured for 10 to 14 days. Curing is

done for the complete setting of the brick. The water for curing should be free from impurities.

2.2.5 Drying

The bricks are allowed to dry till they are left with 5 to 7 percent moisture content. The drying period usually varies from 7 to 10 days. Then they are oven dried. This is maintained in oven for 100 to 150 degree Celsius for 24 to 48 hours.



Fig -3: Casted Bricks

2.3 Tests Performed

Different lab tests are carried out for finding efficiency and strength of the eco brick. They are as follows:

2.3.1 Compressive Strength Test

Place the specimen prepared with flat faces horizontal and mortar filled faces upwards between two sheets and carefully centered between plates of testing machine. It is ensured that the load is at uniformly. Then apply a load at a rate of 14 N/mm² (or 140 kgf/cm²) per minute till failure occurs. Note the maximum load at breaking and repeat the procedure for getting concordant value.

Compressive strength in N/mm² = $\frac{\text{Maximum load at failure in N}}{\text{Area of the bed space in mm}^2}$

2.3.2 Water Absorption Test

The absorption test is the type of test conducted on bricks to determine the moisture absorbed by the bricks when subjected to extreme conditions. The absorption test can be used as an indicator of the durability properties of bricks such as quality, degree of burning and behaviour of bricks in weathering.

Water absorption by the brick specimen is given by the formula,

$$W = \frac{M_2 - M_1}{M_1} \times 100$$

2.3.3 Hardness Test

The hardness of bricks generally implies the resistance of bricks to scratch. For this test, the brick is scratched with sharp tool. If the scratching does not leave behind any impression on the brick, it is considered as a hard brick.

2.3.4 Soundness Test

Soundness Test A soundness test on bricks is carried out to determine the nature of bricks when subjected to sudden impact. For this test two bricks are taken out of stack of bricks. The bricks are then crash against each other. If it emits a clear metallic ringing sound; the brick is of good quality.

2.3.5 Impact Test

In the impact test of the bricks, the brick is allowed to drop flat from a height of 1 meter on the ground. After falling the brick on the ground it should not break into pieces. If the brick gets cracked or crushed into pieces then, it indicates the best quality of the brick.

2.3.6 Efflorescence Test

A good brick should be free from soluble salts. The presence of soluble salts in the bricks leads to efflorescence on the bricks thereby decreasing the quality of bricks.

2.3.7 Shape and Size Test

To maintain uniformity in the construction, the bricks must be of proper shape and uniform size. A good brick must have a good and rectangular shape with sharp edges.

3. RESULTS AND DISCUSSION

Different types of tests are carried out for determining the performance of eco-brick. And these results are compared to the performance of locally available bricks.

3.1 Results of Tests on Brick

The tests on bricks are done by using three bricks for an experiment and an average value is calculated. The tests performed on bricks are:

3.1.1 Compressive Strength Test

Table -2 gives the compressive strength test values of casted brick specimens with varying percentages of clay, sludge, ash, lime, NaOH etc.

Table-2: Compressive strength of various brick specimen

SL NO.	BRICK DESIGNATION	CRUSHING STRENGTH (N/mm ²)
1.	Brick specimen with 100% clay	3.0
2.	Brick specimen with 80% clay	3.5
3.	Brick specimen with 70% clay	6.2
4.	Brick specimen with 60% clay	10.8
5.	Brick specimen with 50% clay	12.4
6.	Brick specimen with 40% clay	12.0

The bricks available in the market have a compressive strength of different values. The ordinary brick made by clay have a compressive strength of 13N/mm² while tested. And the Auto-claved Aerated Concrete (AAC) blocks have a compressive strength of 4.65 N/mm². So by comparing these values eco bricks have higher compressive strength than AAC blocks and nearer to the ordinary bricks.

Based on the above table a graph is plotted with brick having various clay percentage on X axis and compressive strength on Y axis.

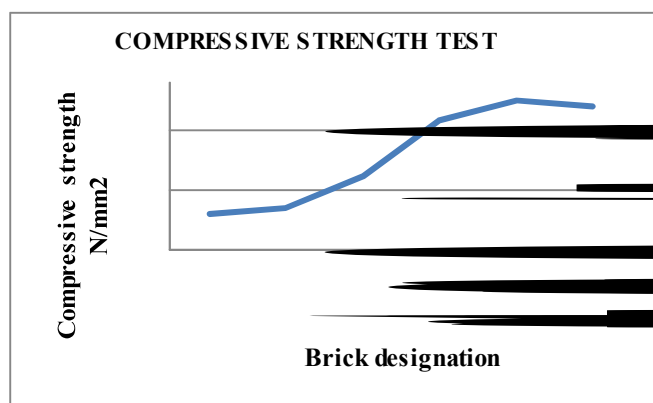


Chart -1: Compression Test on Brick

Chart-1 shows the variation of compressive strength values on brick having varying clay percentage with industrial wastes. In this test the casted specimen of brick shows an increasing pattern up to brick with 50% of replacement of clay.

As per IS specification the brick brought from market have compressive strength similar to first class brick and having a class designation of 12.5. These can be used for construction purposes. From the above result it is clear that brick with 50 % clay have maximum compressive strength and is used for construction work.

3.1.2 Water Absorption Test

Water absorption is an important test on brick specimen. Table-3 shows the effects of water absorption test for different specimen of casted brick and these values are compared with bricks available in markets.

Table-3 Water absorption of various brick specimen

SL NO.	BRICK DESIGNATION	WATER ABSORPTION (%)
1.	Brick specimen with 100% clay	22.81
2.	Brick specimen with 80% clay	20.70
3.	Brick specimen with 70% clay	20.13
4.	Brick specimen with 60% clay	17.26
5.	Brick specimen with 50% clay	12.71
6.	Brick specimen with 40% clay	10.98

From the above table a graph is plotted for water absorption of brick various percentage of clay and industrial wastes.

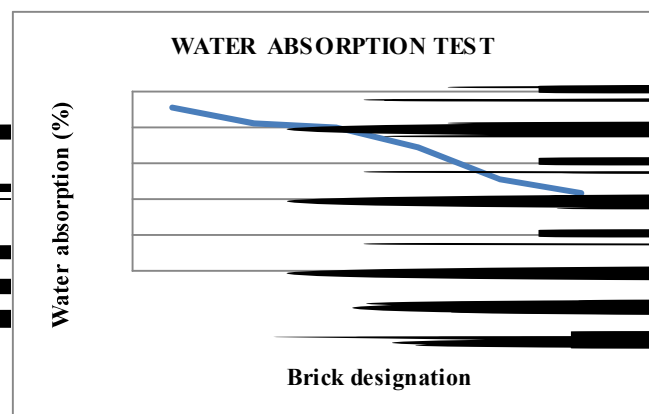


Chart -2: Water Absorption Test on Brick

Chart -2 shows the variation of water absorption on different classes of brick. From these results, it shows that maximum water absorption is at 0% and the value is decreasing with increasing the waste materials. The ordinary brick have water absorption of 14.25%.

As per IS specification, for first class bricks the water absorption should be less than 15%. The brick made with 50% and 40% clays have the value less than 15%. So they can be used for construction works.

3.1.3 Efflorescence Test

Table-4 shows the observations for efflorescence test. From these results it is found that a slight efflorescence is observed for more than 50 % waste materials used. So these bricks are only used for minor works.

Table -4 Efflorescence of various brick specimen

SL NO.	BRICK DESIGNATION	EFFLORESCENCE
1.	Brick specimen with 100% clay	Nil
2.	Brick specimen with 80% clay	Nil
3.	Brick specimen with 70% clay	Nil
4.	Brick specimen with 60% clay	Nil
5.	Brick specimen with 50% clay	Nil
6.	Brick specimen with 40% clay	Slight

3.1.4 Hardness Test

Table -5 shows the results of hardness test on casted brick specimen. By using the finger nail the hardness is tested. From these test all bricks are hard. And they can be used for construction works.

Table -5 Hardness of various brick specimen

SL NO.	BRICK DESIGNATION	HARDNESS
1.	Brick specimen with 100% clay	Hard
2.	Brick specimen with 80% clay	Hard
3.	Brick specimen with 70% clay	Hard
4.	Brick specimen with 60% clay	Hard
5.	Brick specimen with 50% clay	Hard
6.	Brick specimen with 40% clay	Hard

CONCLUSION

Eco-friendly brick manufacturing is completely needed to overcome the conservation of non-renewable resources. This project helps to minimize the depletion of top fertile soil of the formable land by utilizing industrial waste. With the use of alkali activation technology, the effect of carbon dioxide emission in to the Environmental was completely reduced. By performing different lab tests on brick specimen each type of brick was different values depending on the percentage of waste materials added. The tests conducted on brick are the compression test, water absorption test, efflorescence test, hardness test, etc. From these tests we can find that 50 % clay and 50 % waste materials are more suitable for making eco-brick. The optimum value is getting for that type of brick. Those types of bricks are come under the first class brick and which is suitable for major construction works.

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Sustainable Changes on Soil Properties by Using Seashell Powder

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ABSTRACT

Clay soil is widely distributed in Kerala, but it causes difficulties in construction with its low strength and stiffness. This has caused a heavy economical loss and other risk factors to the existing structures, so in this case there is a need for remediating these types of problematic soils for an effective purpose by undergoing various ground-improvement techniques and stabilization. Cement and lime stabilizers are often used to improve the properties of problematic soil. However, the negative impact associated with the production, such as emission of greenhouse gaseous both directly through the combustion of fossil fuels and this gain more awareness of the sustainability issues. The only way to reduce these environmental problems is to approach an alternative sustainable material. In this present experimental investigation, study the effect of the engineering behaviour of these types of problematic soils on the addition of sea shell powder at varying percentages such as 8%, 12% and 16%.

Keywords- Clay soil, Geotechnical properties, Seashell waste, Soil stabilization

products have been extensively used to remediate these types of problematic soil [4]. Here, we are using discarded seashells as additive to improvise soil properties at varying percentage such as 8%, 12% and 16% by weight of clay soil.

Seashell is a hard, protective outer layer of marine molluscs that serves to protect and support their bodies. Seashells of various molluscs such as oysters, clam, and mussels are available in abundance, have no eminent use, and are commonly regarded as waste [5]. Seashell waste is not hazardous waste but aquaculture and seafood industries considered it as 'nuisance waste' and is categorized as municipal solid waste (MSW) or commonly considered as trash or garbage [6]. Generally, the seashells decompose much more slowly than other garbage. So, the improper disposal of discarded seashells may increase land fill site and they become a significant source of pollution [7]. Recycling shell waste could eliminate the disposal problem and turn otherwise useless waste into high-value-added products [8-10]. Hence, this project was aimed not only at soil stabilization but also eliminate the disposal issues of discarded seashell by reusing it as value added product.

INTRODUCTION

Utilization of waste materials as a new construction material as one of the main objectives of sustainable construction activities [1]. This project focuses on the effect of a discarded seashell on the engineering properties of soil. Soil stabilization is the entire process involves the use of engineering techniques to transform weak soil into a strong foundation for construction projects [2]. The soil stabilization may reduce the permeability, enhance the soil bearing capacity, reduce soil settlement and increase its overall strength [3]. Materials such as fly ash, rice husk ash, palm oil fly ash, biomass ash, and other recycled waste by-

METHODOLOGY

This project was conducted on clay soil sample. Initially, the basic properties of clay soil were determined, and later its strength properties. Basic properties test includes specific gravity, Liquid limit, and plastic limit. Strength test includes CBR test, Compaction test, and UCC. Later strength test was performed on seashell added soil mixture. The percentages of seashells were 8%, 12%, and 16%.

MATERIALS USED

In this study, the test was conducted on clay soil. Clay soil was collected from kattangal,

Kozhikode district. The properties of clay soil sample were shown in Table 1. The admixture used in this study is seashell powder. Empty shells of shellfish were collected from seashore, households and restaurants. The empty shells were thoroughly washed with tap water to

remove impurities, drained, and then left for a few days for air drying or heated few minutes. Dried seashell was crushed with a mortar or pestle followed by sieving of appropriate size (Fig. 1 and 2).



Figure 1: Collected seashells.



Figure 2: Prepared seashell powder.

Table 1: Properties of clay soil sample.

SI. No	Properties	Results
1	Specific gravity	2.5
2	Liquid limit	36%
3	Plastic limit	26%
4	Plasticity Index	10%
5	Optimum moisture content (OMC)	12%
6	Maximum Dry density (MDD)	2.03 g/cc
7	CBR Value	2.9 %
8	UCC	4.41 KN/m ²

RESULTS ANALYSIS Compaction Test Results

The light compaction and heavy compaction test results are shown in Fig. 3 and 4.

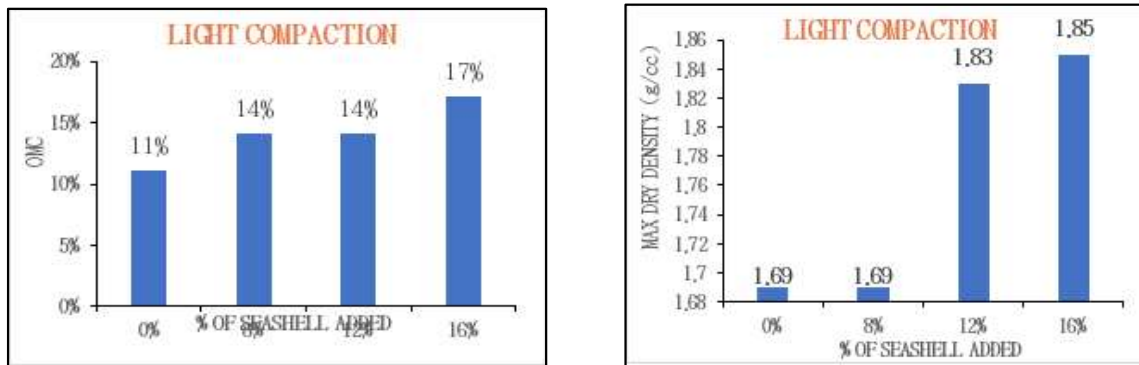


Figure 3: Light compaction test results.

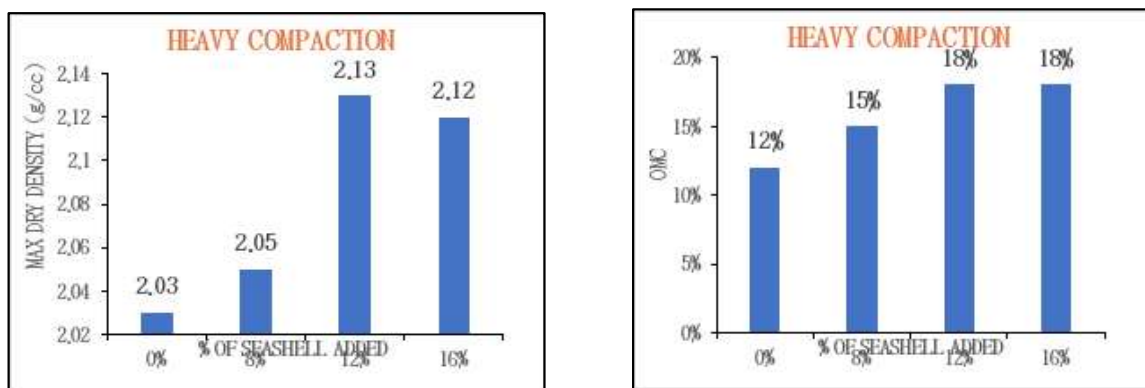


Figure 4: Heavy compaction test results.

From the above graphs, in the compaction test optimum moisture content increased with increasing seashell, and maximum dry density increases with seashell slightly at initial and maximum at 12% seashell mix then starts to decrease. The increasing optimum moisture content with increased addition of seashell content may probably be due to more water is required for the dissociation of

admixture. Hence, addition seashell increased to 0% to 16% it also increases the OMC.

CBR AND UCC TEST RESULTS

The bar graphs have shown Fig. 5 and 6 shows the graphical representation of the comparison of test results of CBR and UCC test with 0%, 8%, 12% and 16% seashell mix.

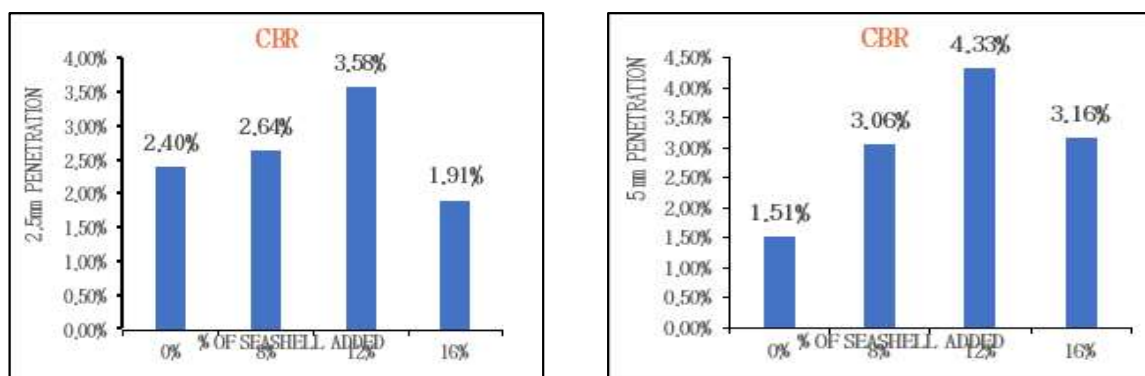


Figure 5: Graphical representation of test results of CBR test.

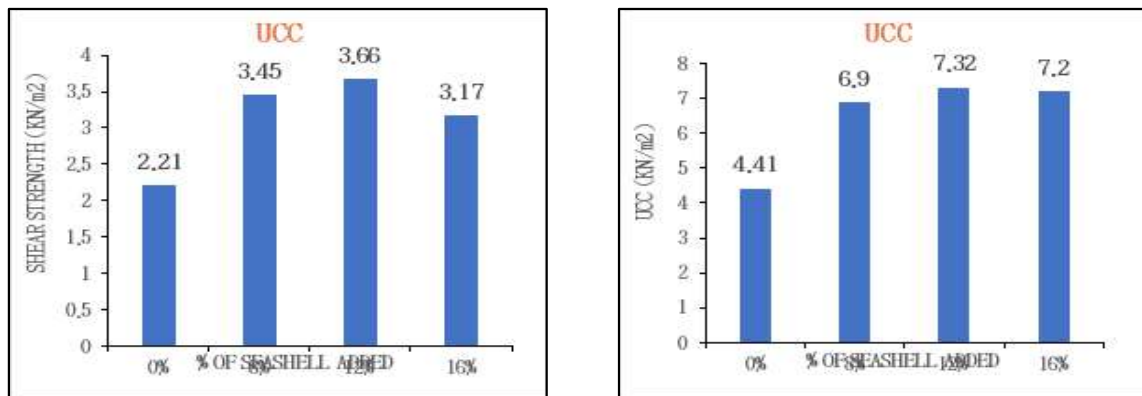


Figure 6: Graphical representation of UCC test results.

From the above graphs clearly the addition of seashell increases bearing strength, Shear strength and unconfined compressive strength of clay soil. The bearing strength and shear strength did not show any increase with treatment more than 12% seashell content. According to the literature reviews, the initial increase in strength parameters could be the effect of the development of major compounds, which may be responsible for strength gain and the reduction could be due to an increase in fine content caused by additional seashell content which leads to larger surface areas being present in the soil-seashell mixture.

CONCLUSION

The effect of seashell content on compaction characteristics showed increasing optimum moisture content with a corresponding increase in maximum dry density. The California bearing ratio (CBR) value of plain clay soil was 1.51 % which is increased to 4.33% at 12 % seashell content. The Unconfined compressive strength (UCC) value increased with seashell content and is maximum at 12%, and the value is increased from 4.41 KN/m² to 7.32 KN/m². Thus, the seashell powder can be used as an effective stabilizer to remediate a large amount of contaminated and problematic soils and also make the environment free from hazards and to create a clean environment by making use of the waste products collected from various sources.

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Evaluation of Water Quality Parameters of Different Bore wells in Different Areas

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ABSTRACT

Water is one of the important compounds which influence the human life. The present uses of water may be classified as domestic, public, commercial and industrial. Sometimes deep bore wells and special borehole pumps provide water supply to homes or communities where water is scarce. The water quality parameter of bore well may be different in different areas depending upon the topographical condition, geological conditions, human activities etc. In this study water samples are collected from different bore wells in different area. Here we have selected three different areas like, hilly area, field area and river area. Each sample was tested for different characteristics such as pH, Turbidity, Conductivity, TDS, TSS, Chloride, Alkalinity, Acidity, Total Hardness, COD, DO, Sulphate, Nitrate, Fluoride, Salinity. Tested samples will be checked against the standards laid by the Indian standards for potable water as per BIS specifications (IS 10500-1991) or WHO standards for potable water condition. The data has shown that there were considerable varied results in the examined sample from different area with respect to their chemical features.

Keywords- Water, Bore well, Samples, Testing, Water quality parameters

INTRODUCTION

Water is an important biological factor that plays crucial role in determining the health of people. Water is essential for the survival of any forms of life [1]. About 80% of the earth's surface is covered by water. Out of the total quantity of water present on the earth, about 97% of the earth's water resources are locked up in the oceans and seas, which is too saline to

drink and for the direct use for agriculture and industrial purpose and about 2.4% is trapped in giant glaciers and polar icecaps [2]. Thus, not even 1% quantity of water is available for drinking, agriculture, domestic and industrial consumption.

In this study, evaluation of water quality parameters in different bore well in different area is identified. The assessment of water quality, usually carried out by determining its physico-chemical and biological properties such as pH, turbidity, Electrical conductivity, Chlorides, Fluorides, Nitrates, Iron, Total Dissolved Solids (TDS), Hardness, Total suspended solids (TSS), Alkalinity, Acidity, Salinity etc. Here samples for evaluation of water quality are taken from different area and they are hill, field and river [3]. Then the water quality parameters of bore wells in an area are identified and are compared with each other [4]. Here we have to identify the water quality parameters are changes when area of bore well is different, and also to identify that what changes may occurs in the water quality parameters in different area [5]. Then the water quality parameters in different bore wells identified and which is compared to standard water quality parameters [6].

METHODOLOGY STUDY AREA

The area is identified for collecting and evaluating the water samples. There are 6 bore wells which are identified from 3 different areas and each area has specific characteristics. The areas are categorized as hilly area, field area, and river area.

Sample 1 (Hill)

The bore well is located at KMCT College of engineering, Kallanthode, Calicut. It

is a hilly area. The bore well is surrounded by KMCT group of institutions. Laterite soil is present at the bore well area. The depth of bore well is 170 ft. water level is decreases at the summer season (Table 1).

Sample 2 (Hill)

The bore well is located at the residence near KMCT Poly Technique College. It is another bore well from hilly area. The soil is present in the location is laterite soil. The depth of bore well is 310 ft. the water is used for the household purpose like drinking, cooking, bathing, washing etc. (Table 2).

Sample 3 (Field)

Here the bore well is located in Kodyathur at Calicut district, Kerala. The area is surrounded by fields. The distance between bore well and field is only 5m. Here the bore well water is mainly used for the irrigation purpose. The soil present in that area is clayey soil. The depth of bore well is 50 ft. (Table 3).

Sample 4 (Field)

This bore well is also located in Kodyathur at Kozhikode district, Kerala. The

bore well is located near the field side. Just few meters from the field. The depth of bore well is 40 ft. the water is used for the house hold purpose (Table 4).

Sample 5 (River)

The bore well is located at a residence in Chaliyam near Beypore in Kozhikode district. It is located few meters away from the Chaliyam River. The river is containing salt water. The water is used for only the washing of utensils and cleaning purpose. The water is not used for drinking and washing cloth etc. the depth of bore well is 31 ft. (Table 5).

Sample 6 (River)

Here the bore well is located at residence in Chaliyam, Kozhikode. The bore well is located at near the river. Approximately 5m from the river. The depth of bore well is 25 ft. The water is used for household purpose like drinking, bathing, cooking, washing etc. (Table 6).

RESULT AND DISCUSSION

Table 1: Result of bore well located at KMCT College of Engineering, Kozhikode district

No.	Parameter	Unit	Results
1	Colour	Hazen	<1
2	Taste and odour	-	Agreeable
3	Electrical conductivity	µS/cm	162
4	Turbidity	NTU	1.7
5	Total dissolved solids	mg/L	85
6	Ph	-	6.62
7	Total Alkalinity	mg/L	60
8	Total Hardness as CaCO ₃	mg/L	66
9	Salinity	mg/L	23.07
10	Acidity	mg/L	40
11	Fluoride	mg/L	<0.01
12	Chloride	mg/L	13.99
13	Iron	mg/L	0.88
14	Nitrate	mg/L	<0.01
15	Sulphate	mg/L	18.12

Table 2: Result of bore well located at KMCT Polytechnic College, Kozhikode district.

No.	Parameter	Unit	Results
1	Colour	Hazen	<1
2	Taste and odour	-	Agreeable
3	Electrical conductivity	µS/cm	244
4	Turbidity	NTU	BDL
5	Total dissolved solids	mg/L	127
6	Ph	-	7.38
7	Total Alkalinity	mg/L	96
8	Total Hardness as CaCO ₃	mg/L	94
9	Salinity	mg/L	21.42
10	Acidity	mg/L	20
11	Fluoride	mg/L	<0.01
12	Chloride	mg/L	12.99
13	Iron	mg/L	0.16
14	Nitrate	mg/L	<0.01
15	Sulphate	mg/L	BDL

Table 3: Result of bore well located at Kodyathur, Kozhikode district.

No.	Parameter	Unit	Results
1	Colour	Hazen	<1
2	Taste and odour	-	Agreeable
3	Electrical conductivity	µS/cm	257
4	Turbidity	NTU	3.8
5	Total dissolved solids	mg/L	135
6	Ph	-	7.12
7	Total Alkalinity	mg/L	94
8	Total Hardness as CaCO ₃	mg/L	100
9	Salinity	mg/L	19.77
10	Acidity	mg/L	20
11	Fluoride	mg/L	<0.01
12	Chloride	mg/L	11.99
13	Iron	mg/L	1.16
14	Nitrate	mg/L	<0.01
15	Sulphate	mg/L	12.10

Table 4: Result of bore well in a residence located at Kodyathur, Kozhikode district.

No.	Parameter	Unit	Results
1	Colour	Hazen	<1
2	Taste and odour	-	Agreeable
3	Electrical conductivity	µS/cm	238
4	Turbidity	NTU	4.3
5	Total dissolved solids	mg/L	127
6	pH	-	7.28
7	Total Alkalinity	mg/L	101
8	Total Hardness as CaCO ₃	mg/L	98

9	Salinity	mg/L	18.68
10	Acidity	mg/L	20
11	Fluoride	mg/L	<0.01
12	Chloride	mg/L	12.01
13	Iron	mg/L	1.29
14	Nitrate	mg/L	<0.01
15	Sulphate	mg/L	11.81

Table 5: Result of bore well in a residence located at Chaliyam, Kozhikode district.

No	Parameter	Unit	Results
1	Colour	Hazen	>1
2	Taste and odour	-	Agreeable
3	Electrical conductivity	µS/cm	458
4	Turbidity	NTU	56.4
5	Total dissolved solids	mg/L	241
6	pH	-	7.05
7	Total Alkalinity	mg/L	152
8	Total Hardness as CaCO ₃	mg/L	188
9	Salinity	mg/L	51.08
10	Acidity	mg/L	80
11	Fluoride	mg/L	<0.01
12	Chloride	mg/L	30.99
13	Iron	mg/L	4.40
14	Nitrate	mg/L	3.57
15	Sulphate	mg/L	56.86

Table 6: Result of bore well near river located at Chaliyam, Kozhikode district.

No.	Parameter	Unit	Results
1	Colour	Hazen	>1
2	Taste and odour	-	Agreeable
3	Electrical conductivity	µS/cm	458
4	Turbidity	NTU	58.3
5	Total dissolved solids	mg/L	255
6	Ph	-	7.12
7	Total Alkalinity	mg/L	148
8	Total Hardness as CaCO ₃	mg/L	191
9	Salinity	mg/L	52.25
10	Acidity	mg/L	87
11	Fluoride	mg/L	<0.01
12	Chloride	mg/L	29.03
13	Iron	mg/L	4.11
14	Nitrate	mg/L	3.83
15	Sulphate	mg/L	59.26

CONCLUSION

In this study, evaluation of water quality parameters in different bore wells in different area is identified. The assessment of water quality is usually carried out by physico-chemical and biological properties such as pH, Turbidity, Electrical Conductivity, Chlorides, Fluorides, Nitrates, Iron, Total Dissolved Solids (TDS), Hardness, Total Suspended Solids, Alkalinity, Acidity, Salinity etc. Samples taken for evaluation of water quality are from hill, field and river area. Here we took two samples from each area and the result obtained is compared with each other.

When considering the hill area, all the water quality parameters are within the acceptable limit except turbidity in one of the bore wells. This turbid water is used only for cleaning utensils and the other bore well water is used for household purposes. In field, turbidity and iron content are higher than the acceptable limits. They use water for irrigation & household purposes except drinking. In river area, bore wells contain very high amount of turbidity and iron content, here colour is also not within the acceptable limit. Here in one of the residences they used filter, thus this bore well water is used for household purposes whereas the other water is used only for cleaning purpose.

So we have to conclude that the water quality parameters are changes with changing water's location and geographical conditions, water usage, vegetation, human activities, seasonal variations, location of buildings nearby site conditions etc.

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Analysis of LULC Change in Kozhikode Corporation Using Remote Sensing & Geographical Information System

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ABSTRACT

Due to the interfering activities of humans in the environment, the Earth's surface has witnessed a variety of changes in land use and land cover (LULC). An understanding of LULC is important to maintaining a sustainable and healthy environment. The present work accentuates a spatiotemporal study on the LULC features of Kozhikode Corporation, a rapidly developed urban area in Kozhikode district, Kerala, India. The study focuses on the trends in Land use change due to the increase in population. For this study satellite images from Landsat 8 and Landsat 7 for the years 2000 and 2022 were interpreted. The LULC aspects were divided into categories of 5 classes: water body, vegetation, built-up land, barren land, and sand deposit. The findings affirm that the expansion of the built-up land area is proportionate to the growth of the population. Modern technologies such as remote sensing and geographic information system accentuate changes in land use patterns over time and the extent to which the changes affect the human population and their habitat.

Keywords- GIS, LULC features, Modify land, Population, Remote sensing

INTRODUCTION

The spatial distribution of soil, water, vegetation, and anthropogenic activities on the surface of the Earth is referred to as Land cover whereas Land use refers to how humans manage or modify land. The land use and land cover (LULC) of an area is the outcome of

socioeconomic undertakings as well as natural changes in the Earth. LULC data support the observed variations and unenviable side effects of imprudent land use, due to population overload [1].

Land use land cover change nowadays has turned into a core part of procedures for the supervision of common assets and checking natural adjustments [2]. Information on land use land cover is useful for some administration exercises and is considered a crucial component for demonstrating and understanding the Earth as a framework, additionally contributing fundamentally to Earth-atmosphere interactions [3].

STUDY AREA

Kozhikode Corporation

The Kozhikode Corporation (Fig.1) is the municipal corporation that administers the city of Kozhikode, Kerala, India. Established in 1962, it is in the constituency [4]. The Corporation manages 117 km² of the city of Kozhikode, with a population of about 609,224 (as of the 2011 census) within that area. Kozhikode Corporation covers coordinates of 11°15'31.5108"N and 75° 46' 49.4796" E. Kozhikode city is the central point for all districts in the northern region. It has been developed as a center for forest and agro-based industries and focuses more on development in trade. The city offers a very high potential for development contributing to the overall economic scenario of the entire northern region of Kerala [5]. Given this Kozhikode is considered one of the priority cities in the State. This demands the study of urbanization trends observed in the past years.

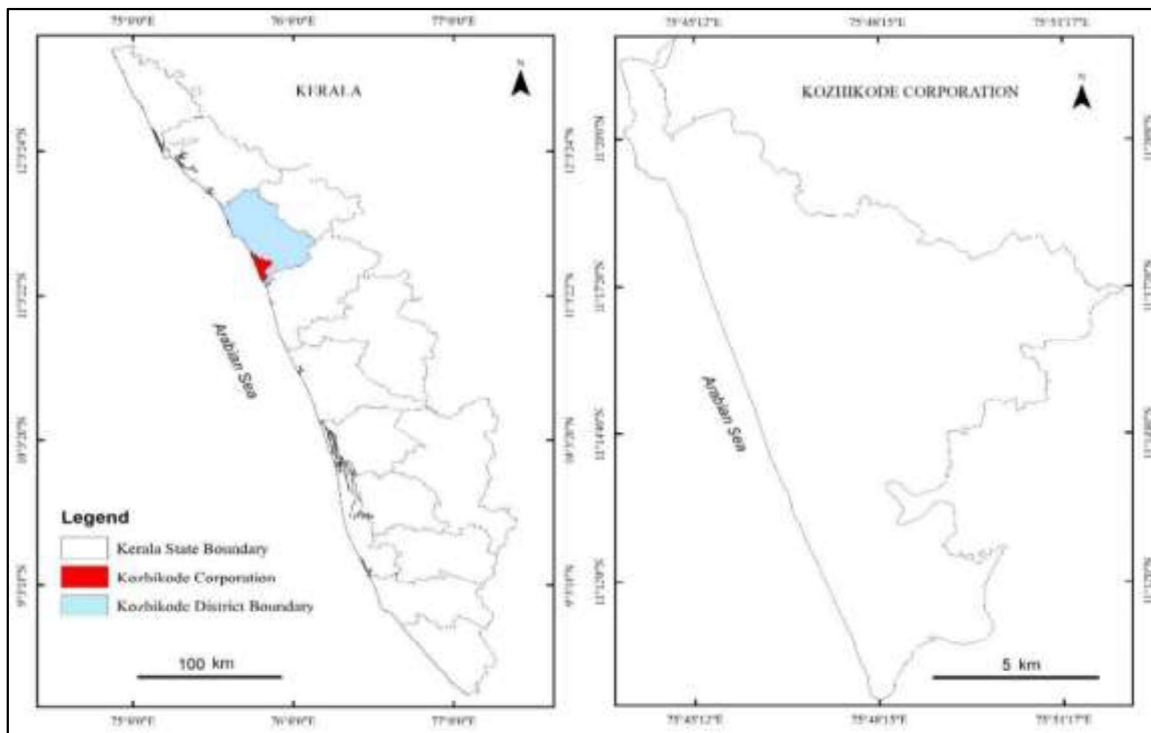


Figure 1: Location map of Kozhikode corporation.

METHODOLOGY

For assessing land use pattern changes in Kozhikode corporation, the most important factor is the generation of the land use land cover map. After generating maps before and after the selected period i.e., in this case during the years 2000 and 2022, change in area for selected classes can be done. The satellite data is collected from the USGS Earth explorer website. Landsat image of spatial resolution 30 m is chosen for the study. The processing of satellite data is done in ArcMap10.5. After carrying out classification the data is analyzed. The major steps for making a LULC map are data

collection followed by Digital image interpretation, Maximum likelihood Classification and finally, change detection [6].

Data is collected from USGS Earth Explorer. The Landsat images were used for this study. Data was collected from Landsat 7 and Landsat 8 imageries. The data for the years 2000 and 2022 were collected.

The next step followed by data collection is digital image interpretation. In this study for processing the images and to extract reliable information, ArcMap10.5 is used. ArcMap is software developed by ESRI, commonly used in tasks related to Remote Sensing and GIS (Fig. 2).

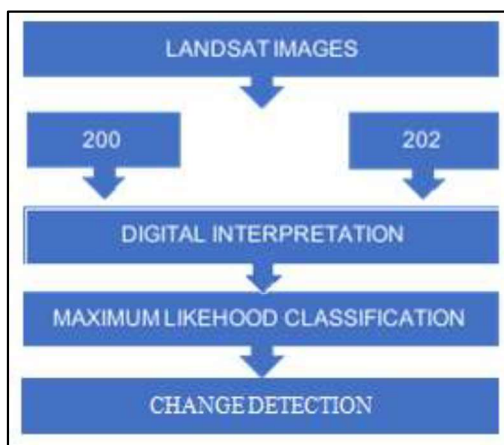


Figure 2: Flowchart of the methodology.

Maximum likelihood classification is done for this study. The classes chosen for this particular study are Vegetation, Water body, Sand Deposit, Built up, and Barren Land [7]. There are two types in which the classification can be done, unsupervised classification and supervised classification. Supervised classification is done for this study. Based on the knowledge of the user training sites (also known as testing sets or input classes) are selected. The user decides the bounds for how similar pixels must be grouped [8]. After selecting the training samples Image classification is done.

RESULTS AND DISCUSSION

The Land use Land cover map of Kozhikode Corporation for the years 2000 and 2022 has been obtained using Landsat imageries. The Kozhikode Corporation (117.8 Km²) has classes of landuse including vegetation, built-up, and barren land. The total area in square kilometers and the percentage for each land use class, for the years 2000 and 2022, were computed for the analysis. The pie chart illustrates the area distribution/land utilization, for each land use class in Kozhikode Corporation for 2000 and 2022.

Table 1: Area of different class in the year 2000 and 2022.

Parameters	Year				Area in Changes Between 2000 and 2022 (km ²)
	2000		2022		
	Area (km ²)	% of The Total Area	Area (km ²)	% of The Total Area	
Water body	2.58	2	2.4	2	Nil
Sand deposit	0.67	1	0.13	0.1~0	-0.54
Vegetation	90.39	77	20.12	17	-70.27
Built up	14.35	12	91.51	78	77.16
Barren land	9.42	8	3.27	3	-6.15
Total area	117.41	100	117.43	100	

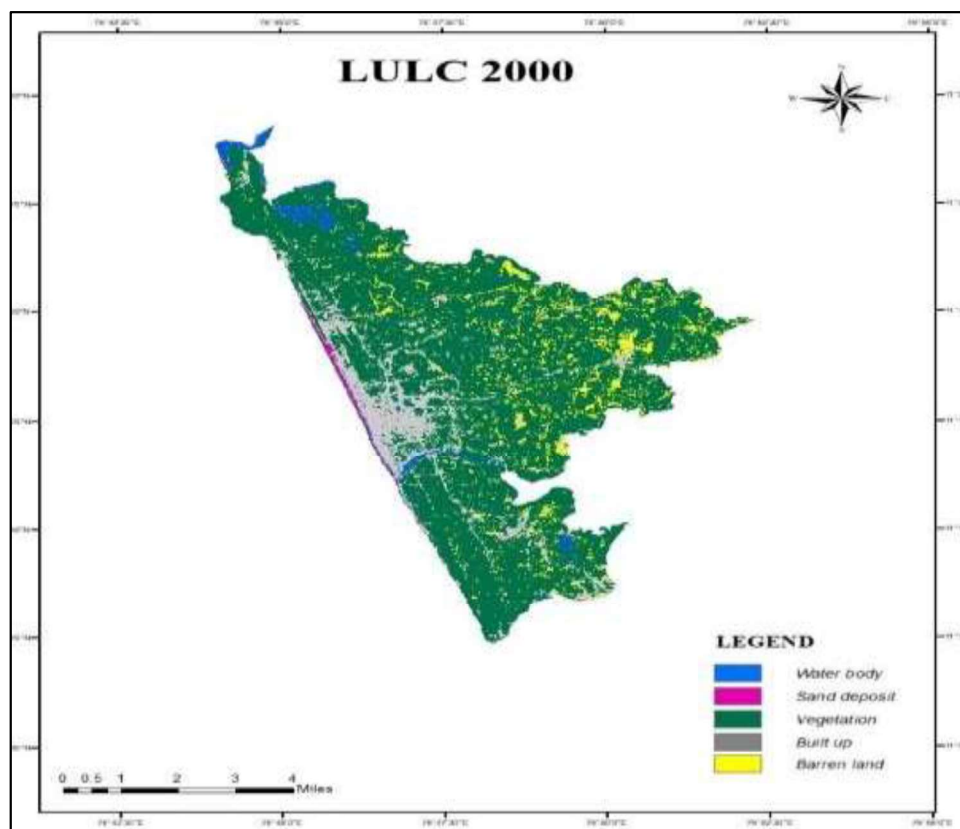


Figure 3: Land use land cover map for year 2000.

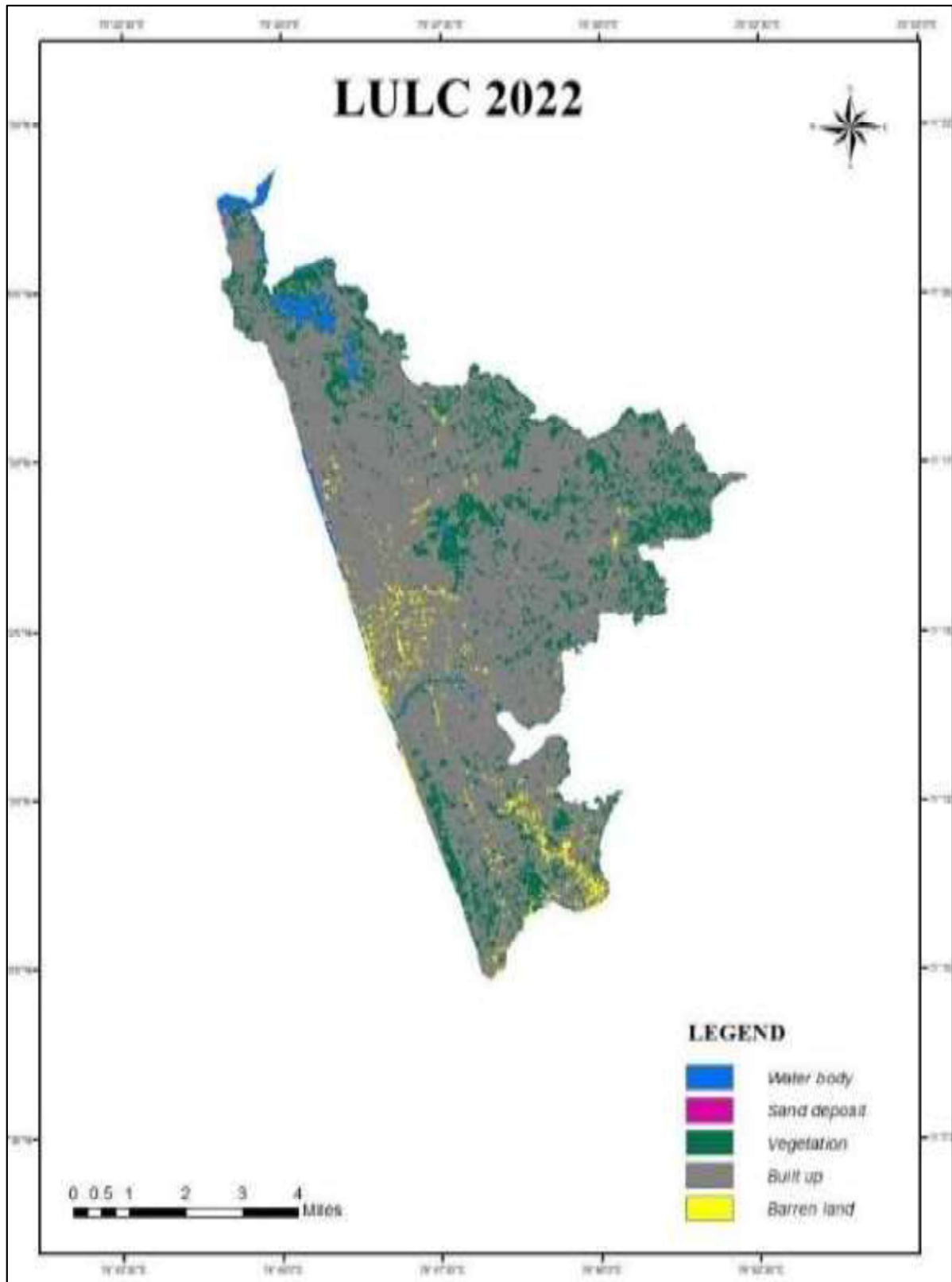


Figure 4: Land use land cover map for the year 2022.

The percentage changes in land use in different classes, over the period from 2000 to 2022, were calculated. From this, it is clear that the built-up land shows an increase in its

distribution from 2000 to 2022 (Fig. 3 and Fig. 4). The year-wise changes are represented by a bar chart. The results calculated based on these years are as mentioned in the table 2.

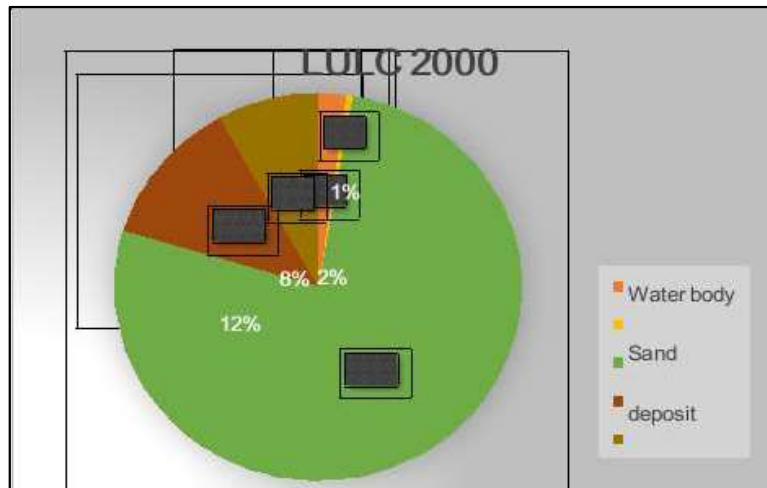


Figure 5: Pie chart illustrating the land utilization for each land use class in Kozhikode Corporation for the year 2000.

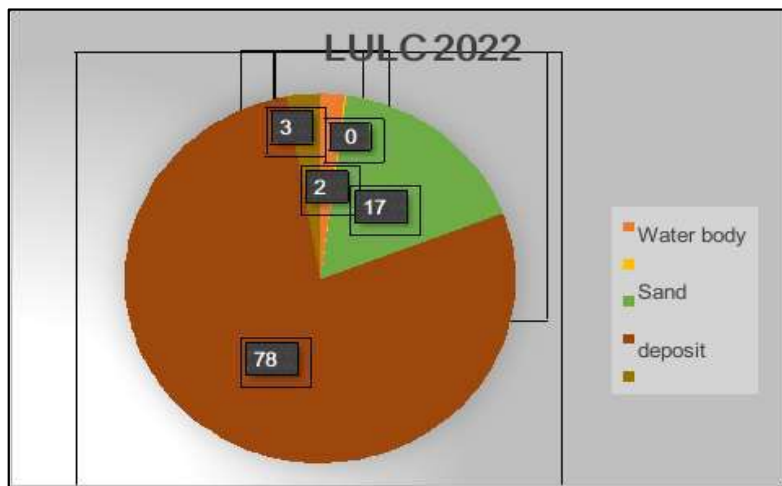


Figure 6: Pie chart illustrating the land utilization for each land use class in Kozhikode Corporation for the year 2022.

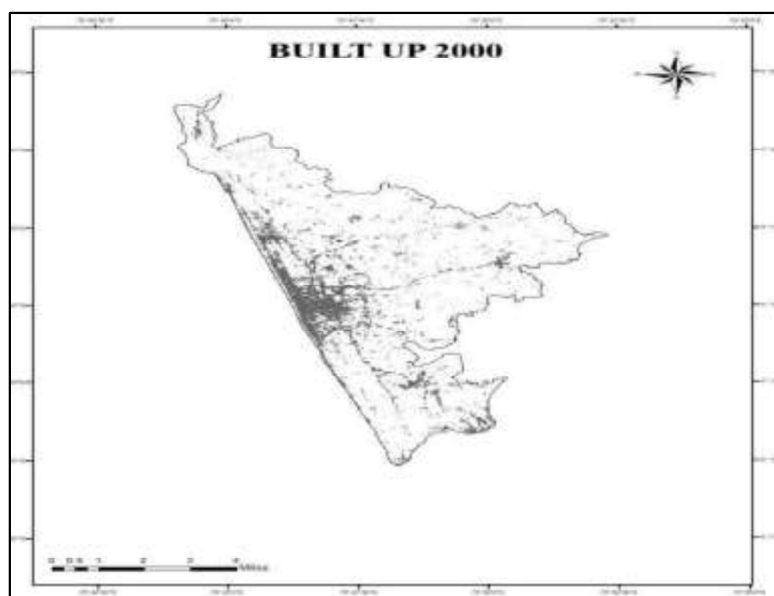


Figure 7: Land use and land cover pattern -built-up land in the years 2000 and 2022.

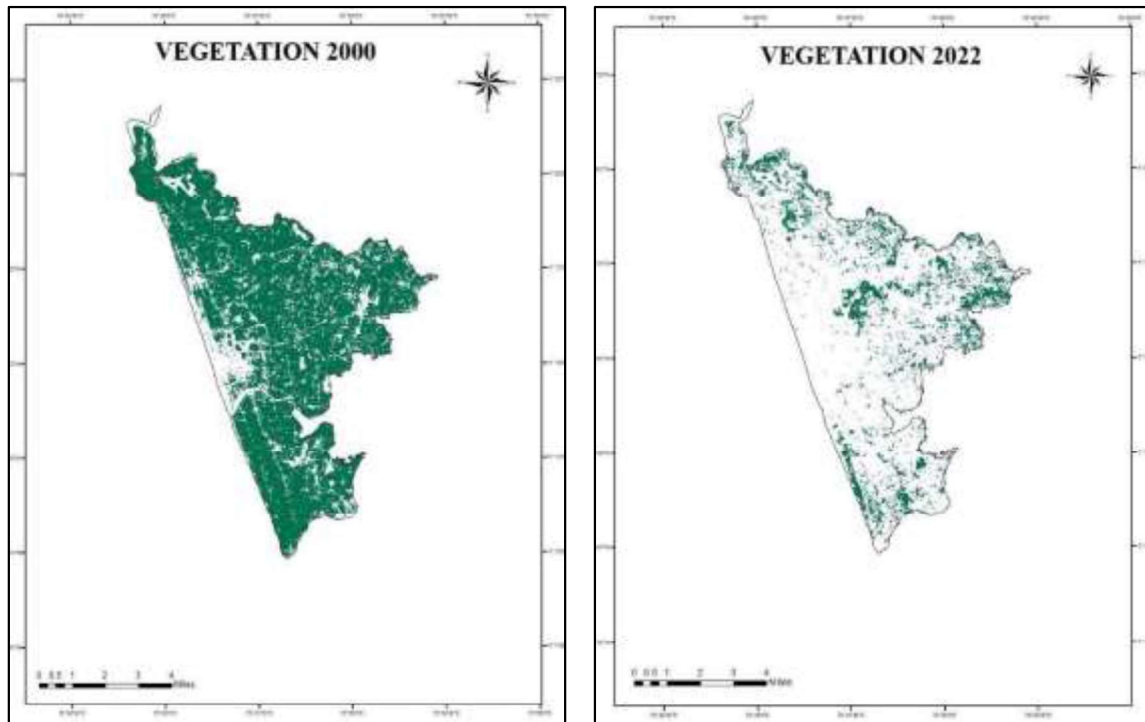


Figure 8: Land use and land cover pattern – vegetation in the years 2000 and 2022.

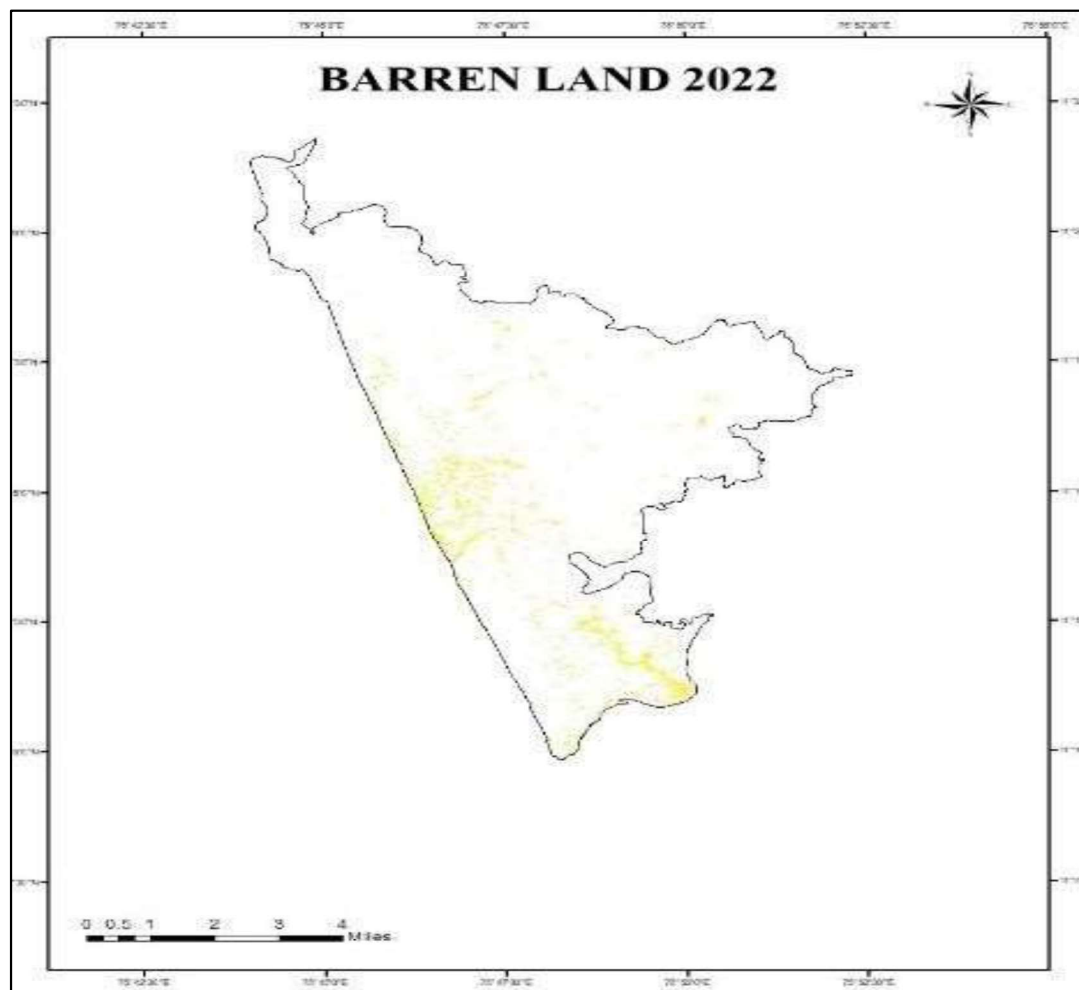


Figure 9: Land use and land cover pattern – barren land in the years 2000 and 2022.



Figure 10: Area in square kilometers for the years 2000 and 2022.

The built-up land in Kozhikode Corporation has shown an increase in the area of about 66%. The total area built up in the year 2000 was only 14.35 km² which increased to an area of 91.51 km². The built-up increase is due to an increase in population. The increased number of panchayaths in the corporation and the census data results of 2011 do reveal a stunning picture of urbanization in the district, with a 67.15% urban population and there is an increase in census urban areas in the previous decade including the corporation (Fig. 5-7).

There is a considerable decrease in vegetation. The vegetation includes plantations, coconut trees, other trees, and shrubs. The total area of 90.39 km² during the year 2000 shrunk to 17 km² in 2022. The rise in the built-up area led to a decrease in the area of vegetation. A decrease of 60% is observed for vegetation.

A decrease of 5% is observed for barren land. Initially in 2000 around 9.42 km² of the total area was barren. The barren land is depreciated to an area of 3.27 km².

Out of the remaining classes, water body initially having an area of 2.58 km² did not show any considerable change during the years. It has remained the same at 2.4 km² at the end of 2022. Water body occupies almost 2% of the total land area. There was a decrease in sand deposits during the years. Sand deposits having a total area of 0.67 km² depleted nearly to 0.13 km². The initial 1% of area decreased to 0.1% (Fig. 8-10).

CONCLUSION

The land use and land cover pattern of Kozhikode Corporation was studied with the help of GIS and remote sensing. The LULC maps were created and the change in different selected classes was studied. The classes chosen for this study were built-up land, vegetation, barren land, water bodies, and sand deposit.

The built-up area in Kozhikode corporation has increased and covers more than three fourth of the total area. This is due to the increase in population during the years between 2000 and 2022.

The vegetation has decreased and is mainly due to the rise in urban growth indicated by the increase in the built-up area. The barren land has shown a decrease in area and it may also be due to the increase in population density.

The sand body deposits which were found along the sides of river bodies depleted. The corporation does not have a lot of natural water bodies except the rivers marking the boundaries. But it contains artificial water bodies. There is no significant change in the area of water bodies present in the study area.

The overall land use land cover change indicates that the corporation had a rapid urban development during the study duration along with depletion in vegetation resources.

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Ground Water Quality Evaluation in Near By Landfill Area Njeliyanparambu, Calicut

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ABSTRACT

In developing countries landfills are situated near to cities, which may cause in release of harmful contaminants which may percolate to the groundwater and result in contamination. Municipal and hazardous waste are the main components of the landfill site which produce that harmful leachate. The main dumping site of Calicut Corporation is located in Njeliyanparambu. In this study an attempt was made to analyze about the physicochemical water quality parameters of groundwater collected from wells located nearby landfill in two different months in which one month having ten days continuous raining and to check whether raining affects these various parameters such as colour, odour, Electrical conductivity, Turbidity, Taste, pH, Chlorides, Fluorides, Total dissolved solids, hardness, Alkalinity, Acidity, salinity, Iron, Sulphates, Nitrates, E-Coli, Total coliform.

Keywords- Groundwater, Leachate, Microbial water quality parameter, Physicochemical water quality parameters, Variation of parameters in two months

INTRODUCTION

Good drinking water is the primary need of every human being. It plays a significant role in the well-being of all people. In India, water is obtained from different sources such as rivers, lakes, ponds, wells and tube-wells [1-3]. The water is consumed for so many purposes such as industrial, domestic needs, gardening, agricultural and irrigation. In all of these the quality of water is a very important concern. In cities water is taken from rivers and other

surface water bodies and is supplied to the population after treatments. But, in rural areas, the water is obtained by open and tube wells. The quality of groundwater depends on two factors such as the quality of soil strata and the nature of the aquifers [4].

Unfortunately, in many countries around the world drinking water supplies have become contaminated and the less quality of surface water is becoming an issue in many parts of the earth [5]. Fresh water became unavailable in nowadays due to pollution and it's over usage.

As the population increased, efforts were made to manage solid wastes increased [6]. The major reason for solid waste generation is changing lifestyle, food habits, and deviation in the standard of living, urbanization, and development of the tourism industry. Landfills are one of the methods which are necessary for waste disposal. In India most of the landfill sites situated near to cities, as an example Njeliyanparambu is a place on the outskirts of the city of Kozhikode in Kerala. Changes in the physico-chemical characteristics of water quality are affected by hydrological conditions, topography, climate, precipitation inputs, catchment area, other factors, etc. [7]. The leachate generation is caused by percolation of water from rainfall through waste deposited in a landfill [8-10]. When contact with decomposing solid waste, the percolating water becomes contaminated, and later it may affect the quality of groundwater as well.

STUDY AREA

Njeliyanparambu landfill site is located 6km away from Kozhikode city and actively being used for dumping waste in Kozhikode city (Fig. 1).

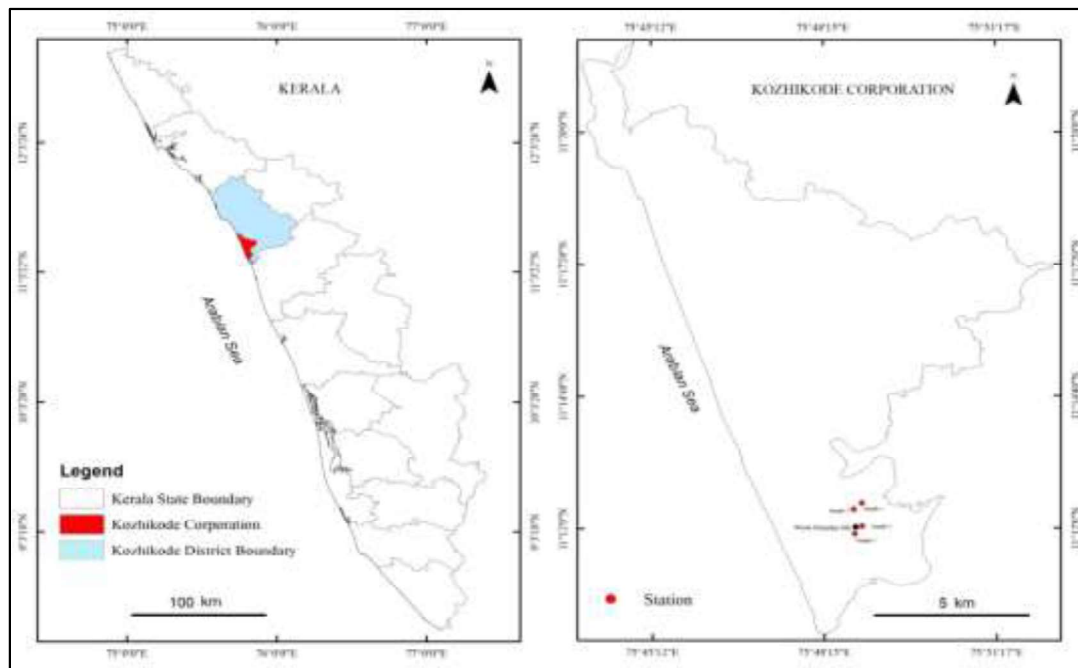


Figure 1: Map of Kozhikode city.

METHODOLOGY

Four water samples were collected from the study area during intermittent and continuous rainy times (May & June). four samples were collected from the wells nearby landfill area. In sterile bottles the physicochemical water quality

parameters were analyzed using standard methods. Parameters analysed were colour, odour, Electrical-conductivity, Turbidity, Taste, pH, Chlorides, fluorides, Total dissolved solids, hardness, Alkalinity, Acidity, salinity, Iron, Sulphates, Nitrates, E-Coli, Total coliform.

SAMPLING AND ANALYSIS

The Physico Chemical Parameters Obtained In May-Phase 1

Table 1: Physico chemical parameters obtained in may-phase 1.

Sl. No.	Parameters	Sample 1	Sample 2	Sample 3	Sample 4
1	Colour	<1 Hazen	<1 Hazen	<1 Hazen	<1 Hazen
2	Taste and odour	Disagreeable	disagreeable	Agreeable	Agreeable
3	Electrical conductivity	1341 $\mu\text{s/cm}$	1200 $\mu\text{s/cm}$	446 $\mu\text{s/cm}$	430 $\mu\text{s/cm}$
4	Turbidity	BDL	BDL	BDL	BDL
5	Total dissolved solids	705 mg/l	653 mg/l	234 mg/l	230 mg/l
6	pH	7.43	7.0	6.56	6.5
7	Total alkalinity	370 mg/l	300 mg/l	50 mg/l	52mg/l
8	Total hardness	362 mg/l	300 mg/l	92 mg/l	94 mg/l
9	Salinity	219.18 mg/l	200 mg/l	74.16 mg/l	78.45mg/l
10	Acidity	50mg/l	50 mg/l	40 mg/l	45mg/l
11	Fluoride	<0.01 mg/l	<0.01 mg/l	<0.01 mg/l	<0.01mg/l
12	Chloride	132.95mg/l	100mg/l	44.98 mg/l	43.9mg/l
13	Iron	0.05 mg/l	0.04 mg/l	0.02 mg/l	0.02mg/l
14	Nitrate	3.25 mg/l	2.5mg/l	1.11 mg/l	1.13mg/l
15	Sulphate	80.11	70.23mg/l	20.46 mg/l	21mg/l
16	Total coliform	TNTC	TNTC	TNTC	TNTC
17	E Coli	present	present	present	present

The Physicochemical Parameters Obtained In June-Phase 2

Table 2: Physicochemical parameters obtained in june-phase 2.

Sl. No.	Parameters	Sample 1	Sample 2	Sample 3	Sample 4
1	Colour	<1 Hazen	<1 Hazen	<1 Hazen	<1 Hazen
2	Taste and odour	Disagreeable	disagreeable	Agreeable	Agreeable
3	Electrical conductivity	1341 μ s/cm	1200 μ s/cm	446 μ s/cm	430 μ s/cm
4	Turbidity	BDL	BDL	BDL	BDL
5	Total dissolved solids	705 mg/l	653 mg/l	234 mg/l	230 mg/l
6	pH	7.43	7.0	6.56	6.5
7	Total alkalinity	370 mg/l	300 mg/l	50 mg/l	52mg/l
8	Total hardness	362 mg/l	300 mg/l	92 mg/l	94 mg/l
9	Salinity	219.18 mg/l	200 mg/l	74.16 mg/l	78.45mg/l
10	Acidity	50mg/l	50 mg/l	40 mg/l	45mg/l
11	Fluoride	<0.01 mg/l	<0.01 mg/l	<0.01 mg/l	<0.01mg/l
12	Chloride	132.95mg/l	100mg/l	44.98 mg/l	43.9mg/l
13	Iron	0.05 mg/l	0.04 mg/l	0.02 mg/l	0.02mg/l
14	Nitrate	3.25 mg/l	2.5mg/l	1.11 mg/l	1.13mg/l
15	Sulphate	80.11	70.23mg/l	20.46 mg/l	21mg/l
16	Total coliform	TNTC	TNTC	TNTC	TNTC
17	E Coli	present	present	present	present

RESULTS AND DISCUSSION Based on Phase 1 (Table 1)

- Sample 1and 2 had disagreeable taste and odour, and high values are obtained for total dissolved solids, total alkalinity and total hardness that is not within the permissible limit
- All samples had presence of total coliform and E coli.
- All the samples are not fit for drinking purpose.

Based on Phase 2 (Table 2)

- All samples were found as turbid and having more dissolved solids than acceptable limit.
- Sample 1and 2 was found that having high alkalinity and more total hardness as compared to samples 3&4 beyond acceptable limit.
- All samples had presence of total coliform and E coli.
- All the samples are not fit for drinking purpose.

CONCLUSION

On comparing samples in two months Colour & fluoride content were same in both the months and it can easily conclude that both the

parameters does not affected by the rainfall. Taste and odour, electrical conductivity, pH, acidity, chloride, nitrate, iron, sulphate contents were changed during the month June .But it was within the permissible limit. Turbidity, TDS, alkalinity, Total hardness, salinity was increased in June and it was exceeded the permissible values.it is due to the leachate percolation is more in rainy season. All the samples contained the presence of E-Coli and had a total coliform count which was too numerous to count. This indicates the water is not suitable for drinking purpose in both months. As the distance from landfill site increases the contamination in the well was found to be decreased. The only way to reduce the leachate contamination to provide good leachate drainage facilities and giving better lining to it.

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ANNEXURE A

Sl. No	Department	Student Name	Guide	Title	Publication Details
1	Biomedical Engineering	DILRUBA P K	Ms. Remya V	Intelligent IoT Based Syringe Pump Controlling and Monitoring Drip Level, Temperature and Pulse rate Using A Smart Phone Applications	Journal of IoT Security and Smart Technologies, Vol-1, Issue - 2 (May - August 2022) https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&as_vlo=2022&q=Intelligent+IoT+Based+Syringe+Pump+Controlling+and+Monitoring+Drip+Level+Temperature+Pulse+Rate+Using+A+Smart+Phone+Application&btnG=
		NISHANA YASMIN			
		PUNNYA P			
		SREELAKSHMI J			
2	Biomedical Engineering	ASWINI KRISHNA	Dr. Sameera V. Mohd. Sagheer	Parkinson's Disease Prediction Using Convolution Neural Networks	International Journal of Advances in Engineering & Management, Vol - 4, Issue - 7, July 2022 http://ijaem.net/issue_dcp/Parkinson%20s%20Disease%20Prediction%20UsingConvolutional%20Neural%20Network.pdf
		AYISHA FARBI C P			
		AYSHA ARSHA			
		HUDA			
3	Biomedical Engineering	ADHILA MUHAMMED K	Ms. Shibitha K P	IoT Based Medical Assistant Robot for Patient Monitoring	Journal of Cyber Security in Computer System, Vol-1, Issue - 2 (May - August 2022) https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&as_vlo=2022&q=low+cost+portable+ventilator+with+pressure+regulation+using+arduino&btnG=
		KHADEEJA FARHATH T			
		SANDRA SASIKUMAR V P			
		SHAHANAS E			
4	Biomedical Engineering	FATHIMA NIHALA P	Ms. Shibitha K P	LOW COST PORTABLE VENTILLATOR WITH PRESSURE REGULATION USING AURDINO	Journal of Electronic Design Engineering, Vol-8, Issue - 2, July 2022 https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&as_vlo=2022&q=low+cost+portable+ventilator+with+pressure+regulation+using+arduino&btnG=
		THASNI FATHIMA S			
		ARYA V			
		KARTHIKA SATHEESH K T			
5	Biomedical Engineering	SUJISHA K V	Ms. Shibitha K P	SIFT Enhanced Multiple Biometric Authentication System Integrated with Temperature Sensor	Journal of Cyber Security in Computer System, Vol-1, Issue - 2 (May - August 2022) http://matjournals.co.in/index.php/JCSCS/article/view/887
		THAMANNA FATHIMA			
		SHAMEEMA E K			
6	Biomedical Engineering	ANJANA B	Ms. Nutan Hegde	Detection of Diabetic Foot Ulcer using KNN Algorithm	International Journal of Advances in Engineering & Management, Vol - 4, Issue - 8, August 2022 https://www.ijaem.net/current-issue.php?issueid=45&title=Detection%20of%20Diabetic%20Foot%20Ulcerusing%20Knn%20Algorithm
		FEMIN ALI K M			
		KEERTHANA A			
		ADITHYA K			
7	Biomedical Engineering	AISWARYA K	Ms. Minilal M	Multilevel Classification of Retinal Diseases using SFCN	Journal of Signal processing, Vol.8 No.2 (2022) http://matjournals.co.in/index.php/JOSP/article/view/952
		AKSHAYA B M			
		APARNA A			
		VARSHA K V			
8	Biomedical Engineering	AGRAJA LENIN	Ms. Arya Indrāja	Parkinson's Prediction Techniques: A Comparison	International Journal of Advances in Engineering & Management, Vol - 4, Issue - 8, August 2022 http://www.ijaem.net/current-issue.php?issueid=45
		DHANYA S			
		SUNYYA P P			
		NAVNEETHA K A			
9	Biomedical Engineering	AALIA THAHA	Ms. Irfana Izzath	IOT Based IV Drip Monitoring and Control System with Compact Medical Stretcher	Journal of IoT Security and Smart Technologies, Vol - 1, Issue - 3, (September-December, 2022) http://matjournals.co.in/index.php/JISST/article/view/1008
		KRISHNA PRIYA P S			
		NEETHU BIJU			
		ATHIRA K			
10	Biomedical Engineering	SONAM SUNIL	Ms. Anusha EP	Canny Edge Detection Based Preprocessing and Feature Extraction for Tooth Decay Classification Using CNN	International Journal of Advances in Engineering and Management (IJAEM) Volume 4, Issue 9 Sep. 2022, pp: 421-424 https://www.ijaem.net/current-issue.php?issueid=46&title=Canny%20Edge%20Detection%20Based%20Preprocessing%20and%20Feature%20Extraction%20for%20Tooth%20Decay%20Classification%20Using%20CNN
		AKSHAYA M V			
		BHADRA BABURAJ I P			
		JASNA P C			
11	Biomedical Engineering	ADHILA MUHAMMED K	Ms. Shibitha K P	IoT Based Medical Assistant Robot for Patient Monitoring	International Journal of Advances in Engineering & Management, Vol - 4, Issue - 7, July 2022 https://www.ijaem.net/current-issue.php?issueid=44&title=IoT+Based+Medical+Assistant+Robot+For+Patient+Monitoring
		KHADEEJA FARHATH T			
		SANDRA SASIKUMAR V P			
		SHAHANAS E			

ANNEXURE C

Sl. No	Department	Student Name	Guide	Title	Publication Details
1	Computer Science and Engineering	SHILPA AJEESH M	Ms. Jijina M T	Rice Leaf Disease Detection and Crop Yield Prediction Using Random Forest	International Journal of Engineering Research in Computer Science and Engineering (IJERCSE) Vol 9, Issue 7, July 2022 https://ijercse.com/viewabstract.php?id=15918&volume=Volume9&issue=Issue7
		ANAGHA C			
		FATHIMA SIFA T			
		HILMA T			
2	Computer Science and Engineering	AYISHA SUMAYYA K	Ms Rahna C M	Sentiment Analysis on Student Feedback Using RNN	International Journal of Engineering Research in Computer Science and Engineering ,Vol - 9, Issue - 11, Nov 2022 https://ijercse.com/viewabstract.php?id=15915&volume=Volume9&issue=Issue7
		ROSHNI JOSEPH			
		SAISREE R K			
		SNEHA SATHEESH T			

ANNEXURE D

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1	Civil engineering	Jilsha A	Reena Abraham	Design and treatability studies of grey water	International Research Journal of Engineering and Technology (IRJET) , Volume: 09 Issue: 09 Sep 2022 https://www.irjet.net/archives/V9/i9/IRJET-V9I992.pdf
2	Civil engineering	Najla K	Binisha P	Ceramic water filter for drinking water treatment	International Research Journal of Engineering and Technology (IRJET), Volume: 09 Issue: 06 Jun 2022 https://www.slideshare.net/irjetjournal/ceramic-water-filter-for-drinking-water-treatment
3	Civil engineering	Rifana Fabin	Rana Rahman M	Treatment of landfill leachate using algae	International Research Journal of Engineering and Technology (IRJET), Volume: 09 Issue: 06 Jun 2022
4	Civil engineering	Sinam Shirin	Harsha P	Air pollution impact on environment in kozhikode city	International Research Journal of Engineering and Technology (IRJET), Volume: 09 Issue: 06 Jun 2022
5	Civil engineering	Thabsheera KK	Rana Rahman M	Production of eco brick from industrial waste	International Research Journal of Engineering and Technology (IRJET), Volume: 09 Issue: 06 Jun 2022
6	Civil engineering	Anjana Paramesh Nimna Nasar KT	Harsha P	Sustainable changes on soil properties by using seashell powder.	Journal of Environmental Engineering and Studies , Volume-7, Issue-2 (May-August, 2022) http://matjournals.co.in/index.php/JoEES/article/view/900
7	Civil engineering	Mufeeda NK Sreelekha TS	Reena Abraham	Evaluation of water quality parameters of different bore wells in different areas	Journal of Environmental Engineering and Studies, Volume-7, Issue-3 (September-December, 2022) http://matjournals.co.in/index.php/JoWRPS/article/view/1038
8	Civil engineering	Arunima pradeep Sufana Ahammed	Binisha P	Analysis of lull change in kozhikode corporation using remote sensing and geographical	Journal of Geotechnical Studies , Volume-7, Issue-2 (May-August, 2022) http://matjournals.co.in/index.php/JoGS/article/view/1010
9	Civil engineering	Fathima Henan E Nadeeda	Rana rahman M	Groun water quality evaluation in nearby landfill area njeliyan parambu, Calicut	Journal of Recent Activities in Infrastructure Science , Volume-7, Issue-2 (May-August, 2022) http://matjournals.co.in/index.php/JoRAIS/article/view/990

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KMCT
COLLEGE OF ENGINEERING FOR WOMEN

August 17, 2022

LETTER OF APPRECIATION

Ms.Sindhu V

Assistant Professor, Department of Civil Engineering,
KMCT College of Engineering for Women.

As a valued faculty of KMCTCEW, I would like to extend my deep appreciation for your hard work and dedication. I honor the effort you have put in leading your project team with maximum number of publications. You deserve this token of appreciation and keep up the excellent work!!

Principal


17/8/2022
Dr. D. Jerline Sheebha Anni

Principal

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