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Maize Oil Blended With Diesel as an Eco-Friendly Energy Source

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ABSTRACT: Petroleum – based fuels is a finite resource that is rapidly depleting. Consequently, petroleum reserves are not sufficient enough to last many years. Considering also the fact that petroleum – based fuels, can cause many environmental problems, imbalance of trade, high oil process etc., it becomes necessary the development of alternative fuel sources. At this paper will be examined the use of diesel-maize oil mixtures in diesel four-stroke engine. The mixtures used are the following: diesel-5% maize oil (k5), diesel-10% maize oil (k10), diesel-20% maize oil (k20),diesel-30% maize oil (k30), diesel-40% maize oil (k40), diesel-50% maize oil (k50). For those mixtures the gas emissions of carbon monoxide (CO), hydrocarbons (HC), nitrogen monoxide (NO) are being measured and the fuel consumption is also examined

Key-Words: - Bio fuels, maize oil as a fuel, Gas emissions,

I. INTRODUCTION

Diesel engines have been in use since the late 18th century. The first diesel engine was developed to run on a peanut oil .Once the technology becomes widely known in the 1900's, the abundance and low cost of fossil fuels, caused a paradigm shift away from vegetable based fuels. At the turn of current century, the same paradigm was beginning to shift back, due to rising fuel costs, the environmental impact and an abundance of waste feedstock available. In India, most of the heavy transportation plants, agricultural plants and power generation plants are powered by diesel engines. Thus there is a demand to find alternative fuels for diesel engines. It is thus very essential to make all possible efforts to search for alternative fuel oils.

A number of renewable energy sources, have been considered to achieve the above objectives. Some of them are Biogas, Alcohol, Hydrogen and vegetable oils. Particularly in tropical countries like India, oil seeds are produced by cultivation. Therefore vegetable oils are more dependable, sources of energy.

In the present conditions, even though the use of diesel is less expensive in engine in course of time, the natural sources will be exhausted and hence its price is bound to increased, then it would be appropriate to use vegetable oils as fuel oils. If vegetable oils are used as fuel oil, there is wide scope for, huge production of oil seeds. Hence cost of vegetable oil automatically will come down. In the present work, a study of the performance of C.I. Engines with maize oil and diesel blends, as fuels are made. The most serious drawbacks for vegetable oils, however is, it's very high viscosity, thus making is very difficult to inject into the cylinder and higher carbon residue, which makes, exhaust smoker than diesel oil.

In this paper, to study the performance characteristics, the experimental setup consists of a single cylinder four stroke diesel engine, coupled to eddy current dynamometer. The mixtures used are the following: diesel-5% maize oil (k5), diesel-10% maize oil (k10), diesel-20% maize oil (k20),diesel-30% maize oil (k30), diesel-40% maize oil (k40), diesel-50% maize oil (k50). For those mixtures the gas emissions of carbon monoxide (CO), hydrocarbons (HC), nitrogen monoxide (NO) are being measured and the fuel consumption is also examined.

After the performance of the above blend following result and conclusion are drawn

"Comparative Study of Performance of Rectangular Fins and V Fins on a Vertical Base Plate under Free Convection Heat Transfer"

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Abstract : Natural convection heat transfer is generally enhanced by provision of various shapes of fins such as rectangular fins, pin fins, perforated fins or V shape fins etc. In this work, the experiments are performed to determine the various heat transfer parameters using rectangular fins and V fins. From experimental observations, various parameters are calculated and graphs are plotted between various parameters such as average heat transfer coefficient, base heat transfer coefficient and Nusselt number versus heat input. The results revealed that the V shape fins produced a better performance than the rectangular shape fins. The calculation of the base coefficient of heat transfer is carried out towards establishment of the ideal temperature range for the base material.

Keywords- "Heat transfer enhancement, natural convection, rectangular fins, V fins"**.**

I. INTRODUCTION

Advanced technologies are needed to improve performance in heat transfer equipment. Methods used for enhancing the heat transfer rate are classified as active and passive methods. In the design point of view, active methods are sometimes complex and costly because they require some external power input for necessary flow adjustments and to improve the heat transfer rate and thus applications are limited. On the other hand, passive methods require some geometrical or surface adjustments to the flow passage by adding additional devices. The amount of conduction, convection, and radiation of an object shows the amount of heat it transfers. The heat transfer rate is enhanced by increasing the temperature difference between the object and the environment or by enhancing the coefficient of convective heat transfer or by maximizing the surface area of the body. In some cases, it is not appropriate or cost effective to alter the first two options.

Introducing a fin to a body, however, expands the surface area and sometimes this is a cost effective solution for heat transfer problems. Extended surfaces or fins are examples of passive methods that are generally used in different industrial applications for the enhancement of heat transfer between the primary surface and the surrounding fluid. The easiest and cheapest ways to dissipate unwanted heat is tackled by the use of fins."Rectangular fins are the most popular type of fins because of their low production costs and high effectiveness. Natural convection heat transfer is augmented usually by provision of rectangular fins on horizontal or vertical surfaces. As a result, energy saving and cost effective solution can be achieved by the use of V shape fins also. [1-2]

II. LITERATURE REVIEW

N. K.Sane and J.G.Kulkarni et.al [1]: The study investigated the free convection heat transfer of vertical tapered fin arrays. It was performed by varying the fin spacing and the base area of the arrays. The results indicated that downward-tended fins are more effective than upward-tended fins in achieving the same free convection heat transfer. Baskaya et al. [2]: Various geometrical factors such as height, width, and fin spacing were examined to study the natural convection heat transfer using horizontal fin arrays. The results indicated that the varying heights and lengths of the fin can affect the overall heat transfer from the arrays. Edlabadkar et.al. [3]: An experiment on a single V-type partition plate was performed to investigate the air flow over a base plate with varying angles in air as an ambience. The V shape fin was attached to the plate. The computational fluid dynamics simulations were performed to determine the optimal configurations for the air flow. The study revealed that the 90° V partition plate provides the smallest struggle to flow departure than the other partition plates. In the downstream zone, it also provides the most efficient high heat transmission area. V. Wankar and S. Taji et al. [4]: Under natural convection, flow patterns on rectangular fin arrays were investigated and tested experimentally. The purpose of the experiment is to investigate the effects of natural convection on a rectangular fin array. Lampblack coating is used to accomplish this. Sable et al. [5]: Multiple V-type partition plates adjacent to a vertical heated plate are used in the authors' proposed heat transfer augmentation technique. The key components that contribute to the heated plate's thermal conductivity are vertical fins that act as flow tabulators and expanded surface partition plates.

III. EXPERIMENTAL SETUP

The system is designed and manufactured for the measurement of heat transfer parameters for which the details are as follows: Aluminium is used to manufacture plain base plate and fin patterns for experimentation work. The aluminium base plate used for research work having the dimensions as 200mm X 200mm X 20mm. The total surface area

of rectangular fins and the total surface area of V-fins is kept equal. Fins of two different patterns are utilized to conduct experiments which are as follows;

1] Rectangular fin pattern

2] V type fin pattern

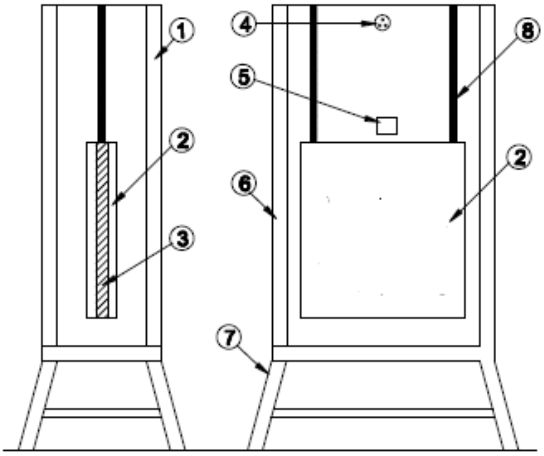


Fig.No.1: Schematic layout of Experimental System

1) Enclosure 2) Heated Plate, 3) Heater, 4) Heater Socket 5) Thermocouple Socket

6) Acrylic Sheet, 7) Stand, 8) Hanger

IV. EXPERIMENTATION

The whole system is kept under natural convection conditions and All measurements were taken in steady state circumstances.

In the present dissertation work, following different configurations are tested:

1) Plain Vertical Plate

2) Vertical Plate with Vertical fins

3) Vertical Plate with Horizontal fins

4) Vertical Plate with V-fins (Apex downwards)

5) Vertical Plate with V-fins (Apex upwards)

6) Vertical Plate with V-fins (Apex on Left Hand Side)

7) Vertical Plate with V-fins (Apex on Right Hand Side)

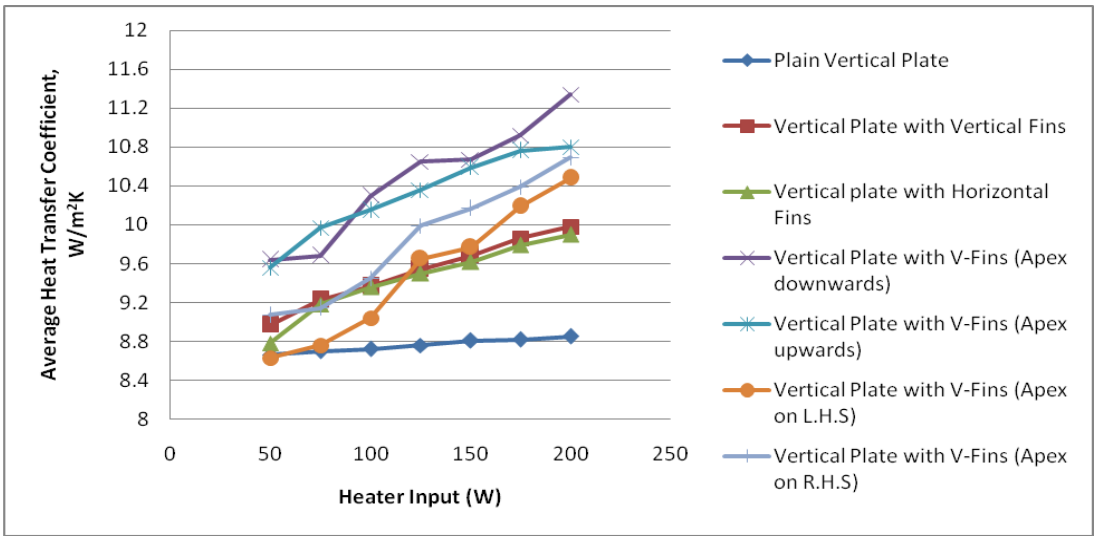
By varying heater inputs through dimmerstat at regular interval of time, wattmeter readings were recorded as Q watt. The temperatures of base plate surface, ambient temperature (T_{amb}) and fins were recorded using digital temperature indicator. The experimental results were obtained for different heater inputs as 50, 75, 100, 125, 150, 175 and 200 watts.

V. RESULTS AND DISCUSSIONS

From experimental observations, various parameters such as average coefficient of heat transfer, Base coefficient of heat transfer, Nusselt number, Grashoff number, Prandtl number, and Rayleigh number were calculated. All the fluid properties are calculated at mean film temperature and are taken from standard tables. The graphs are plotted to show the different trends.

The below mentioned are the results observed after experimentation -

Sr. No.	Heater Input (W)	Average heat transfer coefficient h – W/m² K						
		Plain Vertical Plate	Vertical plate with Vertical Fins	Vertical plate with Horizontal Fins	V-Fins with Apex Downwards	V-Fins Apex Upwards	V-Fins (Apex on L.H.S.)	V-Fins Apex on R.H.S.
1	50	8.66	8.97	8.78	9.64	9.56	8.63	9.07
2	75	8.70	9.23	9.18	9.68	9.97	8.76	9.14
3	100	8.72	9.37	9.36	10.30	10.15	9.04	9.45
4	125	8.76	9.54	9.50	10.65	10.36	9.65	9.99
5	150	8.81	9.68	9.62	10.67	10.59	9.77	10.17
6	175	8.82	9.86	9.79	10.92	10.76	10.19	10.39
7	200	8.85	9.98	9.90	11.34	10.80	10.48	10.69

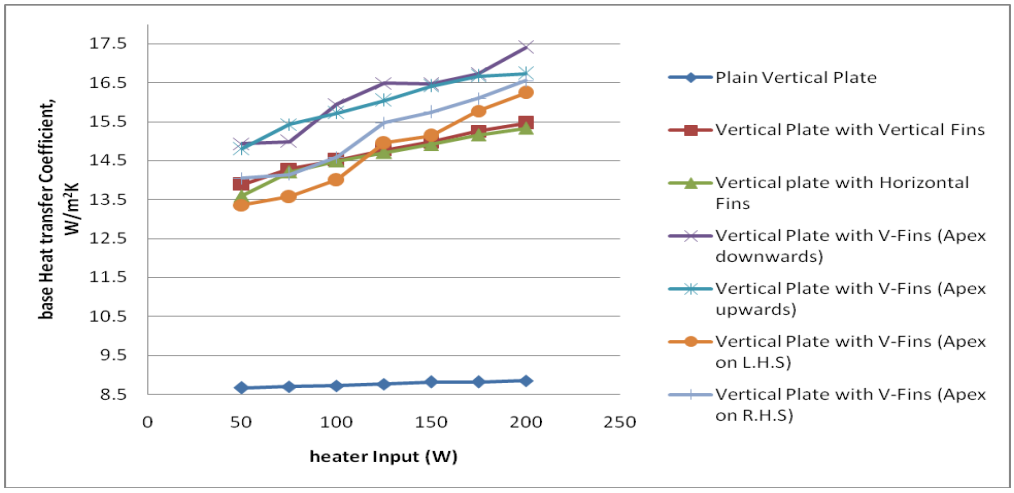


Graph 1 Variation of Heater Input vs Average Heat Transfer Coefficient

(Combined Graph for all Different Configurations)

Graph no 1. Shows the combined graph of variation of average heat transfer coefficient with heater input. The average heat transfer coefficient for V-fins with apex downward ranges from 9.64 to 11.34 W/ m² K. It is found from the data that V-fins with apex downward arrangement have the highest value of the heat transfer coefficient, and thereby has more better performance in comparison with the other configurations.

Sr. No.	Heater Input (W)	Base heat transfer coefficient h_b – W/m² K						
		Plain Vertical Plate	Vertical plate with Vertical Fins	Vertical plate with Horizontal Fins	V-Fins with Apex Downwards	V-Fins Apex Upwards	V-Fins (Apex on L.H.S.)	V-Fins Apex on R.H.S.
1	50	8.66	13.89	13.59	14.93	14.80	13.36	14.05
2	75	8.70	14.29	14.21	14.99	15.43	13.57	14.15
3	100	8.72	14.51	14.49	15.95	15.72	14.00	14.59
4	125	8.76	14.77	14.71	16.49	16.04	14.95	15.47
5	150	8.81	14.98	14.91	16.46	16.41	15.14	15.74
6	175	8.82	15.26	15.16	16.72	16.67	15.78	16.10
7	200	8.85	15.46	15.33	17.40	16.73	16.24	16.55



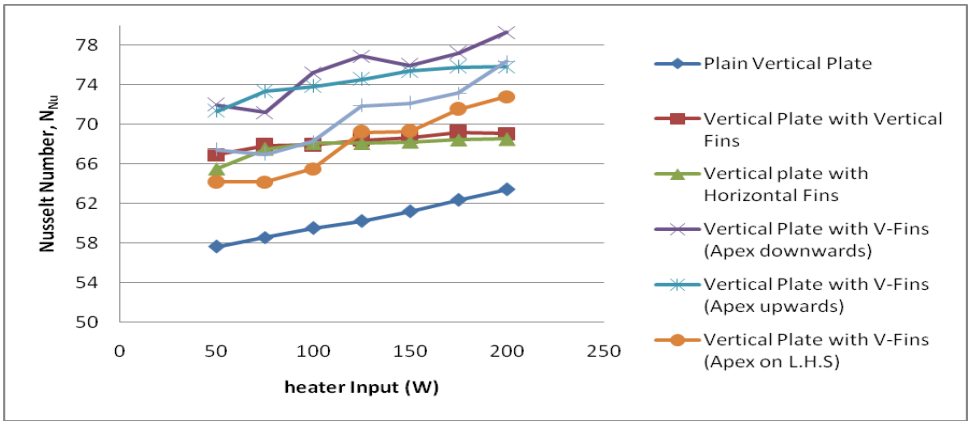
Graph 2 Variation of Heater Input vs Base Heat Transfer Coefficient

(Combined Graph for all Different Configurations)

For all setups, graph no.2 shows the combined graph of fluctuation of base heat transfer coefficient with heater input.

For "V-fins with the apex downwards", the basal heat transfer coefficient ranges from 14.93 to 17.40 W/ m2 K. According to the findings, the base coefficient of heat transfers for "V-fins with apex downwards" arrangement is higher than the other designs.

Sr. No.	Heater Input (W)	Nusselt No. N_{Nu}						
		Plain Vertical Plate	Vertical plate with Vertical Fins	Vertical plate with Horizontal Fins	V-Fins with Apex Downwards	V-Fins Apex Upwards	V-Fins (Apex on L.H.S.)	V-Fins Apex on R.H.S.
1	50	57.65	66.94	65.52	71.94	71.34	64.16	67.43
2	75	58.6	67.87	67.50	71.18	73.31	64.18	66.96
3	100	59.53	67.89	68.07	75.18	73.82	65.51	68.26
4	125	60.21	68.39	68.10	76.89	74.53	69.18	71.87
5	150	61.19	68.65	68.23	75.94	75.37	69.29	72.13
6	175	62.37	69.19	68.46	77.17	75.77	71.51	73.17
7	200	63.44	69.07	68.51	79.30	75.80	72.78	76.36



Graph 3. Variation of N_{Nu} with Heater Input

(Combined Graph for all Different Configurations)

The Nusselt number for V-fins with apex downwards ranges from 71.94 to 79.30, which is higher than the other configurations.

VI. CONCLUSION

When compared to other configurations, the average heat transfer coefficient value for V-Fins with apex downwards is larger. V-Fins showed 20% improvement in average heat transfer coefficient when compared to Plain Vertical Plate. When V-Fins were compared with vertical plate with vertical Fins, V fins showed 10.33% improvement. For V-Fins with Apex facing Downwards configuration, the base heat transfer coefficient is in the range of 14.93 – 17.40 W/m^2 K. The Nusselt number value for V-Fins with Apex facing downwards configuration is in the range 71.94 to 79.30, which is the highest as compared to other configurations.

Results from the present theoretical analysis clearly show that the V-Fins arrangement has good heat transfer performance than all other configurations because it disturbs the flow and due to this the flow of heat becomes turbulent, thereby increasing the heat transfer rate.

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Performance Evaluation of HVNLBP and SVM for Facial Emotion

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Abstract: Facial emotion recognition is challenging task as maximum face region expressions are required to be captured in terms of distinctive features. This paper focuses on evaluation of performance of local binary pattern (LBP) and hvnLBP methods for feature extraction capability for face emotion recognition. The conventional classifiers based performance evaluation is done for multiclass classification in which almost 98.5% accuracy of emotion recognition is seen with use of hvnLBP feature and support vector machine classifier.

Keywords: **LBP, hvnLBP, SVm, performance, Accuracy, Facial Emotion Recognition.**

I. INTRODUCTION

Welcome to International Journal for Research in Detailed Facial features plays important role while recognizing the facial emotions. The commonly used local binary pattern (LBP) method can extract features related to locations of eyes, chick, chin, nose and mouth. The detailed variation iwthing two images having different emotional expressions is challenging task.

One of the most crucial processes in picture description is feature extraction. Each feature extraction method has advantages and disadvantages of its own. A thoughtfully combined set of features, retrieved via various methods, can improve an application's ability to describe images [1].

This research suggests a modified Local Binary Pattern-based facial feature extraction technique (hvnLBP). The image is first acquired in this system. The supplied image is then preprocessed to account for changes in illumination. A face-detection algorithm recognizes faces and cuts out the faces. Then, features from the input image are extracted using the suggested LBP.

A modified LBP operator that conducts horizontal and vertical neighborhood pixel comparison is proposed, in order to overcome the drawbacks of original LBP by retrieving the missing contrast information embedded in the neighborhood to generate the initial discriminative facial representation [2].

II. RELATED WORK

In paper [3], producer dissected future face disclosure dataset and introduced WIDER FACE dataset which is extra outstanding and includes a number sorts of appearances which include obstacle, positions, scale, etc. Past dataset like ALFW, FDDB, and PASCAL FACE do not have sufficient arranging information. They alluded to as, unique face vicinity strategies, produce poor models. They motive that WIDER dataset from a range of foundation, chips away at the graph with each poor and effective models. Here producer proposed a multi-scale two-stage flood shape to put together dataset. Different method attracted with the direction of section extraction and specific datasets like Cohn Kanade, AR enlightening assortment, JAFFE data base, and so forth was once proposed in [4].

In [5] the producer dissected about one-of-a-kind calculation, for example, Viola-Jones face affirmation and mind-set expulsion vector. While seeing face in the picture, troubles like brightening, aggravation emerges. To vanquish aggravations, pre-managing ought to accomplish face region. Four kinds of techniques have been examined for face affirmation. They are Template matching primarily based approach, Knowledge-based approach, Appearance-based approach, Feature invariant framework in [6].

To acquire excessive precision in face depiction Nianyin Zenga et al in [7] proposed Deep Sparse AutoEncoders (DSAE). The DSAE gain is, it take out characteristic questioning about free learning. It shops essentially indispensable data. [6] To dispense with specific phase in the human face is a sizable occupation in characteristic extraction. Various structures have been evaluated like Principal Component Analysis (PCA), Gabor wavelet, Linear Discriminant Analysis (LDA), Discrete Wavelet Transform (DWT), Bezier distort. A excessive layered solidify, via becoming a member of look and numerical parts. The maker in [9] used direction of motion of face datasets like MMI, CK+,FERA, DISFA, SFEW,

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MultiPIE. [9] In this paper, the maker proposed a response with the aid of becoming a member of photo preprocessing steps and Convolutional Neural Network.

[10] Author used PCA, LBP and HOG for contain extraction techniques are used for depiction of face. The shut through elements are taken out in every aspect the use of Gabor wavelets with picked scales and path have been proposed by using the maker Ithaya et al [11]. These components are exceeded to a get-together classifier for seeing the region of face locale. The made method is carried out 98% exactness the use of CK dataset.

III. PROPOSED WORK

The general steps in facial emotion recognition system are shown in figure 1.

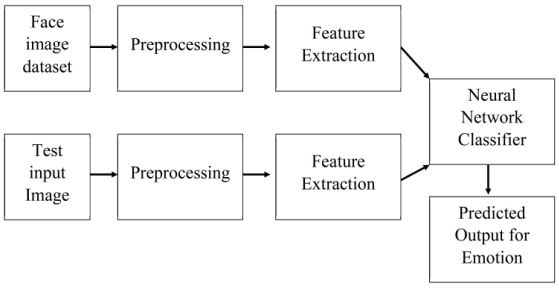


Figure 1: Block diagram of Proposed System

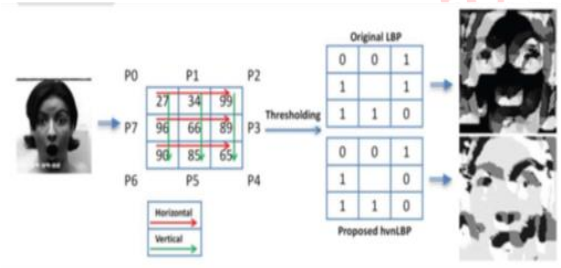


Figure 2: hvnLBP operator vs LBP.[2]

Procedure:

The Facial Feature Extraction as shown in the block diagram is as follows;

1. Image Acquisition: The first step of image acquisition is capturing image through camera interface. The dataset images can also be used which are captured using same camera.
2. Preprocessing: During image capture different light conditions in the environment are seen. The changes in illumination are required to be brought at uniform level which is achieved in the preprocessing stage.
3. Face Detection: For detection of facial features, face region from image is required to be located. The face region location can be done by using haar cascade classifier model. The detected face region then cropped from the image and processed further for feature extraction.
4. Modified-Local Binary Pattern (hvnLBP): In this stage modified-LBP feature extraction is performed due to which the discriminative facial features are extracted.
5. Classifier: The proposed system for facial emotion recognition consist of SVM classifier. The results of different classifiers are also used for comparative analysis as explained in results and analysis section.

Adaptive Histogram Equalization

In contrast to standard histogram equalization, adaptive histogram equalization computes many histograms, each corresponding to a different region of the image, and uses them to disperse the image's brightness values.

LBP (Local Binary Pattern)

Local binary pattern is created in the following manner:

• It first creates cells out of the window being viewed (each cell is, for instance, 16*16 pixels).

• Compare each pixel in a cell to each of its eight neighbors (on its left-top, left-middle, left-bottom, right-top, etc). Circularly, either clockwise or counterclockwise, move the pixels.

• Write "0" in cases when the value of the center pixel is higher than that of its neighbor. If not, type "1". Thus, an 8-digit binary number is produced (which is usually converted to decimal for convenience).

This way from input image, facial images are obtained.

hvnLBP (Modified Local Binary Pattern)

LBP [20], a well-known texture descriptor, uses a circular neighborhood to extract features. The contrast information between the neighborhood pixels is likely to be lost because the original LBP operator compares only the core pixel and the eight pixels around it. We suggest using hvnLBP to fill in the gaps in the neighborhood pixels' contrast information in order to resolve this issue. hvnLBP uses horizontal and vertical neighborhood pixels for direct comparison in place of the central pixel as in the original LBP to obtain the ensuing textural descriptions. [2].

As an example, we employ

$P = \{pi\} | i=1:9$

to represent the eight neighborhood pixels in LBP, as shown in Fig. 2. In either vertical or horizontal comparison, the values of the vertical or horizontal neighboring pixels are compared with one another. A 1 is assigned to the pixel with the highest value and a 0 is assigned to the remaining pixels. This horizontal and vertical comparison process can be conducted in any order, i.e., horizontal comparison followed by vertical comparison, or vice versa. Moreover, in both vertical and horizontal comparisons, we do not include the center pixel for comparison. Referring to Fig. 2, as an example, for horizontal comparison, we first compare the pixel sets of {p0, p1, p2}, {p7, p3}, and {p6, p5, p4}. Subsequently, we conduct the vertical comparison with the pixel sets of {p0, p7, p6}, {p1, p5}, and {p2, p3, p4}.

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If a pixel has conflicting outputs in the horizontal and vertical comparisons (e.g., the highest value in the horizontal comparison but not in the vertical comparison, or vice versa), then the highest value (i.e., 1) is used as the final output, since the pixel is regarded as important, which contains valuable contrast information in the dimension that generates the highest value. The mathematical representation of this proposed hvnLBPp,r operator is illustrated as follows:

hvnLBPp,r = {S(max(l0, l1, l2)), S(max(l7, l3)),

S(max(l6, l5, l4)), S(max(l0, l7, l6)),

S(max(l1, l5)), S(max(l2, l3, l4))} ...(1)

where p is the number of neighborhood pixels, and r is the radius. Li represents the ith neighborhood of pixel l while S denotes the comparison operation, as follows:

S(max(lj, lk, lm)) = 1 if maximum

0 if non_maximum ...(2)

where lj, lk, and lm represent the neighborhood pixels in a row or column.[2]

As we compare conventional LBP with hvnLBP i.e. modified LBP, the results indicates that modified LBP is more capable of capturing discriminative contrast information (corners and edges) among neighborhoods.

IV. Results and Analysis

Facial Region Extraction

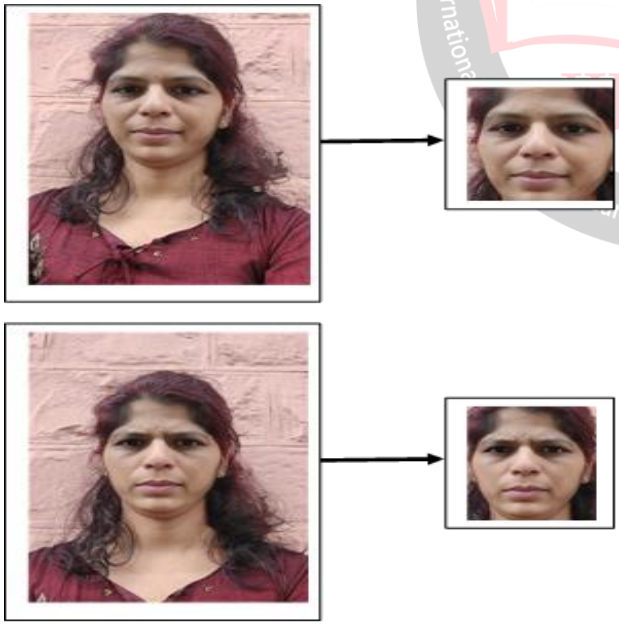


Figure 3: Facial Region Extraction

Classification:

The proposed face emotion recognition system is implemented using SVM, decision tree, Naïve Bays and ANN classifiers. The comparative results are obtained for classification of 5 classes of emotions. The classification accuracy is seen better for SVM model. The one against all type of classification configuration is done as these classifiers are used generally for binary classification. The multiclass classification along with LBP and hvnLBP results are analyzed. The performance outcome is shown in table 1 and 2 along with graphical results in figure 4 and 5 with LBP and hvnLBP features respectively.

Table 1: Classification performance with LBP features

Classifier	Accuracy	Specificity	Sensitivity
SVM	96.5	85	89
DT	91	81	80
NB	87	75	81
ANN	89	81	80

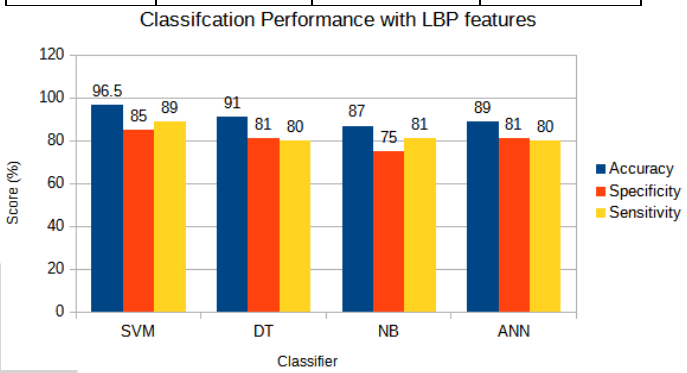


Figure 4: Classification performance with LBP features

Table 2: Classification performance with hvnLBP features

Classifier	Accuracy	Specificity	Sensitivity
SVM	98.5	91	92
DT	92	86	84
NB	89	81	85
ANN	91	86	84

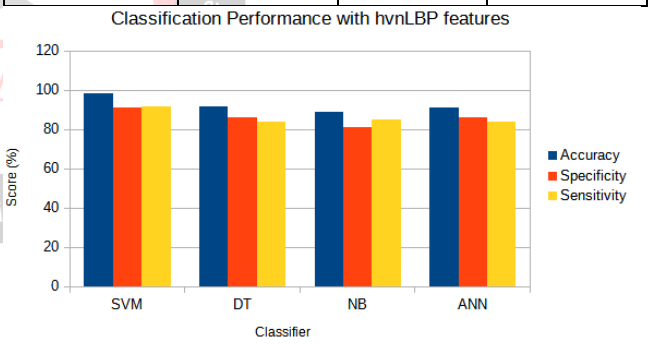


Figure 5: Classification performance with hvnLBP features

V. Conclusion

This paper contributes the performance evaluation of LBP and hvnLBP features with different conventional neural network classifiers. The performance of support vector machine (SVM) is seen well with 96.5 % accuracy for LBP classifier. Almost 2% accuracy is seen to have improved with hvnLBP features due to detailed features of the face. Almost 98.5% accuracy is seen for facial emotion recognition system with use of hvnLBP features and SVM classifier.

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The performance of SVM is seen better which can further be enhanced with use of deep features using deep learning classifier.

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Study of Facial Emotion Recognition Techniques

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***Abstract*—This paper discusses various methods used for emotion recognition from human face images. The stages involved in facial emotion recognition involve various image acquisition, preprocessing, facial region extraction, feature extraction, feature selection and classification stages. Each stage has various aspects with respect to researchers view point. The techniques and their respective key points are collected for discussion in this paper. This paper contributes for forming a platform for understanding various aspects and methods involved in facial emotion recognition system and provide direction for researchers in the field.**

Keywords: Face Region, Facial Emotion, image processing, Feature selection, Classification.

I. INTRODUCTION

As of now a-days, Emotion affirmation is a basic locale in PC vision. It is electronic programming that serves to recognize human opinions, for instance, Fulfillment, Anger, Sadness, Fear, and Disgust, besides, Surprise. Likewise, feeling Affirmation has its foothold on open places. Cases of human sentiments on public spot like genuine dispute between two individuals, driving vehicle with shock and so on. By understanding sensation of the individual, prepared to prevent any inauspicious act or chance. In this paper, unique methodologies and data bases used in later papers are analyzed for look affirmation. Various experts are interested to do explore in facial explanation. Since by the Quote "One individual could be chosen by their reactions not by exercises". Like that, person's perspective can be easily recognized by their sentiments rather than their words.

The human face accepts a critical part in correspondence. The face can impart their opinions through sentiments. Face Expression approach [2] can be isolated into three huge advances so the face in an image is known for extra dealing with, facial part extraction which is the strategy used to ultimately address the looks portrayal which is the movement that bunches the features eliminated in the appropriate verbalizations. The facial enunciation is for recognizing the crucial human tendency like disappointment, fear, euphoria, pity, and shock. Figure1 under showing the general development of feeling affirmation. From the figure, there are three critical times of for the most part structure. First is face revelation task in which first observable features are removed and subsequently face is perceived. The resulting advance is where the facial part extraction and affirmation of focuses on the overall features are taken out at the completion of the last development in portrayal. The general structure of facial emotion recognition system is shown in figure 1.

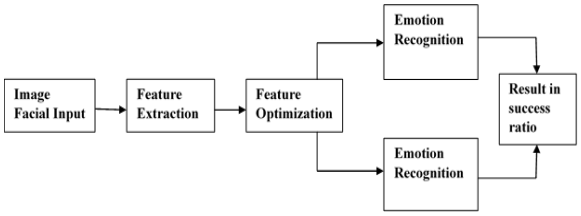


Figure 1: General Facial Emotion Recognition System

II. LITERATURE REVIEW

a. Techniques for facial region extraction

Face revelation is the one of the crucial fear in PC vision. Viola-Jones face locater strategy utilized in clear face unmistakable proof methods by means of the creator Stefanos Zafeiriou et al in [1]. Ankit Srivastava et al [2] reviewed about Viola Jones assessment. Calculation accommodates four phases. Anyway, haar highlights are utilized to see properties, 2nd Intergal photo utilized for consolidate estimation, 1/3 one is AdaBoost classifier utilized for social affair the picture. The imperative advantage of utilising this adaBoost classifier is pointless statistics on the face are disposed of. At last, streaming classifier

calculations are utilized and the blessings of making use of this evaluation is assists with dealing with regular pictures, dismissal of beguiling superb ID and unbelievably low evaluation time.

In paper [3], producer dissected future face disclosure dataset and introduced WIDER FACE dataset which is extra outstanding and includes number sorts of appearances which include obstacle, positions, scale, etc. Past dataset like ALFW, FDDB, and PASCAL FACE do not have sufficient arranging information. They alluded to as, unique face vicinity strategies, produce poor models. They motive that WIDER dataset from a range of foundation, chips away at the graph with each poor and effective models. Here producer proposed a multi-scale two-stage flood shape to put together dataset. Different method attracted with the direction of section extraction and specific datasets like Cohn Kanade, AR enlightening assortment, JAFFE data base, and so forth was once proposed in [4].

In [5] the producer dissected about one-of-a-kind calculation, for example, Viola-Jones face affirmation and mind-set expulsion vector. While seeing face in the picture, troubles like brightening, aggravation emerges. To vanquish aggravations, pre-managing ought to accomplish face region. Four kinds of techniques have been examined for face affirmation. They are Template matching primarily based approach, Knowledge-based approach, Appearance-based approach, Feature invariant framework in [6].

1 Haar Classifier

Analyzing Haar factors involves increasing or decreasing the size of the pixel pack. It uses Haar-like elements to recognise an image. Using this method, items of various sizes can be diagnosed. In the getting ready stage itself, the Haar classifier will identify a number of factors that are mostly responsible for the face distinguishing proof problem. Because of the low estimation multifarious character, it is appropriate for face proximity in the planning stage as it would signal to high acknowledgement accuracy [27].

2 Adaptive Skin Colour

Adaptable skin-assortment mannequin functions face acknowledgment approach thinking about skin-assortment mannequin to apprehend the face area. This computation suggests a excessive precision as complexion is used for division. In this manner it will in standard be honestly to isolate the face place and non-face district. Anyway, this estimation would not work with distinctive stages of illumination. To keep away from this issue, adaptable gamma therapeutic system is smart to use (yet no longer appropriate regularly surroundings as a end result of excessive computational complexity) [27].

3 Adaboost Contour Points

Adaboost is reasonable to recognize face in continuous ecological components due to low computational complexity and extravagant precision. In this technique, different classifiers can be streamed. It traines the faces and fabricated areas of strength for a which prompts exorbitant acknowledgment accuracy. Then the new face will be strangely, with the existence measured model created through the classifier. It likewise used structure components to recognize face. The structure factors may besides supply a positive accuracy and by and large execution due to the truth the parts removed are considerably less which prompts low computational multifaceted design [27].

b. Feature Extraction

To acquire excessive precision in face depiction Nianyin Zenga et al in [7] proposed Deep Sparse AutoEncoders (DSAE). The DSAE gain is, it take out characteristic questioning about free learning. It shops essentially indispensable data. [6] To dispense with specific phase in the human face is a sizable occupation in characteristic extraction. Various structures have been evaluated like Principal Component Analysis (PCA), Gabor wavelet, Linear Discriminant Analysis (LDA), Discrete Wavelet Transform (DWT), Bezier distort. A excessive layered solidify, via becoming a member of look and numerical parts. The maker in [9] used direction of motion of face datasets like MMI, CK+,FERA, DISFA, SFEW, MultiPIE. [9] In this paper, the maker proposed a response with the aid of becoming a member of photo preprocessing steps and Convolutional Neural Network.

[5] To get face depiction, two varieties of buildings are assessed in this paper. They are numerical section based totally method and substantially exhaustive layout based totally systems. LBP, Thermal Image Processing and Neural association, Fuzzy reasoning based totally feeling demand are in like manner audited to attain look. Different get-together opinions like Support Vector Machine (SVM), Euclidean Distance, chi rectangular distance are bankrupt down.

[1] Stefanos Zafeiriou et al. maker examined about include extraction methods. Pixel-based aspects make use of pixel fits and manage factor of set as parts. Nonexclusive direct components are made which is a getting sorted out limit. Experiences primarily based include used to be made for floor social match and nonexclusive openness of thing.

Ali Mollahosseini et al in [8], an arranging known as fundamental idea relationship to manipulate the seem problem over many face datasets. The proposed community has two layers known as 4 Inception layer and max pooling.

[10] Author used PCA, LBP and HOG for contain extraction techniques are used for depiction of face. The shut through elements are taken out in every aspect the use of Gabor wavelets with picked scales and path have been proposed by using the maker Ithaya et al [11]. These components are exceeded to a get-together classifier for seeing the region of face locale. The made method is carried out 98% exactness the use of CK dataset.

Rule Components Analysis (PCA) is a method for overseeing seeing plans in data, and supplying the information to consolidate their related features and differences. The appear affirmation the usage of Eigen faces in which PCA is used to avoid components from enter picture. Explicitly they make planning dataset to look at result. Once inputted face image is pre-overseen and distinction and getting equipped dataset which are at this factor figured proper presently thinking about the idea, they separated the fame set into six essential training as displayed through boundless expression(Happy, Surprise, Disgust, miserable, Angry, Fear)[12].

Neighborhood matched Pattern (LBP) primarily based contain extraction framework is used inferable from its incredible mild invariance property and low computational complexity [13]. The close by traits is restricting via the middle well worth and the end result is handled as a twofold number. Expecting that the run pixels regard is greater vital than the neighbor's well worth development 1, anyway zero consequently, it encodes the close by facts beneficially.

Dynamic Appearance Model (AAM) is a certified method for form and floor look and phase extraction. It has been typically used in PC imaginative and prescient applications. AAM produces quantifiable look fashions via becoming a member of a mannequin of structure assortment with a floor gathering. So the AAM makes the shape, floor combo mannequin of orchestrating facial image improvement "Surfaces" are pixel powers of the aim photo [14].

Facial Action Coding System (FACS) used to be made through Paul Ekman and Wallace Friesen in 1976 is a graph for assessing look. FACS depends on the examination of the members of the family between muscle withdrawal and modifications in the face appearance. The Face can be disengaged into Upper Face and Lower Face Action devices [15].Action Units are adjustments in the face completed by using one muscle or a combo of muscles. There are forty six AUs that tackle modifications in seem to be and 12 AUs associated with eye gaze route and head bearing. Haar classifier based totally technique is picked for face openness inferable from its excessive affirmation exactness and relentless execution [16]. Consolidates in truth setting apart associated rectangular shapes in which the cost of the section is the capability of extent of pixel.

c. Features reduction

1 Linear Discriminant Analysis (LDA)

LDA is a method for learning coordinated subspaces. As it might be organised soon, paper [16] used a straight LDA-based request plot for FER. While this was going on, paper [13] utilised LDA to view enunciations by utilising LBP characteristics. In paper [13], LDA is employed to look for projections of hatchets where the records of activity for various lessons are distant from one another while calling for the records of activity for comparable lessons to be close to one another.

2 Fisher Face Method

The Fisher Face approach calls for exact normalisation, registration, and mapping of internal face features [16]. The Fisherface approach was proposed by Peter N. Belhumeur, Joao P. Hespanha, and David J. Kriegman [17] and has been tested on the Harvard and Yale face databases with results that demonstrate lower error rates than Eigenface. Fisher's Linear Discriminant (FLD) approach served as the foundation for Fisherface. The ratio of between-class scatter to within-class dispersion will be maximised [17].

3 Principle Component Analysis (PCA)

The most frequently used strategy is PCA. It is a face affirmation technique considering straight appearance.

The information speculation approach behind PCA isolates input face photos into a foreordained number of specific component pictures. The "Eigen Face" feature picture is one of the fundamental pieces of the basic planning set of face pictures. PCA is in like manner utilized in clinical picture assessment, handwriting examination, lip scrutinizing, talk affirmation, and hand movement assessment [29].

d. Classification

Support Vector Machine classifier use Eigen values to parent out Eigen faces in [5]. In Euclidean Distance, the rectangular root summation view is regarded as the viable end result of the exceptional picture. In chi rectangular distance, least distance yields the most over the pinnacle well worth amongst the two precis of limits.

The instructive assortments, for example, Cohn-Kanade statistics base and JAFFE instructional listing are utilized to accomplish feeling insistence. Ghulam Ali et al in [10] proposed classifier helped NNE (mind affiliation outfit) assortments relies upon upon three undertakings. A first errand is to set up the blueprint of baselevel classifier. Second mission is to bring gathering set of sport plans. Third undertakings it to deal with the trouble of becoming a member of choices. Creator introduced NB classifier (Naïve Bayes classifier) to settle becoming a member of preferences issue. Convolution frontal cortex community flood is utilized in [2]. It perceives massive edifying collection. It accomplishes extraordinary velocity and greater accuracy. [4] Classifier is utilized to bundle disposed of elements. SVM, Nearest Neighbor and SVM classifiers are utilized. Planning of Convolutional Neutral Network proposed with the aid of the creator in [9]. It consists of 5 layers, for example, convolutional layers, sub-surveying layers and definitely associated layer. Here, first layer remove visible parts. First layer from an ordinary standpoint spin round corners, shapes, etc. Spatial purpose is diminished in the following layer.

Face components can be perceived in the 0.33 and fourth layer. The final layer receives the components in time-honored and produce eventual effect of stage of sureness of the alluded to verbalizations. [8] Author using waiting for pass records base. Creator introduced essential frontal cortex format and accomplishes stage of reflection and portrayal to tune down tangled plan. [7] In this paper, producer proposed a necessary forlorn autoencoders, a large frontal cortex community which is made via stacked little autoencoders and subtle maxclassifier. While organizing arranging, establishing development is to coordinate the stack forlorn autoencoders and their consequence is feed to the greater layer of DSAE. Next mess up engendering method is utilized to make overhauls of cutoff factors which are utilized in the necessary frontal cortex affiliation.

Well functions a bunch of factual mannequin to painting the measurable way of behaving of a signal [21]. In paper [21], they lookup 5 selections of HMM fashions which are; (I) Left-Right HMM, (ii) Ergodic HMM, (iii) Emotion-Specific HMMs, (iv) Multilevel HMM and (v) Mixture of HMM and intelligence organization. End is, the HMM accomplishes higher grouping both three or 5 kingdom mannequin utilized free articulation or combo of articulation making use of staggered nation models.

NN executes a nonlinear reduce of the information dimensionality. It plans a factual desire about the classification of the articulation that has been noticed. Each end result unit will gauges on the probability of the analyzed articulation has a area with the associated classification [22].

Support Vector Machine (SVM) is one of the nicely recognized measurable tactics utilized in AI to damage down records utilized for order and relapse examination. SVM utilized exclusive piece functionality to format facts in enter area into high-layered spotlight areas [21].

Bayesian Network (BN) is a graphical mannequin which equipped to exhibit a life like and herbal connections by using making use of probabilistic methodology amongst a bunch of attribute [21].

Scanty Representation Method (SRM) makes use of a direct combine of all the education exams to "meagerly" tackle and signify the face picture. "Meagerly" is alluding to sure coefficients of the direct combine are equal or close to zero [18].

Table 1 offers define of the facial district extraction techniques.

Algorithm	Accuracy	Performance in real-time
Haar classifier	Accuracy is high for face detection due to suitable Haar features	Computational complexity is very less due to a set of features which contribute the maximum, for the face detection problem in a training phase
Adaptive skin color	Accuracy is good as skin color in identified easily but fails in different levels of illumination	Approaches such as adaptive gamma corrective method is used to get rid of illumination problem which leads to high computational complexity and is not suitable in real-time environment
Adaboost contour points	High detection accuracy due to strong classifier single face is detected using contour points due to which the accuracy is good	Computational cost is less due to trained model low computational complexity due to less number of features

Table 1: Comparative study of different facial region extraction methods

Table 2: Comparative different existing methods for facial emotion recognition

Paper	Expressions	Face Detection	Feature Extraction	Expression Classification	Data set	Accuracy
[3]	Happy, Anger, Sad, Surprise, Normal	Luxand Face Recognition	Angle And Distance Method	SVM	Real-time	85.6%
[5]	Anger, Contempt, Disgust, Fear, Happy, Sadness, Surprise, Neutral	AAM, Hog, PCA	DSAE	Softmax Classifier	CK+ JAFFE	95.79 %
[7]	Happy, Sadness, Surprise, Anger, Disgust, Fear, Neutral	Define Distance between Two Centers of Both Eyes	Wavelet Entropy	Jaya Algorithm	[15]	96.8%
[8]	Happy, Sadness, Surprise, Anger, Disgust, Fear, Neutral	Viola-Jones's Haar-like feature cascade detector	PCA, Fisher Face + HOG	SVM	CK+	81%
[9]	Neutral, Fatigue	Hog	Facial Landmarks Points (Cascade of Regression Tree)	SVM	CK+ PICS	82.79 %
[11]	Joy, sad, surprise, fear, anger, disgust, neutral	Hog	Face Alignment with Regression Tree (Landmark Detection Algorithm)	Multilayer Perceptron	JAFFE	88.03 %

III. CONCLUSION

This essay adds to the body of research on techniques for facial emotion recognition. Different face region extraction techniques from the input image are used by the facial recognition system. Then, features are taken from the extracted face region. Following that, the retrieved characteristics are optimised to choose the signature features. An artificial neural network classifier is trained using signature features. Thus, the trained classifier is prepared to recognise facial emotions. Typically, multiclass support vector machines outperform traditional classifiers. For better feature selection and optimization for quicker classifier convergence, the particle swarm optimization and micro genetic algorithm might be taken into consideration.

In the near future, the research of facial emotion detection may also improve social feedback and interactions between Human Robot Interfaces (HRI). The geometric portion of the face is mostly used for emotion detection (eg; eyes, eyebrow, and mouth). The review takes controlled experimentation, real-time data, and uncontrolled imagery into account. The primary concerns are on the validity of the research methods used.

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Development of Pose Invariant Face Recognition Method Based on Pca and Artificial Neural Network.

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ABSTRACT-

This paper considers human face for pose invariant face recognition as a biometric parameter. There are lots of methods proposed for the face recognition. Face recognition by Neural Network and PCA is common method used now days. But every time it is not possible that the situation or poses are same. Due to some reasons the conditions are change like wink position, blinking, left pose, right pose, etc. In such cases recognition goes difficult. This paper focused on pose invariant human face recognition system and as a result we focus on face recognition system using PCA with feed forward Neural (Multilayer) Networks for recognition of human face irrespective of pose of face in images. The Principal Components Analysis (PCA) is used as a feature extractor whereas Neural (Feed Forward) Network is used for classification. We refer Yale Face Database with 11 images for each subject in which is having poses like wink, open mouth, smile etc.

Keywords- PCA; Neural Network; Yale; Pose; Eigen Vector; Eigen Value;

1. INTRODUCTION-

Face recognition methodology uses computer algorithm to prefer out some specific, typical details about a human's face. Some of these details, such as distance between the eye's opening or shape of the chick and chin, are represented into a mathematical model and compared with the data on other faces composed in a face database.[6][11]

Face recognition is a methodology of recognizing or authenticating a subject's through an image of their face. Generally, this recognition is used to access an applications or systems or services. Facial appearance has more gestures or positions due to the face muscles above the skin on face. As per the controversial theory, the movement of muscles conveys the emotional state of a specific to viewers [11][17]. There are lot many from facial of poses as per the study: Happy, Sad, Angry, Fearful, Disgusted, Surprised, wink, Appalled, Hate, Impressed etc. Independent of the Poses, the face recognition is process perform by both human's eyes and brain system or by means of some algorithms, which has the steps as:

1. Face Locating in picture (detection of face),
2. Feature Extracting by means of some algorithm from above face (e.g., Eigen value calculation; this step is called as feature extraction for face recognition),
3. Analyzing face from the pose image with the extracted features and recognizing the face from above information by means of classifier and recognizing it as a subject.

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This paper proposes PCA for the process of extraction of feature from input images and Feed Forward Neural Network for the process of classification. The neural network is multilayer NN.[29[[36]

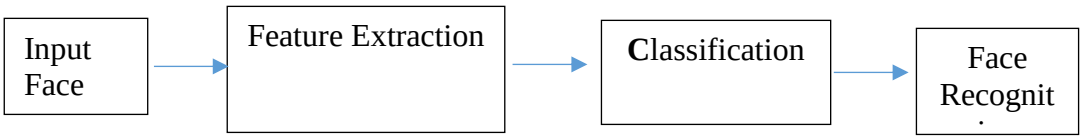


Figure 1: steps in designing the Pose invariant Face Recognition.

a. PCA (Principal Components Analysis): -

PCA (Principal Components Analysis)[29] is one of the used standard statistical methodologies recommended to facial features extraction. This transforms input dataset which is represented by a random Vector as

$f = [fo, f_l, f_2,...,f_{p-1}]^T$ (1)

$E[f] = 0$

As with Correlation Matrix $R_f = E[FF^T] = R^T_f$ to some sets of coefficient called principal component (PC).

$ki = U^T i\ F = F^T Ui$, I = 0, 1, 2, … … , .p-1 (2)

and represented by the vector $k = [ko, k_1, k_2, . \ . \ . , k_{p-1}]^T$.

Unit vectors $Ui = [u_{io}, u_{il}, u_{i,2}.. , u_{ip.i}]^T$ which forms matrix as $u = [u_0, u_1, u_2, \ … ., u_{p-l}]$, then have the Eigen vectors of Correlation Matrix R_f, linked with the Eigen values $\lambda_0, \lambda_1, \lambda_2, … \lambda_{p-1}$ where as $\lambda_0 > \lambda_1 > \ …>… >\lambda p-1$ which having $\lambda_0 = \lambda max$

Useful and key Eigenvectors are these values which having highest Eigenvalues of R_f.[40] To consider the required input data by reducing total number of values called as PC (Principal Component) of the Eigenvectors (after dimensionality reduction). This transformation used Eigenvectors equivalent to highest Eigenvalues of Rf and these values corresponding to smaller Eigenvalues are useless (ignored). [16][17]

b. Multilayer Feed-Forward NN (Neural Network):-

The perceptron is a basic building unit for artificial neuron. Perceptron compute weighted sum of all input with threshold weights and then passes that sum through some activation function (preferred sigmoid):

$$Vi = S_i + \sum_{i=1}^{\infty} Wij.fj \quad (3)$$

$Yj=\varphi i(Vi)$ (4)

Where Vi is linear grouping of inputs fl, f2, ...,fp of neurons = i and wjo= Sj is threshold value of the weights linked to input fo = - 1, Yj is Output of j^{th} Neuron whereas $\varphi i(.)$ becomes forms the activation function. Here I recommend here to use a special sigmoidal function as activation function-

$$y_j = \frac{1}{1+\exp(-v_j)} \quad (5)$$

In multilayer perceptron, from the output of one layer derives the input to the consecutive upcoming layers. The Weights of each Network will generally calculated by training those networks. [15][16]

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c. Face Database -

This paper focus the work that done on database from Yale, which is having the face images of 15 (fifteen) number of subjects (shown in Fig. 2), 11 (eleven) for each subject under various poses and scales. Hence the total numbers of face images are 165. The size of each image becomes in database is 240 pixels X 320 pixels with eight-bit gray scale image. The illustration for the database face image pattern belongs to the single subject is shown below in Figure 2 below. [15][16][17]



Figure 2: - A Subject with different poses

d. Epoch: -

An epoch is an instant in instance for which coordinate is specify. A case of coordinate, the pose at another time can computes by considering precession and suitable shift. Similarly, in cases of elements, it's necessarily considers perturbation done by another object in order to analyze elements for special time. An epoch is the training of the NN Network with all data for the training for single cycle. In it, forward pass and backward pass jointly are counted as one pass: Epoch will be made-up of 1 or more than 1 batches. This paper used a part of dataset for the purpose of training the neural network and past for classification.[16][17]

2. RECOGNITION METHODOLOGY: -

Calculated PCA (Principal Components) depicts indirectly to facial posed images via Eigen value. Eigenvector calculation step is shown in following schematic diagram 3. Correlation Matrix for the training images from database are computed first from 1or 2 or… or 9 input posed faces and the classification is done by help of first 15 Eigen Vectors of calculated Correlation Matrix. After that methodology applied, the faces of subjects irrespective to the poses got the result of 95.54 % from the test input faces which are recognized fruitfully. Thus the resultant methodology on pose invariant face recognition is depicted in figure below (figure 3).

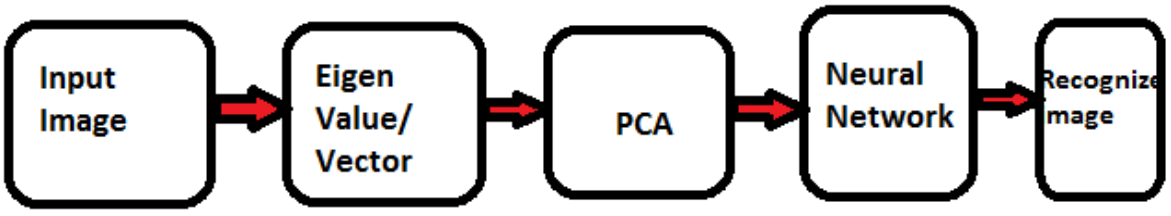


Figure 3:- Pose Invariant face recognition system

Here, the considered database is Yale Face database. In that database the subjects are fifteen (15) with eleven (11) images with dissimilar poses. Each image from database is having 240 pixels X 300 pixels size. Firstly down samples these images by 25% (¼) to get 60 pixels X 80 pixels size, which is reduced from 72000 pixels to 4800 pixels. Now from that down sampled images, considering the different number of input images (which varies from 1 to 9) for training

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purpose, even if, this paper recommended the eight face images for each subject for training of neural network but it will be possible that person in-front of proposed system may having pose differ from that consider poses.

Down Sample image = |Fn x n| (5)

Where, Fn- input Image size in Pixels and n- down sample rate in percentage. Here I am Considering n=25%. .

From that, first computes the PCA required for training purpose. Also while calculating PCA; considering here either 8 or 9 pose images for training as well as all eleven images as testing images. Considered PCA size becomes 20 X 20 for every pose image.

3. ALGORITHM-

1. Calculate Eigen value, Eigen vector for each image
2. Consider the PCA from calculated Eigen vector
3. Stored PCA values for Neural Network training
4. Considering Neural Network with 2 layers
5. Apply neural network for each pose image as input for recognition.

4. RESULT AND DISCUSSIONS-

The some Eigen Vector of Given images are as follows:-

Columns 1 through 9

-0.0003 0.0115 -0.0257 0.0582 0.0025 -0.0454 -0.0745 0.0330 0.0430

Columns 10 through 18

0.0108 -0.0154 0.0229 0.0276 -0.0713 0.0297 -0.0026 0.0794 -0.0101

Columns 19 through 27

0.0068 -0.0669 -0.0291 -0.0065 0.0068 -0.0120 0.0240 -0.0421 -0.0173

Columns 28 through 36

-0.0862 -0.0044 -0.1144 0.0408 0.6681 0.0117 -0.0035 -0.0087 -0.0018

Columns 37 through 45

-0.0016 -0.0013 -0.0011 0.0021 0.0048 0.0010 -0.0129 -0.0044 -0.0058

Columns 46 through 54

0.0083 -0.0006 0.0073 -0.0035 0.0022 -0.0113 -0.0026 -0.0020 -0.0020

Columns 55 through 63

0.0090 0.0041 -0.0011 -0.0008 -0.0064 0.0006 0.0015 -0.0057 -0.0045

Columns 64 through 72

0.0079 0.0017 0.0002 -0.0043 -0.0029 -0.0031 -0.0037 0.0036 0.0024

Columns 73 through 81

-0.0005 -0.0040 0.0013 -0.0004 -0.0034 0.0013 0.0029 -0.0062 -0.0082

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Columns 82 through 90

-0.0011 -0.0030 -0.0018 -0.0070 -0.0002 -0.0016 0.0021 0.0040 -0.0045

Columns 91 through 99

-0.0038 0.0032 0.0005 0.0020 0.0034 -0.0045 0.0024 -0.0100 -0.0031

Columns 100 through 108

-0.0057 0.0031 -0.0009 -0.0064 -0.0054 -0.0084 -0.0035 -0.0045 0.0067

Columns 109 through 117

0.0027 -0.0010 0.0047 -0.0011 -0.0060 0.0082 0.0022 -0.0021 -0.0034

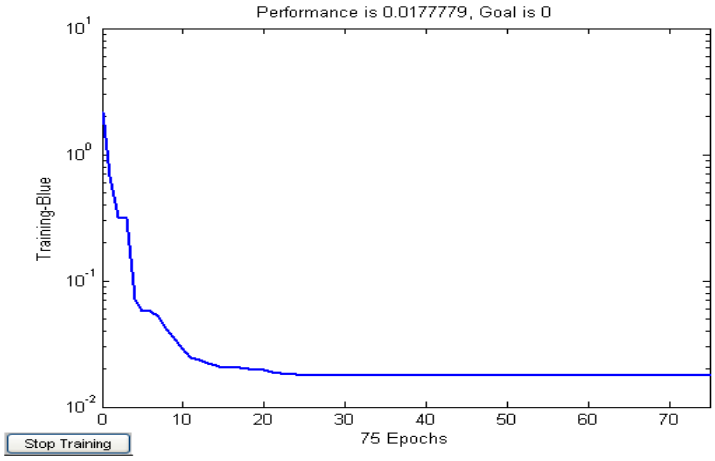


Figure 4: -Sample Results of plot for 1000 Epochs from that the image contains only 75 epochs

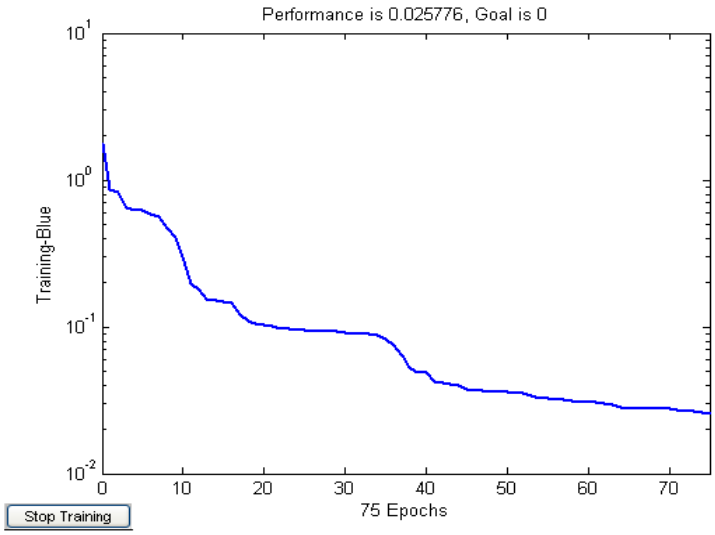


Figure 5: - Sample Results of plot for 900 Epochs from that the image contains only 75 epochs

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Figure 6: - Subject with Wink face pose



Figure 7: - Subject with sad face pose



Figure 8- Subject with Surprise face



Figure 9- Subject with Happy Pose

```
num_train= 6
     correct = 144
     total =   165
False identification rate = 12.7273
recognitionRatio =   87.2727
```

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In number of Training images consider to be less, then result is 87 % (less)

```
num_train= 8
  correct =  155
  total =   165
False Identification rate= 6.0606
recognitionRatio =   93.9394
```

As number of images for training is increases the result is increases.

As number of training Images and Epochs are increased, the result increased. The considered number of images for training varies from 1(single) image to 9 images for training. The recognition rate varies from 13% (for single image) to 96% (for 9 images). The recommended NN here is the Feed Forward Neural Network with 2 layers having 2 hidden layers.

5. CONCLUSION: -

As number of training Images and Epochs are increased, the result is also increased. Due to down sampling of images, the processing time required reduces. Initially, this paper considered the down sampling of 25%, so image size becomes 60 x 80 pixels. This is better for further processing like calculation of PCA and testing. As the numbers of training images are increased, the result of face recognition irrespective of poses can be varied from 13 % to 96%. So finally, this paper concludes that if Number of images for training is 8 or 9, the system gives better recognition result i.e. 95% to 96%. The main drawback of the proposed system is that it only detects straight face's images looking towards camera. Different poses we consider here are smile, sad, wink, happy. If the subject is in that pose, the face recognition is possible. Beside of that, if subject wears glasses, the proposed system recognizes the face. Even inside the fields of detecting frontal faces more work still remains. This paper represents the usage of 2 layered feed forward NN (Neural Networks) for pose invariant face recognition.

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Automatic Animal Food Feeding System

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ABSTRACT: India dominates among other countries in terms of agriculture production, and is one of the largest milk-producing country in the world. A huge human population in India relates itself to agriculture and livestock. Because of this, there are a massive number of cattle farms & dairy farms in India. Also, there is large number of poultries present. According to a survey conducted by the national dairy development board in 2019, there are more than 192 million cattle in India and is at least one personal is required for every 10 animals. In gigantic dairy farming the manpower required is also huge as well as the operations are very laborious and time consuming. By the use of automated machines, it is possible to control the number of required man power, and to avoid financial loss. The time required for process is also reduced. The main objective of the project discussed in this paper is to introduce a laboratory model for automation in animal food feeding process using instrumentation and control strategies. It is thought that the implemented model discussed in this paper can also be used with AMS (automatic milking system) in future.

KEYWORDS: arduino, automatic feed system, automatic milking system, infrared sensors, instrumentation, PLC.

I. INTRODUCTION

To feed the growing size of human population in India and across the globe it is very important to increase the productivity and efficiency of all kinds of farmers. With special attention to dairy farmers, growing herd sizes in dairy and bull fattening farms are leading to higher workloads, making it very laborious and time consuming. Farmers have a variety of choice to deal with this aspect. However, they often decide to automate several work processes at their farms. In recent years, a marked trend towards automation especially in dairy farming can be seen. One example of this is automatic milking systems (AMS), which has become widespread in India and abroad the last decade. However, the automated feeding of mixed feed ratios is also becoming more and more important in dairy farms. AFS (Animal Feeding Systems) are used among others, because of their potential for increasing productivity and efficiency. Farmers with an AMS can aim to increase cattle activity by a increasing the feeding frequency in automated fashion helping them to achieve more uniform use of their AMS on regular basis.

II. LITERATURE REVIEW

India is an agriculture dominant country around 70% people are farmers. Along with farming they have side businesses such as cattle farming, dairy farming, backyard poultry, goat farming. India is one of the largest producer of milk in the world where cow farms and buffalo farms are the foundation of the dairy industry. Breeds of buffaloes like Jaffarbadi, Murrah, and Mehsani, are the high breeding ones while Gir, Rathi, Red Sindhi, and Sahiwal are the top milk breeders from India

Indian government have various schemes for dairy farming and poultry. India has vast livestock resources. Livestock sector contributes 4.11% GDP and 25.6% of total Agriculture GDP [1]. Home to more than 60 million milk cows, India produced more than 187 million metric tons of milk in fiscal year 2019. The population of poultry stood

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at over 851.8 million in 2019 across India, while this number was about 535.8 million for livestock in the same year. Between 2012 and 2019, poultry population grew at an exponential 16.8 percent compared to livestock's only 4.6 percent [2].

Where there are such dairy plants or poultries, they have animals and hens on large scale. If the owner wants to make more profit from businesses, he should check the quality of products. Quality of products can be increased by increasing quality of the food which is given to their cattle, animal or hen. The animal should be fed in time-to-time manner for quality products [3][4] and for this large man power is required as one person can handle only 10 animals at a time. Many dairy industries use AMS (automatic milk system) for milk yielding from animals. More manpower is required to handle thousands of animals. Therefore, it was decided to design, model and implement an AFS (automatic food system) using hardware and software components that are based on instrumentation and control systems. This model discussed in this paper uses PLC based controller system which responses to the Infrared sensors connected to a specially design printed circuit board. It is thought that by using the modelled concept, it can be possible to reduce the problem of manpower and also reduce the time required for feeding the animals.

III. MATERIALS AND METHODS

The conceptual idea of the AFS discussed in this paper is illustrated in figure 1. The system is made up of a hopper, container and feeder platform on wheels that moves on a rail. The wheels feeder and wheel are motorized and can travel on the rail within the left and right boundaries (ends of the rails). The boundaries are sensed using the limit switches. The feeder motor is operated based on the IR sensors data knowing the presence or absence of cattle near the gate.

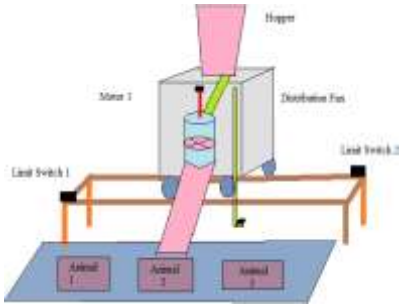


Figure 1. The proposed system setup for AFS

The feeder consists of a distribution fan to control the feed rate as per the requirements of the cattle. Figures 2 and 3 illustrate the hardware and process control block diagrams. Table 1 lists all the hardware components and its details specifications used to practically implement the AFS discussed in this paper [5].

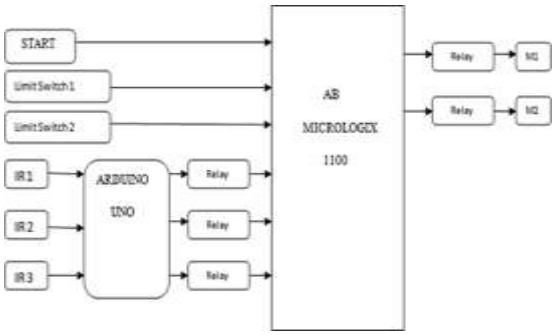


Figure 2. Hardware block diagram of the AFS

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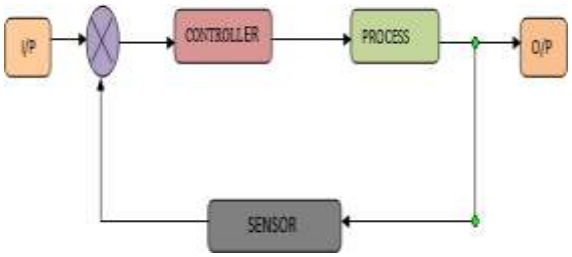


Figure 3. The process control diagram of the AFS

IV. HARDWARE DESIGN

Table 1. Components its specifications

Components	Specification
Infrared sensors	1. Proximity range up to 7 centimeters 2. Active High digital Output (+5V) 3. 3mm mounting hole 4. Two onboard LED's 5. Calibration Pot
12V DC motor	1. 60 RPM 12V DC motors with Gearbox 2. 6mm shaft diameter with internal hole 3. 125gm weight 4.2kgcm torque 4. No-load current = 60 mA (Max), Load current = 300 mA (Max)
Transformer	1. 10RPM 12V DC motors with Gear 2. 6mm shaft diameter with internal hole 3. 125gm weight 4. 12kgcm torque 5. No-load current = 60 mA (Max), Load current = 300 mA (Max)
Rail Track	1. Weight Carries: up to 10 kg 2. Length of Track: 90 cm 3. Height of Track: 10 cm 4. Width between two Rails: 15 cm
Arduino UNO	1. Microcontroller- ATmega328P 2. Operating Voltage- 5V 3. Digital I/O Pins- 14 (of which 6 provides PWM output 4. Analog Input- 6 5. Flash Memory- 32KB
Distribution Structure	1. Size of Structure: - L= 30 cm, W= 15 cm

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	2. Height of Structure: - 45 cm 3. Total Weight of structure: - 2.5 kg 4. Distribution with respect to time: - 200 gm /10 sec approx.
PLC	1. Controller name: - Allen Bradley 2. MicroLogix 1100 PLC system. 3. Analog inputs: - 2 analog inputs 4. Digital inputs: - 10 digital inputs. 5. Digital output: - 6 digital outputs 6. Power supply required: - 12/24 v dc.
Relay	1. 12V Four channel DC relay module 2. Relay specification 10A/24V DC 3. Trigger level 2 ~ 5 VDC 4. LED on each channel indicates relay status 5. Header connector for connecting power and trigger voltage
Limit Switches	1. Input Voltage: 125VAC-6A 250VAC-3A 2. Hole Diameter: ½” 3. N.O. (normally open) 4. Push Button
Plastic Hopper as depositor	1. Diameter: 13.5 cm/9.5 cm/6 cm. 2. Heat resistant from 0 up to +80 degrees Celsius. 3. Not Microwave safe 4. PP Polypropylene (BPA-free).

From Figure 4 it is clear that the IR sensors placed near the feeder gate are hardwired to a open source microcontroller board called Arduino. as well as depending on the sensor signals the relays are controlled in on-off fashion. The relays are also hard wired to the Arduino board. Whereas, the power required to drive the relays is also provided from the Arduino itself.

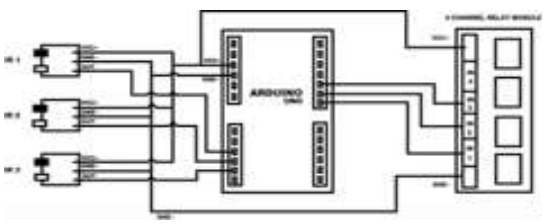


Figure 4. The Arduino based circuit diagram to read the IR sensors in the AFS.

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As shown in figure 5, the wheel motors of the feed storage container are controlled from the PLC via a specialised motor driver circuit, who direction is also controlled via using two relays. This way the feed storage container can travel on the support rail in both directions until it reaches the extreme edges of the rail. The extreme edges are sensed using two limit switches whose signals are hard wired to the PLC. While travelling and depending on the presence of absence of cattle as sensed by the IR sensors, the container will first stop. Then it will start the feed motor to deliver an appropriate amount of cattle feed using its dispenser at the gate. The fed storage container can be refilled by loading the feed in the hopper mechanism [6].

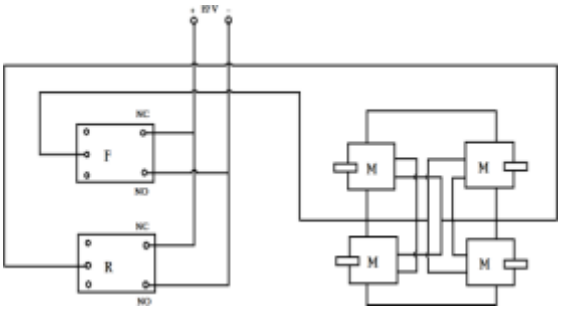


Figure 5. The PLC based wiring diagram to control the motors on the AFS.

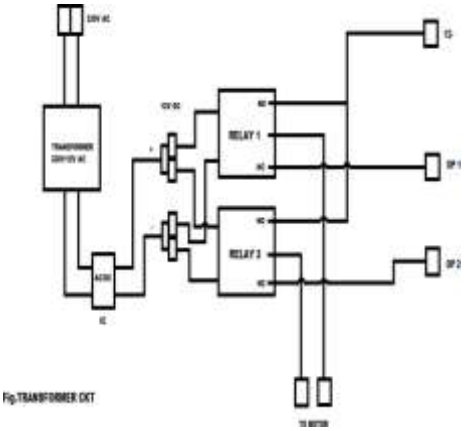


Figure 6. The system wiring diagram to supply power to the AFS.

V. SOFTWAR DESIGN

The software used to acquire sensor data and to take control actions is designed based on the flow diagram as shown in figures 7 and 8. As shown in figure 7 the wheel motor keeps running as long as the IR sensors are generating zero signal which means no Cattle is available at the gate. the moment the there is cattle, the motor will stop its rotation at the respective position and then start the feed dispensing motor.

As shown in figure 8, the software algorithm keeps on checking the states of all motors in simultaneous manner. for example it will check the state on-off state of the feeding motor versus the dispensing motor versus the wheel motor so that only one motor shall keep running at one time in the turn. This way it ensures that the feed is not getting wasted by getting dispensed accidently while travelling on the rails.

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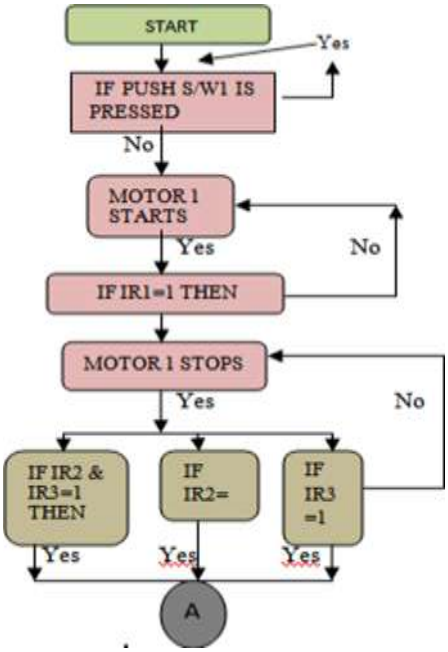


Figure 7. The software flow chart for data acquisition and control system in the AFS (part a).

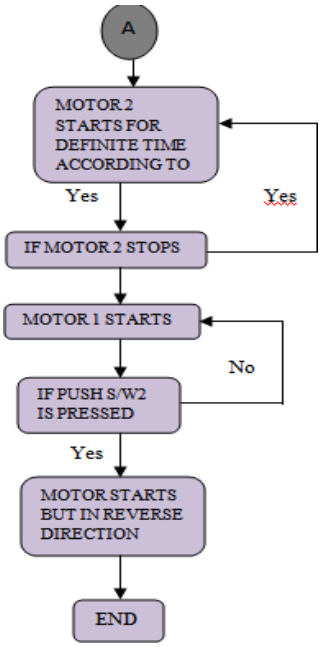


Figure 8. The software flow chart for data acquisition and control system in the AFS (part b).

VI. RESULTS AND DISCUSSIONS

As shown in figure 9. the rail track was made using aluminium for implementing the mobility of feed distribution structure of the practical AFS. As discussed in earlier sections. The distribution structure is

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supposed to move on rail track, when the feeding system is powered. However, it shall stop and reciprocate when it reaches the both ends of track as it is connected to alternate pair of limit switches.



Figure 9. The rail track



Figure 10. The System setup

As shown in figure 10, the distributions structure is mounted on the wheels for distribution of feed to the cattle The structure contains four 12 VDC motors of 60 rpm and 2 kg/cm torque. These motors are at base of the structure, and base chase made of stainless steel. the upper structure, was implemented using plywood sheets. For distribution of food, plastic made vertical turbine like structure is created which distributes according to motor mounted at its vertical shaft. This motor is 12 VDC of 10 rpm and 12 kg/cm torque. So, this system distributes food according to rotation of this motor with respect to time. Whereas the hopper was

VI. CONCLUSION

The initial idea behind the development of the AFS discussed in this paper is based on using instrumentation and control technologies. The systems were practically implemented using low cost electronic and mechanical hardware

components such as analog and digital sensors, motorized actuators and PLC and Arduino to define the control the data acquisition and control strategies. It is clear that with an increasing demand in the area of Agricultural Automation, PLCs become significantly useful in this field. Also, Automatic Animal Food Feeding system (AAFS) using PLC is typical process control system, so how food distribution system is going to work, is necessary for everyone to know the procedure of control system. For this reason, PLC based AAFS is designed in laboratory. However, with slight modifications, the same system can be widely implemented in fields to resolve the practical challenges on labor and time-consuming processes. It is clear that this model reduces man power requirement. for example, by utilizing fully automatic mechanism, it is possible to control required man power and financial loss. This also reduces time required for the completion process of feeding animals. However, it should be noted, that if the IR system fails it can affect the whole system.

VII. ACKNOWLEDGMENT

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On Development of a Portable Touch Screen Oscillo scope

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ABSTRACT: Oscilloscope is very important equipment in the industry as a measuring instrument. There are few types of oscilloscopes: digital, analog, digital storage and digital sampling oscilloscope. The easiest and earliest type of oscilloscope also called as cathode ray (C.R.O.) consist of a vertical amplifier, a time base, a cathode ray tube (CRT), a horizontal amplifier and a power supply. In contrary, a digital oscilloscope is a complex electronic device composed of various software and electronic hardware modules that work together to capture, process, display and store data that represents the signals of interest of an operator. In general oscilloscopes are also massive in size and so they are not easy to carry. Therefore, in industries, whenever there is a need of measurement of the parameters it was often hectic because of the oscilloscope's size and weight. However portable and touch screen oscilloscope can be very small in size, lighter in weight, cheap in cost and also having less maintenance which means lucrative from all point of views. With low cost and open source electronics and software it is possible to develop an oscilloscope in house. Therefore the project discussed in this paper discusses on the development of a portable touch screen oscilloscope.

Keywords: Oscilloscope, instrumentation, portable, touch screen, measurements

I. INTRODUCTION

Most of the studies haven't shown the essential upgradation in the field of oscilloscope [1][2][3]. In industries, whenever there is a need of measurement of the parameters it was often hectic because of the oscilloscope's size and weight. Also, for small businesses it becomes impractical financially to conduct maintenance on regular basis, and therefore these industries run their equipment at its maximum extend and after some time in future this results in huge cost of repairing that machine or instrument. Nonetheless, in big industries the reason to avoid the maintenance of the equipment is because of the impractical field environment, temperature and space to carry such heavy devices. Cathode ray oscilloscope (C.R.O.) is very important part in the industry as a measuring instrument. In any industry every instrument require calibration and also, they want to save money. In these cases, the cost of calibration is very high because the C.R.O. present nowadays is having the Knob, Switches and because of that the cost of calibration and cost of maintenance is high. These C.R.O.s are also massive in size and so they are not easy to carry. So, portable and touch screen oscilloscope which is very small in size, lighter in weight, cheap in cost and also having less maintenance which means lucrative from all point of views, and therefore We can carry it in any industry from one place to another place easily. The portable touch screen oscilloscope, which is suggested in this paper has lucrativeness in terms of weight, size, cost and it's result calculating speed which ultimately saves time, efforts and calculations.

II. LITERATURE REVIEW

There are few types of oscilloscopes: digital, analog, digital storage and digital sampling oscilloscope. When attempting to build an oscilloscope, it is thought by someone to understand how conventional oscilloscopes work. There are 2 main kinds of oscilloscopes – the analogue and digital oscilloscopes and both shall be discussed in the next few sections as follows

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A. ANALOG OSCILLOSCOPE

The easiest and earliest type of oscilloscope consist of a vertical amplifier, a time base, a cathode ray tube (CRT), a horizontal amplifier and a power supply. These are commonly known as the "analog" oscilloscopes. Generally used for numerous applications, oscilloscopes are specifically utilized in testing the circuitry of advanced digital equipment, the voltage and working situation of an electronic instrument or the new software of a digital instrument. An analog oscilloscope is easiest in theory compared to a digital oscilloscope, which became popular between 90s. It directly connects measured signal voltage to the vertical axis which is also represented in the electron beam that passes on the display screen of the oscilloscope. Compared to other oscilloscopes, analog oscilloscopes have several advantages. One of them is the scope's focus and intensity controls, which can be conveniently adjusted to reveal a more legible and sharper display. An analog oscilloscope also features phosphor-based display to provide brighter trace during occurrence of signal features. Also known as intensity grading, this capability helps users distinguish details of signals easily. Connecting the analog oscilloscope's probe to a circuit enables the voltage signal to travel to the scope's vertical system, or to the cathode ray tube's vertical deflection plates near the screen.

Depending on how the vertical scale (volts/div control) has been set up, an amplifier helps increase the signal voltage. To reduce the signal voltage, users should use the attenuator. The signal then directly travels to the vertical deflection plate of the CRT. The applied voltage to the deflection plates produces a glowing dot, which is an electron beam hitting the phosphor within the CRT. A negative voltage causes the downward movement of the dot, while a positive voltage moves the dot upward [3]. The signal travels to the trigger system of the oscilloscope to trigger a "horizontal sweep" or to start. A horizontal sweep is the action of the horizontal system which moves the glowing dot across the screen. Thus, the horizontal time base moves the glowing dot across the screen within a specific time interval only when the horizontal system has been triggered. Many sweeps in fast sequence cause the glowing dot's movement to blend into a solid line. The glowing dot can also sweep up to 500,000 times each second across the screen [4].

The vertical deflection and the horizontal sweeping action draw a graph of the signal on the display. To produce a clear picture, the trigger stabilizes repeating signals and ensures that the sweep starts at a similar point of a repeating signal [4].

B. DIGITAL OSCILLOSCOPE

A digital oscilloscope is a complex electronic device composed of various software and electronic hardware modules that work together to capture, process, display and store data that represents the signals of interest of an operator. Digital oscilloscopes are often referred to as digital storage oscilloscope (DSO) or digital sampling oscilloscopes (DSO). In its simplest form, a digital oscilloscope features six elements — the analog vertical input amplifiers, analog-to-digital converter and a digital waveform memory, a time base which features a triggering and clock drive, the circuits for waveform display and reconstruction, the LED or LCD display, and the power supply. Digital oscilloscopes periodically sample a time varying analog signal and stores in the waveform memory the signal's values in correlation with time. Using an internal clock, digital oscilloscopes chops input signals into separate time points. The instantaneous amplitude values are then quantized by the oscilloscope at those points.

The resulting digital representations are then stored in a digital memory. At a predetermined clock rate, the display is regenerated from the device's memory and is consequently viewed as connected dots or a series of dots. Digital Oscilloscopes provides powerful features on how they trigger the digitized data from its memory. Some of the advantages of a digital oscilloscope over analog oscilloscope include the scope's ability to store digital data for later viewing, upload to a computer, generate a hard copy or store on a diskette and its capacity to instantly make measurements on the digital data. After a trigger event, digital oscilloscopes can be made to display the waveforms as compared to an analog oscilloscope that needs to be triggered first before it starts a trace. A digital oscilloscope also has the ability to examine digitized information stored in its memory and make automatic measurements based on the selected parameters of the user, such as voltage excursion, frequency and rise times. It can also display similar captured data in various ways. This capability is attributed to the presence of more captured data than what shown on the screen. It also offers the flexibility of providing a vast array of storage, processing and display options, such as graphics and one-quarter and one-half screen displays and multiple step processing programs.

A digital oscilloscope is ideal for displaying intricate signal waveforms where calculations and measurements on specific portions

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of the waveforms must be made to provide numerical and waveform output displays which reflects the chosen parameters of the waveforms. The two general categories of digital oscilloscopes are single shot oscilloscopes and random interleave or equivalent time sampling oscilloscopes. Single shot oscilloscope starts real-time sampling of an event after a trigger condition has been satisfied. The speed of the analog-to-digital converter determines the limitations of the sampling speed of single shot oscilloscopes. The size of the device's acquisition memory, which receives the output from the converter, limits the time on which a single event can be sampled. Meanwhile, random interleave oscilloscope or equivalent time sampling oscilloscope relies on sampling repetitive events at different points over certain periods of time [5]. The project discussed in this paper is based on digital oscilloscope.

III. MATERIAL AND METHODS

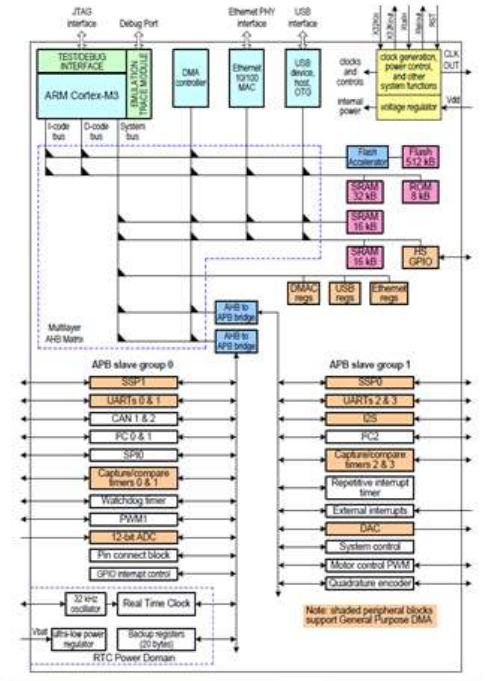


Figure 1. Block/Architecture diagram of the LPC1768 [6] .

A. NXP ARM LPC 1768 CORTEX M3 (controller)

The processor used to build a portable touch screen oscilloscope is a low-power processor that features low gate count, low interrupt latency, and low-cost debug. It is intended for deeply embedded applications that require fast interrupt response features. As shown in figure 1 the processor implements the ARM architecture v7-M [6] .

B. ER-TFTM070-5 (display)

The processor incorporates the Processor core. A low gate count core, with low latency interrupt processing that features ARMv7-M. 16-bit and 32-bit, and excluding blocks for media, Single Instruction Multiple Data (SIMD), enhanced Digital Signal Processor (DSP) instructions (E variants), and ARM system access with Banked Stack Pointer (SP) only, Hardware divide instructions, SDIV and UDIV, Handler and Thread modes, Thumb and Debug states, Interruptible-continued LDM/STM, PUSH/POP for low interrupt latency, Automatic processor state saving and restoration for low latency Interrupt. Service Routine (ISR) entry and exit. ARM architecture v6 style BE8/LE support, ARMv6 unaligned accesses. Nested Vectored Interrupt Controller (NVIC) closely integrated with the processor core to achieve low latency interrupt processing. Features include the External interrupts of 1 to 240 configurable size, Bits of priority of 3 to 8 configurable size, Dynamic reprioritization of interrupts, Priority grouping. This enables selection of pre-empting interrupt levels and non-pre-empting interrupt levels, Support for tail-chaining and late arrival of interrupts. This enables back-to-back interrupt processing without the overhead of state saving and restoration between interrupts and Processor state automatically saved on interrupt entry, and restored on interrupt exit, with no instruction overhead [6]

Item	Standard Value	Unit
Display Format	800	RGB	x 480 Dots	--
Display Connector	FFC or Pin Header	--
Operating Temperature	-20 ~ +70	℃
Storage Temperature	-30 ~ +80	℃
Touch Panel Optional	Yes	--
Sunlight Readable	No	--

Figure 2. Display specifications [7].

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Figure 3. Front image of the display [7].

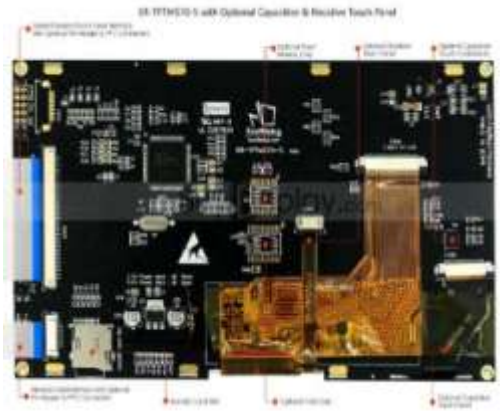


Figure 4. Back side of the display [7].

The table in figures 2-4 shows the display specifications as well as the front and back sides of the unit. It is 800x480 RGB pixel with inbuilt touch panel. Operating temperature of the display is -20 to +70 which means it can work in the extreme cold and hot environment without any technical problem. The display supports two types of interfaces with the LPC 1768, these are nothing but series interface connection and parallel interface connection. The best suitable interface in consideration of the speed of the oscilloscope to show real time results is parallel connection. Here we have liberty to send all data from controller to the display as once which is not the case with series connection where we have to send each bit one by one and eventually there is addition of lag in the results [7] .

C. CALCULATION OF WORKING FREQUENCY

First and foremost, specification of any digital or analog oscilloscope is it's working frequency which is nothing but the combined result of the controller frequency and displays working frequency. The mentioned ARM controller has working frequency up to 100 MHz which is offered by its CPU, while the TFT display has frequency of 10 MHz which is only related to the displaying procedure i.e., this does not affect on the signal conversion and manipulation rate which is the subject of concern. Apart from this, LPC 1768 is packed with one 8-channel 12-bit analog to digital converter which is capable to work at maximum conversion frequency of 13MHz/ 65 clock cycles. From this information we can calculate our final working frequency of the suggested digital Oscilloscope [6].

D. EQUATION FOR CONVERSION TIME OF ADC

Theoretically the frequency or the conversion time of the ADC of LPC1768 is as follows.

The ADC is of 12 bit which means it needs 12 cycles. On the other hand, it has sampling time of 65 clocks therefore its conversion time is

Conversion time = clock cycles/ frequency

= 65/(13x106)

= 5 microseconds

In another words, it is capable of sampling rate up to 200Khz

E. RESOLUTION OF THE ADC

As mentioned, it is 12-bit ADC

Here,

Fc = frequency of the ADC

Tc = Clock cycles

Also, its maximum voltage is 3.3V and its range is 0-3.3V this means the ADC can have total of 212 equal parts of the range with each part of 0.805 mV and the 200KHz frequency means the samplings are multiplexed among up to 8 inputs.

The resulting maximum sample rate per input is distributed on the used inputs.

- 1 input only- max 200kHZ per input
- 2 inputs – max 100kHz per input
- 3 inputs – max 66.67kHz per input
- Etc.

There are still some lags which are not yet calculated. These are directly related to the processor's instruction execution time.

IV. CONSTRUCTION DETAILS

A. DISPLAY

As shown in figure 5, the device below has size of 8 inches with display size of 7 inches and thickness of 2 inches, this is the 3D view. It has one switch to turn on the device and then it can be controlled by touch screen mechanism. Input signals are given through USB port which supports voltage up to 5V and therefore there is one signal conditioner is used which is capable of conditioning voltage signal up to 230V and voltage regulator is used to regulate the voltage to 5V for USB port. If

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there is high voltage signal needs to be measure then use of other type of signal conditioner and voltage regulator is possible.

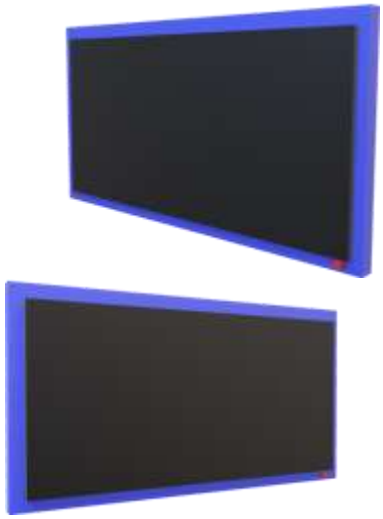


Figure 5. Shows side views of the device.

B .GRAPHICAL USER INTERFACE (GUI):

The Graphical User Interface was built into LABVIEW which shows real time output of the device before installing it in the device itself [8]. After adding appropriate delays which are associated with the LPC 1768's instruction processing time and it's ADC conversion time. To add these delays, LabVIEW's delay block is used and expected results are mentioned further. After the successful working of GUI, it can be installed on the device.

V. RESULT AND DISCUSSION



Figure 6. The sample output 1 of the device.



Figure 7. The sample output 2 of the device.



Figure 8. The sample output 3 of the device.



Figure 9. The sample output 4 of the device.

After installing the GUI onto the LPC1768 there is very minimum lag in its working when compared to the theoretical values. Apart from this, the device has accuracy same as the CRO (cathode ray oscilloscope). Distortion in the waveform can be a result of lose connection of its. Figures 6 - 9 show the sample outputs in the form of waveforms on the touch screen.

VI. CONCLUSION

The project discussed in this paper discusses on the development of a portable touch screen oscilloscope. It is clear from above sections that oscilloscope is very important equipment in the industry as a measuring instrument. It is possible to develop a portable touch screen oscilloscope which is a digital type. It can be implemented using readily available hardware components such as an arm processor, display screen, touch sensor screen, an analog to digital converter system and a specially designed graphical user interface. The working frequency should be taken into account before selecting all above. Considering the low cost and open source electronics and software availabilities, it is possible to develop an oscilloscope of such type in house.

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The authors would like to express special thanks to HoD of Department of Instrumentation Engineering, and Principal of P.V.P.I.T. Budhgaon Sangli for their support in terms of providing laboratory facility during conduction of the project. Also would like to thank to Mr. K.M. Bhagawat, Ms. M.D. Mane, and Mr. S. Kadam for their

contributions in design, development and testing of the prototype.

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On Design Rapid Prototyping and Testing of IoT Enabled Sensors Using Open Source Tools

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ABSTRACT: The term IoT (Internet of Things) has recently become more relevant to the practical world largely because of the growth of mobile devices, embedded and ubiquitous communication, cloud computing and data analytics. The IoT application covers smart and healthy environments in various domains but not limited such as: agriculture, building, city, culture and tourism, emergency lifestyle, environment and energy, factory, supply chain, healthcare, retail, transportation, user interaction, etc. There is plenty of documented literature available in the internet and digital space (database) on IoT from knowhow, hands-on to its implementation and testing using both proprietary and open-source tools. However due to lack of availability of structured and complete set of instructions in the internet space, with special attention to several project activities including software and hardware development phases is exceptionally challenging to rapidly prototype and test an IoT enabled sensor device in timely manner. The objective of this paper is to demonstrate a project and document the complete structured set of instructions to research, design, rapid prototype and test a general purpose IoT enabled sensor device using open-source tools.

KEYWORDS: IoT, WSN, prototyping, 3D printing, design, embedded systems, temperature, humidity, sensors, hardware, Software, cloud, instrumentation, dashboard, AI, ML, data analytics

I. INTRODUCTION

The IoT concept was coined by a member of the Radio Frequency Identification (RFID) development community in 1999, and it has recently become more relevant to the practical world largely because of the growth of mobile devices, embedded and ubiquitous communication, cloud computing and data analytics. Internet of things is an internet of three things: (1). People to people, (2) People to machine /things, (3) Things /machine to things /machine, Interacting through internet.[1].

The IoT application covers smart and healthy environments in various domains but not limited such as: agriculture, building, city, culture and tourism, emergency lifestyle, environment and energy, factory, supply chain, healthcare, retail, transportation, user interaction, etc. In this context, it is possible that the level of diversity will be scaled to a number a manageable connectivity technology that address the needs of the IoT applications, are adopted by the market, they have already proved to be serviceable and are supported by a strong technology alliance [2]. Examples of standards in these categories include wired and wireless technologies like Ethernet, WI-FI, Bluetooth, ZigBee, GSM, and GPRS.

The term IoT (Internet of Things) has recently become more relevant to the practical world largely because of the augmentation of mobile devices, embedded and ubiquitous

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communication devices, cloud computing services and data analytic algorithms. With the IoT the communication is extended via Internet to all the things that surround us. It is much more than machine to machine communication, wireless sensor networks, sensor networks, 2G/3G/4G, GSM, GPRS, RFID, WI-FI, GPS, microcontroller, microprocessor etc. These are considered as being the enabling technologies that make "Internet of Things" applications possible [3].

There is plenty of documented literature available in the internet and digital space (database) on IoT from knowhow, hands-on to its implementation and testing using both proprietary and open source tools. It is also clear that IoT is not a single technology, but it is a mixture of different hardware & software technologies. It provides solutions based on the integration of information technology, which refers to hardware and software used to store, retrieve, and process data and communications technology which includes electronic systems used for communication between individuals or groups [4]. However, there is lack of availability of structured and complete set of instructions in the digital space, with special attention to conduction of several cost-effective project activities including software and hardware development phases. Therefore, it is exceptionally challenging for many instructors and students to practically teach and demonstrate on how to rapidly prototype and test an IoT enabled sensor device in timely manner.

The objective of this paper is two-fold 1) to demonstrate a simple approach on conducting IoT projects using cost effective means and 2) to document a complete and structured set of instructions to research, design, rapid prototype and test a general purpose IoT enabled sensor device using open-source tools.

II. LITERATURE REVIEW

The Internet of Things provides solutions based on the integration of information technology, which refers to hardware and software used to store, retrieve, and process data and communications technology which includes electronic systems used for communication between individuals or groups. However, there is a heterogeneous mix of communication technologies, which need to be adapted in order to address the needs of IoT applications such as energy efficiency, speed, security, and reliability [5].

IoT architecture consists of different layers of technologies supporting IoT. It serves to illustrate how various technologies relate to each other and to communicate the scalability, modularity and configuration of IoT deployments in different scenarios [6].

Smart device / sensor layer: The lowest layer is made up of smart objects integrated with sensors. The sensors enable the interconnection of the physical and digital worlds allowing real time information to be collected and processed. Various types of sensors are used to measure and monitor the environmental conditions when placed in their surroundings. For example; acceleration, color, humidity/moisture, light intensity, level, pressure, position, speed, and temperature are the most commonly known parameters to whom almost everyone is aware of.

Gateways and Networks: Massive volume of data will be produced by these tiny sensors and this requires a robust and high performance wired or wireless network infrastructure as a transport medium. Wired and wireless, switch, subnet, and routers working on TCP/IP protocols are some of the commonly known devices in this category. Where Ethernet and Wi-Fi are the most commonly known examples of Local Area Networks (LAN) of wired and wireless types respectively. Network Address Translation (NAT), Firewall, De-Militarized Zone (DMZ), Port Forwarding (FWD) are some the techniques implemented by the router device to handle security while connecting between devices in Wider Area Networks (WAN).

Management Service Layer: The management service renders the processing of information possible through analytics, security controls, process modelling and management of devices. Cloud services for data storage and processing are some examples of such management layers. Where, Google, Microsoft, Amazon, etc. are some commonly known examples offering such services to manage their proprietary or open source devices.

Application Layer: This is the layer where a human or non-human (robotic) user interacts between devices for monitoring, control or usage purpose. such layer can be implemented either as web based application irrespective to its operating system or it can also be implemented as a mobile device based application developed for android or iOS. The IoT application covers "smart" environments/spaces in all domains.

Based on literature it is clear that IoT has wide area of applications, it is not based on a single technology. It makes use of integrated hardware and software-based systems. There are different proprietary and open source tools available in the market to design and prototype IoT based devices depending on the target application required for industrial, commercial or domestic purpose.

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III. MATERIALS AND METHODS

3.1 Selection of the Product to be prototyped:

Based on literature and the stated objectives of this paper, hereafter we will demonstrate the steps we followed to design, prototype and test an IoT enabled device (product) to record and monitor environmental parameters such as Temperature and Humidity measurements in our surrounding space in timely manner.

The reason to choose prototyping such a product was based on the requirements set by our project sponsor as well as for the versatile applications and importance of measuring, monitoring and controlling temperature and humidity parameters in agriculture and food processing industries, which is the main type of industry in the region where our institute is set up. According to the additional requirements set by our sponsor the prototype must also offer geo-coded mobile data acquisition features and finally the development cost should be at the minimum.

Therefore the network layer was implemented using a readily available circuit board (SIM900A) based on Global System for Mobile Communications (GSM) Technology and the sensor layer was implemented using DHT21 (Temperature and Humidity Sensor) and Arduino based microcontroller hardware (prototyping board). Use of Global Navigation Satellite System (GNSS) Technology such as GPS receiver (Neo 6M) was used to record the geographical positions of the acquired data points in space.

To implement the full functionality of the product including its features and Interactive development environment (IDE) from Arduino was used to develop and program the arduino based microcontroller. Arduino based IDE's are free, and arduino offers low cost and readily available hardware and is based on open source Technology.

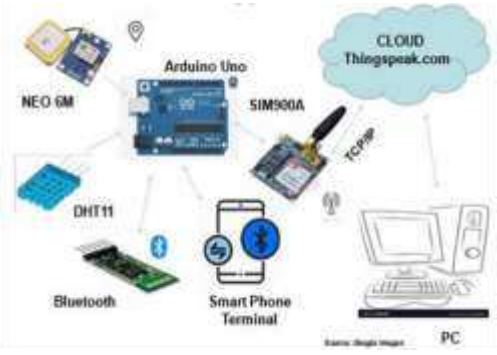


Figure 1. The conceptual block diagram of the IoT Enabled Temperature and Humidity Sensing Device

Usually use of open Source tool means no license is needed to develop, implement, test, distribute or sell products built on such platforms. To implement the cloud storage and application layer we used the cloud service from Thingspeak.com. Things peak is a proprietary cloud data storage and data analytics service provider from MathWorks Inc. However, it also offers limited free space options, depending on the size of data to be stored for a given time duration in months. Finally for troubleshooting and testing reasons a Generic Bluetooth device was used to enable communication features between smart phones and the prototyped device. Therefore the overall development cost were drastically reduced. Figure 1. Illustrates the conceptual Block Diagram of the proposed product to be prototyped and tested.

3.1 Proof of Concept (PoC)



Figure 2. Various activities involved during implementing the PoC

To implement the device as per the conceptual block diagram as shown in Figure 1, we decided to go ahead with building the PoC and test it. Various activities that were involved in this phase are shown in Figure 2. The activities included; purchase of on shelf components, assembly, discrete programming and testing, and build version 1.

3.2 Prototype

To develop the prototype and to protect the electronics, we went a step forward by placing the assembly inside an enclosure. The enclosure was initially implemented using a readily available Ice cream container made up of plastic. Special holes and grooves were made in the container to allow prototype interface with external world such as power and programming cables. However, in the later stage the enclosure was redesigned using a open source 3 dimensional (3D) Computer Aided Design (CAD) application called FreeCAD.

Later the enclosure design was printed in Polylactic Acid (PLA) material as a prototype using a low cost and readily available 3D printer from FLSUN. 3D printers from FLSUN are DIY type and are based on open source platform like

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Arduino. For more details on working, materials and applications on 3D printers please refer to [7].

IV. COST

Table 1. Summarizes the costs of material

Sr. No.	Component Quantity	Unit Price* including shipping and handling charges in INR	Cost**
1	Arduino Uno	499 X 1	499
2.	Neo 6M	1100 X 1	1000
3.	SIM 900A	1100 X 1	1000
4.	DHT 22	800 X 1	700
5.	Jumper Wires	10 X 15	150
6.	Power Adapter	250 X 1	250
7.	Enclosure 3D Print	700 X 1	700
8.	9V Battery	50 X 1	50
9.	Purchase of SIM Card and monthly DATA Subscription	150 X 1	150
10.	Bluetooth device	200 X 1	200
11.	Miscellaneous Hardware	300 X ~	300
12	Arduino IDE	0 X 1	0
13	Cloud Data Storage	0 X 1	0
Total			4999/-

* - Unit price of components were slightly higher as compared to regular average due to the ongoing Covid-19 related pandemic situation, when this project was being conducted.

** - Costs exclude price of laptop computer, smart phone, testing tools and prototyping devices such as 3d printer, due to readily availability reasons.

V. RESULTS AND DISCUSSION

Figure 3 illustrates the implementation of the proof of concept (PoC). It follows the block diagram shown in Figure 1. The first 2 layers (Sensor and Network) was implemented by assembling the readily available components. The Arduino based Microcontroller board was programmed through Arduino's IDE installed on a read lily available laptop computer to implement the functionality as per the sponsors requirements.
Figure 4 illustrates the implementation of the partially prototyped product. All components are shown to be mounted on some base plates in tower mount configuration to reduce the total volume. However, some interference was detected between the power supply modules of the GPS and GPRS modules and their antennas. Therefore, a flat mount configuration was adopted in the final prototype as illustrated in Figure 5.



Figure 3. The implementation of the PoC.

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Figure 4. Partial implementation of the Prototype Product



Figure 5. Implementation of the final Prototype Product; (a) ice-cream container used as enclosure.

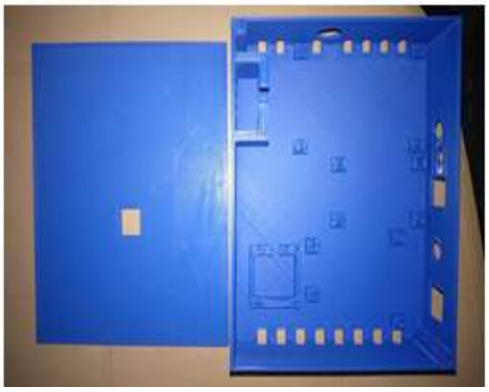


Figure 5. (b) Custom designed and 3D printed enclosure.



Figure 6. Illustrating the cloud storage and data analytic service (the third and fourth layers) of ThingsPeak.com also illustrating the data points of temperature and humidity as well as the geographical coordinates (latitude and longitude) in timely manner.

VI. CONCLUSION

In this research we identified the four layers of the IoT architecture. Using open source tools, we were able to successfully design, prototype and test the general purpose IoT enabled temperature and humidity sensing device (product). While implementing all the four layers of the architecture. Depending on the sponsor specifications/requirements we were able to add the geo-coded mobility data acquisition feature and we were able to build the prototype at minimum developmental costs. To protect the electronic components as well as to add aesthetics to the prototype (product) we used 3D Printing technology to rapidly design and print the enclosure as per the selected mounting or placements of all components. Therefore overall we were able to demonstrate a simple approach on conducting IoT projects using cost effective means and we were able to document a complete and structured set of instructions to design, rapid prototype and test a general purpose IoT enabled sensor device using open source tools.

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A Case Study on Steps Taken by Higher Educational Institutional to Create A Complete Ecosystem to Foster the Culture of Innovation across the Region from Ideas Generation to Pre-Incubation, Incubation and Graduating from the Incubator as Successful Start-Ups

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ABSTRACT: India has always been a great country in terms of producing high quality and highly skilled manpower needs starting from ancient times until today. In terms of its educational sector, many reforms have been undertaken by all governments till date. e.g. the New National Education Policy (NEP) 2019 [1], which is the latest one among all. India also being a densely populated country and having a maximum number of student population in the world India. It has also set its different missions to enhance the quality of education system to create the best man power needs of future world. Among the different missions, the National Mission of Innovation (NMI) [2] has been the most important promising one in this decade. The work discussed in this paper describes a case study on steps taken by a higher educational institutional to create a complete ecosystem to foster the culture of innovation across the region from ideas generation to pre-incubation, incubation and graduating from the incubator as successful startups.

KEYWORDS: pandemic, covid-19, entrepreneurship, education, hands-on, idea, innovation, invention, incubation, intellectual property rights, startup

I. INTRODUCTION

Let's take an example of Smart Phones. Why? The number of smartphone users in India was estimated to reach over 760 million (76 Crore) i.e near to 60% of India's Population in 2021 (at present) [3]. Even a layman end user in India knows what is Smart Phones are made up of. Some electronics hardware (mother board) resting on a mechanical support (enclosure), energy source (battery), electrical supply to refresh the energy source (charger) and some software (popularly known as android) that runs inside the mother board and takes care of the rest. Obviously for technocrats the same Smart Phone means much more e.g. it is a product with; a circuit board with specialized micro-processor and 100s of thousands of miniature electronic devices embedded, with n-number of input and output devices (wired and wireless), such as Memory, Speaker, Vibrator, USB, Display Screen, and RF devices, such as WiFi, NFC with appropriate type of Antennas, etc. In addition these, it also has various sensors like Microphone, Touch, Camera, GPS, Accelerometer, Compass, Temperature, Power, Battery, Charger, Mechanical Structure, Enclosure, Lid, Screws, Washers, Stickers and other types of Adhesives, etc. In addition to the hardware components, there is a software component called operating systems on which thousands of applications are developed and made available for the interaction with the human end users. The operating system is sometimes based on an open-source platform (Android) and sometimes a proprietary platform on

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(iOS). The product comes packed in a beautifully ornamented box with attractive graphics imprinted on it. The average selling price of Smart Phones in India is roughly 11,000 INR [4]. One can simply do the math's to understand the revenue generated in this segment.

Now the question is which of the hardware components/devices used in building a Smart Phone are manufactured in India? Even if some of them are manufactured in India, were majority of them invented in India? Who owns the majority of intellectual property rights for it? Either as a unit component, or as a complete product (1st kind – Utility Patent)? The next question is that, who invented the software that runs inside the mother board? and who invented the software application development interface on which all other applications are developed and used by the end users ? who owns the IPR for it in this category (2nd kind – Copyrights)? The next question is that, not all Smart Phones look alike, neither as a whole product, nor from its interior arrangement? who designed the shapes, structures, and aesthetics etc. ? Again who owns the IPR for it in this category (3rd kind – Industrial Designs)? and the last question is about the ornamented packaging box and its imprinted graphics along with the user manual. Who owns the IPR for it from this last category (4th & 3rd kind – Copyright & Trademark)?

The other questions that simultaneously arise in our mind are: What is Invention? What does IPR exactly mean? What are the categories of IPR? How to own an IPR? What is its significance? How it relates to the Smart Phone example? What is Innovation? What is Global Innovation Index? What is India's National Mission on Innovation? What is the current scenario of India? and then the same of Maharashtra? Do we really understand what is Make in India? Do we really understand the significance of Atmanirbhar Bharat ? What are innovation enablers? What is MIC, IIC?

How a private Higher Educational Institute located in rural India called PVPIT-Budhgaon community is contributing towards this mission. What is the plan? What were the scenarios? What is the current status? What is the outcome? Where it sees the future? What else its needs in support to continue even further? The objectives of this note are to discuss on these question one by one.

II. LITERATURE REVIEW

a. What is Invention?

According to [5], An invention is a unique or novel device, method, composition or process. The invention process is a process within an overall engineering and product development process. It may be an improvement upon a machine or product or a new process for creating an object or a result.

b. What does IPR literally mean?

According to [6], intellectual property rights are the rights given to persons over the creations of their minds. They usually give the creator an exclusive right over the use of his/her creation for a certain period of time.

c. What are the categories/types of IPR?

According to [6] intellectual property rights include patents (multiple Utility Patents - In Smart Phone example), Copyright (Operating Software, Applications, and User Manual in Smart Phone Example), Industrial Design Rights (The structure, size, look, aesthetics in Smart Phone example), trademarks (The Ornamented Enclosure Box, Stickers and other Adhesives in Smart Phone example), geographical indications, and in some jurisdictions trade secrets (Both not applicable in case of Smart Phone Examples as of yet).

d. How to own an IPR?

According to [7], this is a vast topic by itself and therefore the information related to these questions is planned to be published as a supplement to this edition of information series.

e. What is its significance?

According to [8], intellectual property rights (IPRs), such as patents and copyrights, are an important means used by firms to help protect their investments in innovation. They are legal instruments that have been used by governments for centuries to encourage industrial development and economic growth.

When paying special attention to the Smart Phone as a product example, literature suggests that there are 100's of thousand IPR'S involved when considering a Smart Phone device as a product. And the majority of IPR's are owned by International Telecommunication Device Manufacturing firms such as Apple (USA), Samsung (South Korea), Nokia (Finland), Motorola (USA), ZTE (China), Ericsson (Sweden), Honeywell (USA), Sony (Japan), etc. I hope the above section answers many questions in direct or indirect manner and explains how the international firms make their revenues even after manufacturing or simply selling a product in a hugely populated country like India?

Dear readers, here we are not considering the telecommunication technology enablers, on

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which a Smart Phone or any other general digital communication device really works or we haven't considered any other product. For simplicity just took one popular product among the billions designed, developed and manufactured or assembled across the global! Wait there seems a hope! In the paragraphs, let's discuss how India is planning to steer in forward direction. But before we reach there, let's educate our self on some extra definitions related to the subject.

f. What is India's National Mission on Innovation?

According to [9] the Mission is named as Atal Innovation Mission (AIM) and it is Government of India's flagship initiative to create and promote a culture of innovation and entrepreneurship across the length and breadth of our country.

g. What is Innovation?

According to [10], Innovation is the process of creating value by applying novel solutions to meaningful problems. The reason we believe it has utility is in the three explicit tests for "innovative-ness" we can apply:

- Is it novel? The notion of novelty is baked right into the word "innovation." If it's not new, it's probably more optimization than innovation.
- Does it solve a meaningful problem? If not, maybe it's art instead of innovation. That's not to say art isn't valuable, but it's generally not designed to solve a problem. To us, innovation is.
- Does it create value? If not, maybe it's an invention rather than innovation. Inventions can lead to value creation, but usually not until someone applies them through innovation.

h. What is Global Innovation Index (GII)?

According to [11], the Global Innovation Index (GII) provides detailed metrics about the innovation performance of 131 countries and economies around the world. Its 80 indicators explore a broad vision of innovation, including political environment, education, and infrastructure and business sophistication.

i. What is the current scenario of India in terms of GII? And what is it that for Maharashtra?

According to [12, 13], India's Global Innovation Index 2020 rank is 48 among 131 economies, moves up by four positions since 2019. Within India, our Maharashtra State Ranks 3rd in terms of performance. However, our Maharashtra state ranks 1st in terms of being Enabler, when compared to other states like Karnataka and Tamilnadu.

j. What are innovation enablers?

According to [14], a model of innovation is where, Managers and leaders can create the conditions for innovation by amplifying the Enablers (vision, people, environment, resources) and dampening resistance to change. If the combined effect of the enablers overcomes resistance, then innovation emerges. The model also shows that innovation cannot occur in the absence of any of the amplifiers on the left-hand side.

Enablers (Vision x People x Resources x Environment) > Resistance i.e. (Amplifier)> (Dampen) ..... (Eq.1)

k. Do we really understand what is Make in India?

According to [15],Make in India is a major national program of the Government of India designed to facilitate investment, foster innovation, enhance skill development, protect intellectual property and build best in class manufacturing infrastructure in the country.

l. Do we really understand the significance of Atmanirbhar Bharat?

According to [16], Atmanirbhar Bharat, which translates to 'self-reliant India' or 'self-sufficient India', is a policy formulated for making India "a bigger and more important part of the global economy", pursuing policies that are efficient, competitive and resilient, and being self-sustaining and self-generating. Where and important point must be noted that, Atmanirbhar Bharat doesn't mean "self-containment", "isolating away from the world" or being "protectionist".

m. What is Ministry of Educations (MoE's) Innovation Cell (MIC) and Institutions Innovation Council (IIC)?

According to [17], Ministry of Education (MoE), previously also known as Ministry of Human Resources Development, (MHRD), Govt. of India has established an 'Innovation Cell' with a purpose of systematically fostering the culture of Innovation in all Higher Education Institutions (HEIs) across the country. MIC will focus on creating complete ecosystem which will foster the culture of Innovation across all educational institutions from ideas generation to pre-incubation, incubation and graduating from the incubator as successful start-ups.

MIC will also work on designing ranking system to identify institutions in the forefront of innovation. Ministry of Education has established

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'MoE's Innovation Cell' with the mandate to work closely with our Higher Education Institutions (HEIs) to encourage the creative energy of our student population to work on new ideas and innovation and promote them to create start-ups and entrepreneurial ventures. Where, Institution Innovation Council (IIC) is an Initiative of MIC for selected Higher Education Institutes and PVPIT-Budhgaon is proudly one among them. Now let's discuss on how PVPIT-Budhgaon community is contributing towards this mission. What is its plan? What will be the scenarios? What is the current status? What is the outcome? Where it sees the future? What else its needs in support to continue even further? The objectives of the next section is to discuss on these question one by one.

III. MATERIALS AND METHODS

Being said, to foster innovation culture in the region, PVPIT-Budhgaon in Sangli has founded its three pillars in the forms of cells and the details are as listed below:

1) Research and Development (R&D) Cell
2) Institutions Innovation Council (IIC)
3) Intellectual Property (IP) Cell

Where all three cells have smartly planned actions and functions as follows:

1) Creating skilled human resources (students) by providing interest specific hands-on additional skills training, apart from the existing curriculum. In addition to it, interested students are taken on tours outside the institute, either to some field or industry or lab, etc. Or various stake holders from the field of, education, agriculture, environment, society, to industry are invited to speak about problems faced their stakeholders in real-time.
   This is followed by encouraging those students to participate in internal or external competitions on innovations, where they can apply their skills, educated experience and learning's to solve real time problems in innovative fashion.

2) Creating awareness about the outcomes from due course of actions taken by the interested student in the past. This includes conducting webinars, talks or even one-on-one sessions by the successful students who benefitted from performing the right actions so that they can share their experiences with prospective members among the student community at PVPIT Budhgaon in Sangli.

3) Amplifying the number interested students to become action takers, either through doing R&D, or by participating in innovation based competition's or by encouraging them to file an IP on their innovation.

V. RESULTS AND DISCUSSION

Table 1. Summarizes the outcome of such actions (related to research and Innovation only) when conducted by PVPIT's R&D and Innovations team members from Year 2018-19 to 2020-21:

A	B	No. of Students					
		C	D	E	F	G	H
1	2018-19	150	70	232	24	0	1
2	2019-20	1750	100	650	40	56	3
3	2020-21	238,-***	-***	68-***	25-***	120	2-***

A - Sr. No.,
B - Year,
C- [1-]Participated in acquiring additive skills training and learning about problems,
D - [2-] Participated in Internal Competitions related to innovation,
E - [3-] Participated in External Competitions related to innovation,
F - Awards or certificates won in the area of innovation,
G - [4-] IPR applied,
H - Involved in Startups or became entrepreneurs.

[1]- Resources to Acquire Additive Skills: Spoken Tutorial (IIT-B), NPTEL, SWAYAM, COURSERA, ALISON, YOUTUBE, etc., as well through meeting internal or external members and learning about their problems.
[2]-Internal Competitions included: Challenge to Solutions (C2S), Poster Presentation on Innovative Projects (PIP), Internal Smart India Hackathon, etc.
[3]- External Competitions included Ignited Innovators of India (i2i), Smart India Hackathon (SIH), Samadhan, Avishkar, KPIT Sparkle, etc.

[4]- There are 4 students in each patent application (on average basis)
[***]- Due to Covid19 related pandemic

Table 1. summarizes the success story of PVPIT-Budhgaon and its contribution on the front India's National Mission. Within a span of less than 3 years, around 22 design patents were bagged by PVPIT'ians (Students and Faculties). Another 17 patents have been submitted and are under review. Majority of innovations are to solve challenges in the area related to Technology, Environment, Manufacturing, Agriculture, Food Processing. At least 1200 students were trained for additional skills beyond the curriculum; at least 1000 students have experienced solving problems on real-time solutions in innovative manners.
At least 70 students and 20 faculties have practically invented various devices or machines or technologies and have secured the intellectual property rights behind such innovations. In addition to this, there are 8 Innovation Ambassadors (IA) among the PVPIT teaching faculty community who recently got selected and are recognized by MIC, Govt of India.

These IA can work as resource people (enablers) and can run their own clinics to spread awareness as well as to guide and assist aspirants in the area of Design Thinking, IPR-Technology Transfer, Entrepreneurship and Development, and Pre-Incubation and Incubation support, This way PVPITians (students and faculties), should become industry ready to contribute even more to transform the Global Innovation Index of India as well that of our state of Maharashtra.

VI. CONCLUSION AND FUTURE WORK

It is clear, that PVPIT-Budhgaon has planned for a great future for its students and faculties who are interested in building a strong career in Innovation, Startup and for those who want to become Entrepreneurs. The institute is planning to setup an incubation center and to provide co-working space to faculty and student innovators, as well as to provide all sorts of enablers (Vision, People, Resources, Environment) to foster a culture of innovation, startup and entrepreneurship within and nearby regions. PVPIT-Budhgaon is also looking for collaborators from all fronts of its society members in India and in Abroad.

For e.g. at present there are two reverse engineering and innovative product development projects being carried under by PVPIT faculties and students in collaboration with two different industries. One industry is a local and internationally recognized. It manufactures and services products used in the energy segment. The second one is a Canadian start-up firm who specializes in food and health safety related technologies. Optimistically, in future, India, through PVPITians, may contribute even more in the global mission, of inventing and protecting a series of meaningful products built for some special purpose, for the demand in India and across the globe. All being well, PVPITians become the owners of at least one among the 100's of thousand inventions for what will be the next beyond Smart Phones.

ACKNOWLEDGMENTS

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3D Printing Technology and its Applications in Real-World Scenario

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ABSTRACT: - 3D printing is an additive manufacturing process in which the entire part of a product is constructed using layer by layer deposition of materials that based on plastic and its derivatives. There are various processes of 3D printing namely fused deposition modelling (FDM), selective laser sintering (SLS), stereolithography (SLA), digital light processing (DLP), and multi jet fusion (MJF) to name a few. Each process has its unique characteristics and applications but the fused deposition modelling process is widely used due to its simplicity. As additive manufacturing processes becoming more common coupled with rapid technological advancement in the manufacturing sector, we may see the decentralised manufacturing network in the near future. The prices of 3D printers vary depending of several factors related to the type of printing material used, and the precision and quality requirements. This paper discusses a study conducted on using low cost 3d printer for rapid prototyping a commercially ready product. It also summarises the experiences, advantages and disadvantages of the study.

KEYWORDS: 3D printing, FDM, rapid prototyping, design thinking, product, design, engineering.

I. INTRODUCTION

One of the major disadvantages of traditional manufacturing techniques is their limits and huge capital investment is needed for setup of industry[1]. Unlike traditional subtractive manufacturing techniques additive manufacturing techniques have limitless possibilities. In additive manufacturing one can start from basic printers and may expand up to industrial grade more advanced 3D printers according to the need. This is also supported by many researchers, as once can always find their reports on proposing ideas to develop the habitats on other planets using 3D printing techniques [2,3,4]. The first 3D printing process invented was stereolithography technique invented by Japanese researcher Dr. Hideo Kodama in 1970's. The Fused Deposition Modelling 3D printing technique is developed by Scott Crump in 1980's who later founded Stratasys Ltd. company which is a leading 3d printer manufacturing company [5].

II. RELATED WORK

Now a days one of the widely used manufacturing technique for plastic products is injection moulding. However, it requires a huge machine, and creation of a precise and high quality die. Therefore, a huge capital investment is needed [6]. Whereas the idea of manufacturing a commercial grade product using fused deposition modelling 3D printing technique may help one to save the huge capital investment that was anyways needed for injection moulding process. 3D printers are built using electromechanical hardware components. from its construction point of view a basic 3D printer consists of a printing bed, an extruder, filament, together integrated on a tri-axial motion stage, where everything is controlled using a specially design controller also called as the mother board [7]. Whereas from the application point of view 3D printing a product involves following procedures designing a 3D part on any 3D modelling software like AutoCAD, Fusion 360, Freecad etc. Then the 3D part is converted into standard tessellation language abbreviated as STL which is then given to the slicing software which slices the 3D part into small units enabling slicer to generate G code information acceptable by 3D printer mother board to build a part. All these steps are already summarised in a previously published paper. [8, 9] The chief objective of this paper is to discuss on a study conducted by the authors, using a low cost 3d printer to rapidly

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prototype a batch of a previously patented product, for it readiness on its commercial use. This paper also summarises the experiences, advantages and disadvantages of the study.

III. MATERIALS AND METHODS

The authors in this paper learnt about the basics of fused deposition modelling 3D printing techniques at an incubation centre facility of P.V.P. Institute of Technology Budhgaon Sangli in the year 2019 [9, 10]. Later the authors (Founders of Autosustaintive 3D printing and prototyping services) self purchased a desktop 3D printer to learn and exploit more advance 3D Printing techniques. Using the user manual and after going through several online courses and through free learning resources like YouTube the printer was assembled and made ready to use it to print some actual job. One of the first implementation of 3D printing was the named key chains of themselves. Later the founders started approaching nearby businesses which were making commercial grade products by using subtractive manufacturing techniques. During meetings with prospective business subjects, knowledge and awareness was shared on the idea of potentially rapid prototyping their products and how batch production of the commercial grade products can be done using the 3d printing Plans were also discussed on its potential for very early delivery to the hungry market, as compared to the subtractive manufacturing techniques. Finally one business subject got interested to batch produce his formerly patented commercial grade product and is discussed here after.

III a MEETING WITH PROSPECTIVE BUSINESS CUSTOMER

Table 1. Information of the first batch commercial grade product to be created using 3D Printing.

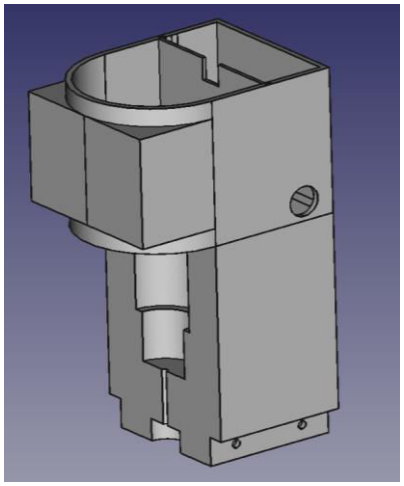
Name of Invention	3d Printed Household Cotton Wickes Machine
Idea Patent Applicants Name	Abhishek Sutar.
Company Name/Company Product and Services	Founder of Abhishek enterprises/ Manufacturer of SPM parts.
Designed by	Mr. Nitesh Raju Chavan Founder, Autosustaintive 3d printing and prototyping services.
Helping credits during managing the 3D printing	Mr. Dnyaneshwar Ashok Patil. Co-Founder, Autosustaintive 3d printing and prototyping services.
Credits on Mentorship	Dr. Nandkishor M. Dhawale, Incharge - R&D Cell P.V.P. Institute of Technology Budhgaon, Sangli,

The details of the potential first batch production of the commercial grade product is summarised in table 1. This was when and where the authors approached the founder of Abhishek enterprises, Mr. Abhishek Sutar sir and gave them information of their 3D printing and prototyping services. Also all technical information was shared in regards to the potential of batch production of commercial grade products and the cost associated with the rapid prototyping techniques and what advantages this technique gives us over the traditional manufacturing techniques. Later the customer was convinced and he shared the details of the requirements of his potential product that could be tried manufacturing using 3D Printing Technology. Considering the requirements a initial skecth was drawn and then a details 3D Design/Model was created using Free CAD (an open source application software tool to create 3D Computer Aided Designs) The details of the design is shown in figure 2. From design it was clear that product to be printed was a machine and it consisted of four parts. 1) the main body, 2 top cover, 3) bottom part, and 4) slider cover.

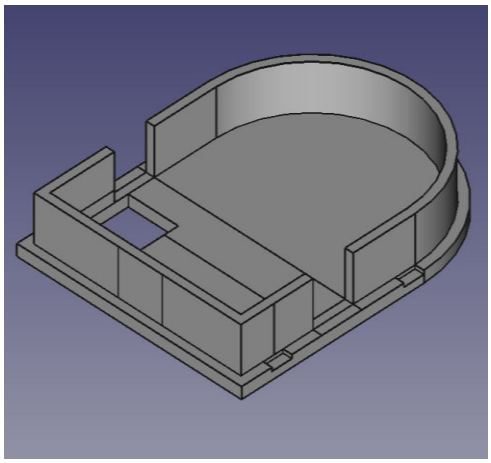
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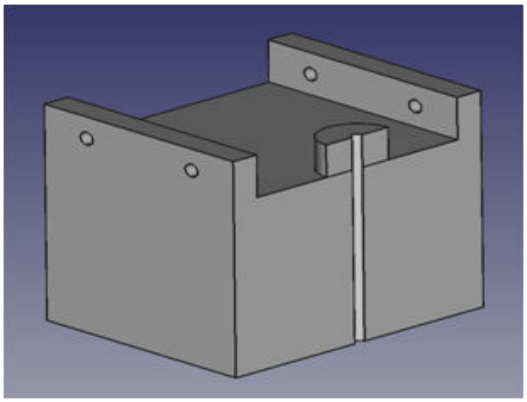
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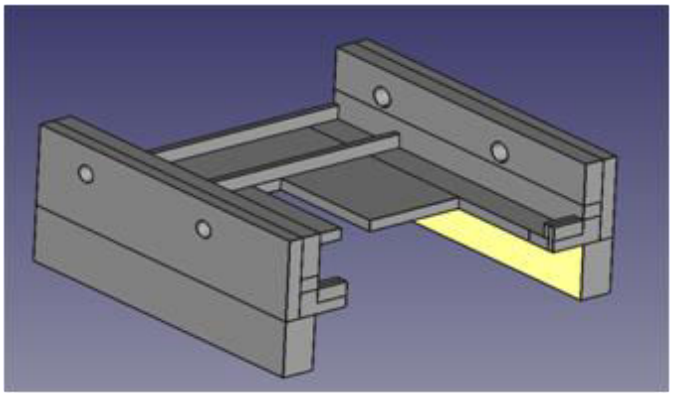
(a) Main body of Machine



(b) Top cover of Machine



(c) Bottom part of Machine



(d) Slider Cover

Figure 1. The designed parts of the to be 3d Printed Household Cotton Wickes Machine.

Considering the requirements and the designs the next step was to assess the cost associated with the rapid prototyping techniques and what advantages this technique gives us over the traditional manufacturing techniques. The details are specified in the next sections.

The cost consideration factors for the injection moulding process are the initial mould making cost, material cost, machining cost, labour cost etc. Also, when we opt for injection moulding process there is a certain criterion for minimum number of parts that we have to take order as per the machining and economical factors of injection moulding industry. As per findings the minimum number of parts to be injected for injection moulding process are 1000 so we have calculated the cost per unit based on following formula.

Total Cost = Mould Making + material + labour + Machining, Maintenance (EQ.1)

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Table 2. Information summarizing the total cost of product using injection moulding.

Mould Making Cost (a)	Material cost (b)	Labour cost(c)	Machining, Maintenance and other (d)
1,50,000, (Local mould maker)	1000 units * 200 gram = 200000 grams = 200 kg. (Average cost of commonly used plastic moulding Materials like ABS, polyethylene.) Overall Material cost 200* 80 =16,000	600 Rs per day. (Local market labour cost.)	8000 Rs per hour. Total hours = 6 Total cost= 6* 8000= 48000 (Local industry information.)
So total cost per product using EQ.1 will be, 1,50,000 + 16,000 + 600 + 48000 = 2,14,600 Therefore the usnit cost per product shall be 2,14,600/1000 = **214.6 Rs.**			

III a1 COST CALCULATION FOR BATCH PRODUCTION USING FDM 3D PRINTING

The cost consideration factors for the batch production using FDM 3D printing process are the Product design cost, Material cost, Machining cost, labour cost etc. In 3D printing process there is no any criteria for minimum number of products to get printed for a given order. So, it will be advantage over plastic moulding process that we can manufacture the product as per the customers' orders with minimum of capital investment. The formula used to calculate the cost associated using FDM 3d printing was as listed as EQ.2 as follows:

Total cost = Product design + Material + Machining + labour (EQ.2)

Table 3. Information summarizing the total cost of product using 3D Printing.

Product design cost (a)	Material cost (b)	Machining, Maintenance and other (c)	Labour cost(d)
It took 1.5 hours for the author (Founder) to design the product in Free CAD. Taking arbitrary average hourly rates charged by designers as 1000/hour. 1000*1.5 = 1500. (The product design cost is one time cost.)	Thus is easily calculated by the slicer tool. As per the tool the total material consumption per product was ~ 200 grams. Generally 3d printer PLA filament cost is around 950 Rs per 1000 gram. So, the material cost per product was supposed to be 200*0.95=190 Rs	Machining cost is considered keeping in mind electricity consumption expenses and maintenance cost. 360-watt machines consumption 1 kW in roughly 2.8 hours. As per slicer tool information. The time required for whole machine for printing = 11.5 hours. Therefore, total kW consumption = 4.11 electricity consumption expenses. 4.11* 8 = 33 Rs. Maintenance cost was considered to be 10 Rs per hour. 11.5*10 = 115 Rs.	As per the slicer tool the printing time was supposed to be 11.5 hrs. Considering an average hourly labour rate as 40 Rs there for the associated labour cost was to be 11.5 *50 = 460. (Labour cost is minimum as machines are automatic only requires human intervention during start of print and at end of print to remove part.)
So total cost per product using EQ.2 will be, 1500 + 190 + 148 + 460 = 2298 Rs. Per Product However considering the designing cost as to be charged only once the unit product cost could be 798Rs.			

As shown in table 2 and 3 and figure 3, it was clear that 3D printing cost per product is almost 3.5 times greater than the cost associated per product by injection moulding process. However the customer was briefed on the advantages by going ahead with 3d printing. One main reason was that his product could land into the market very early. Where as the huge capital investment were also avoided, helping him to reduce the burden to sale the products as in the injection moulding process. After briefly putting such ideas in front Abhishek sir, he got impressed and gave the amber signal to go ahead. However he also gave another challenge of producing a cube with good compression strength.

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This was possible by re-designing the product and 3D printed it keeping the high infill percentage therefore the product passed the test and also helped to confirm the deal.

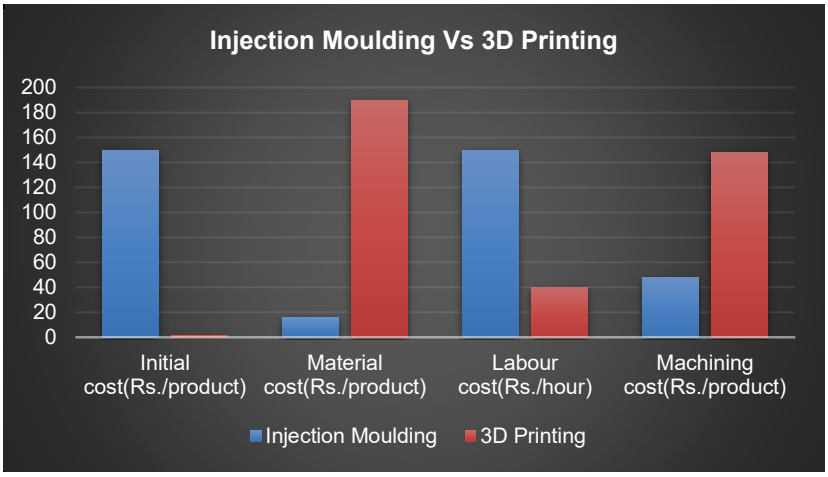


Figure 2. Comparison of cost involved in injection Moulding and 3D printing.

III b ***MORE CHALLENGES***

Once the customer was satisfied. He than briefed about the general idea of small handy size cotton Wick machine and its general aesthetics and insisted if it can be manufacture by 3D printing technique with a minimum cost. The customer already being experienced about his product, all necessary insights were taken from him from him by conducting a small meeting to discuss about the product features, parameters, about product aesthetics and general product shape and sizes. Considering all points as discussed in the meeting a design of the machine was created using Free CAD and submitted to the customer for their review. The customer was impressed with the design and aesthetics of a product and suggested few improvements as per his experience of manufacturing machines over the last few years. After re-adapting the requirements in the design the first prototype was printed using FDM 3D printing process and tested it in real world conditions. However it was realised that the product needs to have wall mounting features and easy operating sliding platform for the efficient use. Therefore all necessary changes to the final product design were made and then it was a time of selection of a printer, printing parameters, hardware changes etc. Based on readily availability reasons the choice was between Geeetech A10 3d printer and Creality's ender 3 3d printer.

III b1 COMPARISON BETWEEN PRINTERS

Table 4. Comparison between low cost readily available 3D Printers

Aspects Category	Aspects	Geeetech A10	Creality Ender 3
Mechanical	Drive system	Stepper motor, Belt driven	Stepper motor, Belt driven
	Build volume.	230*230*260	230*230*250
	Extruder system	Bowdon system	Bowdon system
	Material compatibility.	PLA, ABS, TPU, PETG,	PLA, ABS, PETG
	Dimensional accuracy	0.1 mm	0.1 mm
Electronics	Motherboard	V4.2.7 32 bits motherboard	V3.1.7 32 bits motherboard
	End stops	Limit switch	Limit switch
	Temperature control	thermistor based PID control	thermistor based PID control
	Power supply.	24-volt 16 ampere Standard PSU.	24-volt 16 ampere Standard PSU.
	Power rating.	360 w	260 w

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	Motors's	NEMA 17 stepper motors	NEMA 17 stepper motors
General	Max. Temperature Nozzle, Heat bed	260, 110	250, 110
	Automatic Bed Levelling	No	No
	Input type	LCD with Knob	LCD with Knob



(a) Geeetech A10 (b) Creality Ender 3 (b)

Figures 3a and b. Images of the low cost readily available 3D Printers.

Figure 3 illustrates the two choices of the low cost readily available 3D Printers. From table 4, it is observed that there were no major differences between the printers so both printers were suitable for printing this product. The only thing which is going to vary between printers is power consumption Geeetech A10 has 360 W power rating and ender 3 has 260 W power rating so Geeetech A10 will consume somewhat more electrical power.

III b2 MATERIAL SELECTION

As per the customers requirement on reducing the costs. The design was based on minimum Material requirements basis. Which involves keeping enough material on the specific dimensions of part which can supports the load putted on it. The printed PLA material has approximately 42 n/mm2 strength (according to the temperature and printing parameters it may vary) and when considered the normal human handling it was sufficient to withstand the stresses. The PLA material is also easy to print as compared to other materials. Also, when we considered the usage aspects of product it is going to be used in indoors so there are no any significant degradation issues involved. One of the other strong contenders for material selection was ABS material but it is somewhat costly, and difficult to print as compared to PLA. So according to the mechanical principles and compatibility with 3d printing PLA material was selected for the production of part of the product.

III b3 SELECTION OF MACHINING PARAMETERS

Selection of machining parameters are taken purely based on previous learning's and experience of printing and prototyping. For this product a 0.6 mm nozzle was selected for faster printing without compromising the strength and surface finish characteristics. Figure 4, below summarises the time and material consumption comparison for 0.4 mm nozzle vs 0.6 mm nozzle by keeping other printing parameters same. Form figure 3, it is observed that 0.6 mm nozzle increases the material consumption by 5 grams, but reduces the time consumption by 1.5 hours. In terms of cost 0.6 mm nozzle increases material cost by 6 Rs. and reduces electricity cost (dependent on time consumption) 4 Rs. Also when we considering the number of production quantities (in future) the 0.6 mm nozzle works great so we 0.6 mm nozzle was selected for the printing.

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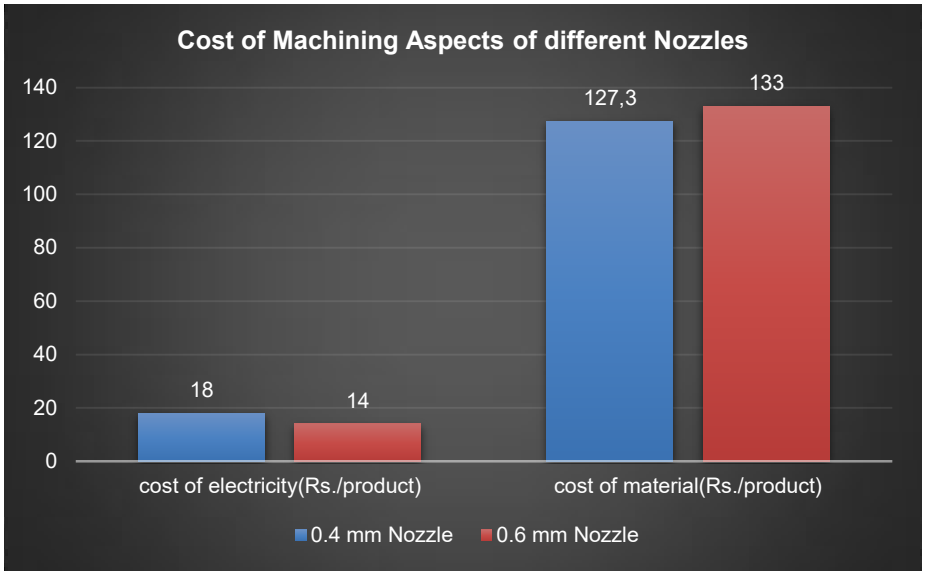
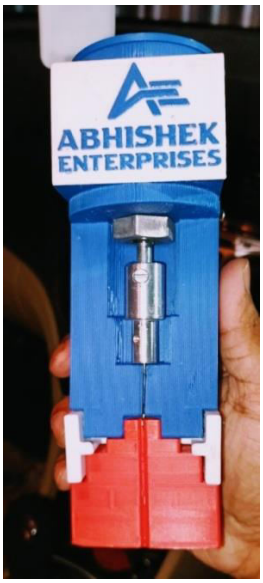


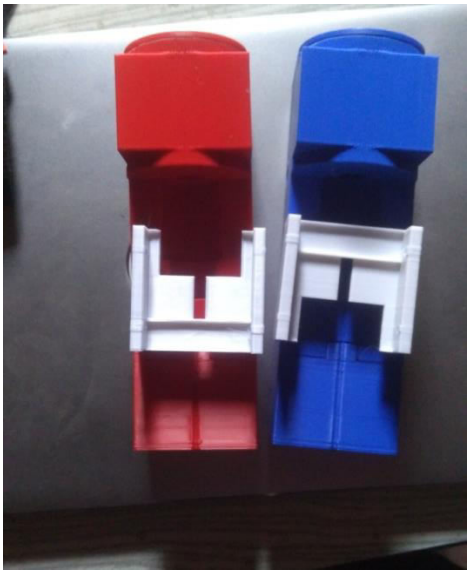
Figure 4. Comparison of various machining aspects of different nozzles in terms of cost.

IV. RESULTS AND DISCUSSIONS

Figure 5 shows the example of the real product. It was formed by assembling all four parts that were 3 printed using step discussed in previous sections. Various designs for cotton wickes machine are available in the market but those machines are industrial grade and requires somewhat more capital investment and some skill to operate it. In contrary the machine as discussed in this paper is designed and prototyped primarily considering household needs. The machine has been made small as possible as well as by satisfying all of the functional requirements. After taking a small marketing effort the customer started giving more orders for the machine. Therefore its was possible to print and assembled the machines on the order basis. As per the customer he was possible to dispatch around 120 machines to various parts of India. By doing this project from the development phase to the manufacturing phase it was possible to gain lots of experience and especially marketing knowledge.



(a) Assembled product



(b) Assembled product from back

Fig. 5 The real product assembled after 3 printing all its four parts.

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V. CONCLUSION

The world is changing rapidly with technological development pace like never before. Everyday new technologies are emerging and making the existing technologies old. Traditional manufacturing techniques are efficient and effective for specific sector of manufacturing. Additive manufacturing techniques can adapt to the product requirement very easily without much changes in its structure. It is very easy to set up the additive manufacturing industry and manufacture the things based on the trend and customers requirement. Additive manufacturing techniques are becoming more common and individuals are accepting it as a hobby or as a small business. We may see a global network of additive machining small and medium manufacturers which will revolutionize the supply chain industry soon before that we need to achieve the technological maturity and suitable infrastructure readiness.

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A Review on Detection Techniques to Quantify Nutritional Constituents of Milk

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ABSTRACT: Milk is an essential part of human diet, also milk in its raw form consists high numbers of its constituents just because it is a undeniably better source of natural and pure source of fats, lactose, proteins, minerals and vitamins. The major source of milk is from cows (world wide including India) and buffaloes (India). Most of the time many people prefer to consume cow's milk just for its health benefits. On the other hand, many people are inclined to drink buffalo's milk. The main question arises here is 'how to find out which is which?' and 'how to quantify the nutrients?' Numerous studies and methods have been explored to find out precise information of the milk including its source. There are methods available to sort these milks out but these methods are expensive, laborious and time consuming. In this study, we will take a look on the areas which are not explored yet, and are potentially showing more room for further studies in this particular field. Then we will discuss a portable instrument, which has not been developed yet, but can be useful and helpful along with an idea of using machine learning to predict whether that is a cow's milk or buffalo's milk, from the images recognition only

KEYWORDS: milk, cow, buffalo, portable, instrument.

I. INTRODUCTION

Milk is an essential part of human diet, also it has lot of minerals and vitamins. Most importantly, protein is the main constituent which makes it more valuable but there are lot of factors that affects on the quality of milk, also milk in its raw form consists high numbers of it's constituents just because it is a undeniably better source of natural and pure source of fats, lactose, proteins, minerals and vitamins [1].

Numerous studies and methods have been explored to find out precise information of the milk but most of the time many people prefer to consume cow's milk just for its health benefits. On the other hand, many people are inclined to drink buffalo's milk and it's worldwide production reached at 659 and 111 million tons respectively in 2016 [2]. The main question arises here is 'How to find out which is which?' there are methods available to sort these milks out but these methods are expensive, laborious and time consuming. Nonetheless, even if we choose best milk out there still consumers are oblivious of one main and foremost factor is SCC (Somatic Cell Count) higher the SCC poor the quality of milk and vice versa.

Also, there are loads of procedures and devices available to measure milk's quality such as, high performance liquid chromatography method for lactose content [3], Kjeldahl method for protein content [4], Rose Gottlieb method for fat content [5] and direct forced air oven drying method for total solids, it is essential to measure these charges to make dairy product's quality transparent. Moreover, it is very important to identify the adulteration of the milk, water is the economic adulterant of the milk. It is usually mixed to increase the amount of milk in order to raise the profit, which in result lowers the quality of the milk and can be dangerous for human being. Most of the time, cow milk is mixed with goat or buffalo milk to make profit. Hydrogen peroxide is added into the milk to increase it life which has bad effects on human health. Similarly, urea is used to maintain the density and fat content in the milk.

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In the study discussed in this paper, we will take a look on the areas which are not explored yet, and are potentially showing more room for further studies in this particular field. Then we will discuss a portable instrument, which has not been developed yet, but can be useful and helpful along with an idea of using machine learning to predict whether that is a cow's milk or buffalo's milk, from the images recognition only. Device can calculate all factors at once in one device with the help of sensor fusion method i.e. multiple sensors calculate different parameters and collects different data for further processing, then we will apply machine learning to predict the results

II. LITERATURE REVIEW

i. MAIN NUTRITIONAL CONSTITUENTS IN MILK

The most part of milk is aqueous solution of lactose, minerals, vitamins, and other small molecules. Besides the solution, proteins at the molecular level (whey proteins) or as large colloidal aggregates (casein proteins, 50–600 nm) and lipids as globules (0.1–20 mm) in an emulsified state were dispersed in milk [5]. Many factors, such as species, individual, stage of lactation, feed and health, have influences on the compositions of milk [6]. Milk fat is mostly contained in fat globule which is the core of triglycerides surrounded by a membrane. In the milk of most species, 97–98% of the total lipids are triacylglycerols (TAGs). Other lipids like diacylglycerol, cholesterol, phospholipids, and free fatty acids (FFAs) can also be found. Since TAGs are the main parts of milk fat, the properties of milk fat such as density and melting profile are mainly influenced by TAGs. There are more than 400 different fatty acids (FAs) in milk fat, which is much more than in other fats. From a practical viewpoint, milk fat gives distinctive properties in nutritional, textual and organoleptic aspects of dairy products such as butter, cream and cheese. Milk contains hundreds of types of proteins, which could be divided into three kinds, that is, casein proteins, whey proteins and minor proteins. Most of the casein proteins existed in a colloidal particle is known as casein micelle. There are two kinds of whey proteins, that is, b-lactoglobulin and a-lactalbumin, which can result in allergy even at a very low concentration[7]. Each protein has its specific biological functions [8]. Both of them are classified as high-quality proteins since they meet the human requirements on amino acid with high digestibility and bioavailability.

Lactose is the main carbohydrate in the milk of most species and is regarded as a ready source of energy for the neonate. In the formation of neural system and growth of skin (texture), bone skeleton and cartilage in infants, lactose also has an important impact. However, lactose intolerance can result in different degrees of abdominal discomfort, bloating, diarrhea and flatulence due to insufficient amounts or activity of lactase in the human intestine.

In addition to the main constituents described above, several hundreds of minor constituents, for example, minerals and vitamins, are also significant for the nutritional, sensory and technological properties of milk. The milk minerals, including citrates, phosphates, chloride, potassium, sodium, magnesium, and calcium, exist as ions in solution or as colloidal species complexed with caseins. These minerals are essential for human nutrition. For sustaining life and promising good health, vitamins are necessary microelements [9]. There are two groups of vitamins in milk according to their solubility, that is, water-soluble vitamins and fat-soluble vitamins. Both water-soluble (B complex and vitamin C) vitamins and fat-soluble (vitamin A, D, E) vitamins are contained in milk.

ii. RAPID DETECTION TECHNIQUES

a. Chromatography

Chromatography, such as high performance liquid chromatography (HPLC) and gas chromatography (GC), is very useful in complex food analyze since they combine the separation and detection steps together. In principle, HPLC can be used to separate any dissolved analytes by using different techniques. Reversed-phase HPLC (RP-HPLC) is the most commonly used HPLC techniques. Many different detectors such as refractive index detector (RID), evaporative light scattering detector (ELSD), pulsed amperometric detection (PAD), mass spectrometry (MS), photometric and fluorescence are usually used in HPLC. GC is generally applied for compositional analyses of thermally stable compounds that are volatile or become volatile using derivatization. Flameionization detector (FID) and MS are the most commonly used detectors in GC analysis [10].

b. Spectroscopy

Raman, MIR (2500–25000 nm), NIR (780–2500 nm), and Vis-NIR (400–2500 nm) spectroscopy are widely applied in constituent analyses of milk. Raman spectroscopy is based on vibrational, rotational and other low-frequency modes. Without the interference of water, Raman spectral analysis is suitable for a wide range of liquid products (Jha et al. 2016). MIR, NIR, and Vis-NIR spectroscopy express typical vibrations of covalent bonds in molecules. Therefore, their spectra contain quantitative information about all the compositions that absorb infrared radiation [11]. These infrared methods are

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mainly based on the absorption, provided the scatter is possibly avoided or suppressed. Besides Raman, MIR, NIR, and Vis-NIR, other spectroscopy techniques such as ultraviolet (UV) spectroscopy [12], fluorescence spectroscopy [13] and atomic spectroscopy [14] have also been used in the milk quality analysis.

c. Dielectric Properties

The usually interested dielectric properties include dielectric constant and dielectric loss factor, which are the real and imaginary parts of the relative complex permittivity, respectively [15]. Dielectric properties are inherent properties of materials and they explain the interactions of materials with electric field. The dielectric constant reflects the ability of a sample in storing electric energy, and the loss factor shows the ability of the material in dissipating electrical energy into heat [16]. Many studies have shown that the dielectric properties of materials not only depend on the temperature and frequency of electric field but also rely on their physical and chemical characteristics like density and compositions [17]. Therefore, the dielectric properties have usually been used to determine the compositions of food, including milk.

Sensors

In recent years, sensor technology has received considerable attention and developed rapidly. Many efforts have been devoted to develop in-line/on-line sensors based on different principles for detecting the compositions of milk or dairy products, such as microwave sensor [18], optical sensor [19], resonant cavity sensor [20], biosensor [21], and photoelectric sensor [19]. When compared with other traditional methods, the biosensors developed by using various biological materials have greater potential in practical applications with some prominent advantages such as fast determination, simple procedure, low cost, high sensitivity, and excellent selectivity [22].

d. Sensor Fusion Method

Till the date, many researches and studies have been done regarding the different procedures of finding out milk's nutritional values. But there is still lot of space available to explore more accurate method to find out these same parameters. One of which is Sensor Fusion Method (SFM) this defines, in other words, that more the data greater the accuracy. In this method multiple sensors can be used to measure single parameter which in turn increases measurement accuracy. Protein and fats, for instance, are the main parameters of measurement. If two of more sensors are connected to measure only protein and two or more sensors to calculate fats in the milk then after collecting and processing the measured data of these number of sensors. After then, it's mean will be of high accuracy.

III DISCUSSION

Up to now, the combinations of chromatography with other detection techniques have become an important technology in analyzing food composition, especially for trace contents, and have been successfully applied for the compositional analysis of fat, protein, lactose, minerals, and vitamins in milk owing to its high sensitivity, flexibility and specificity. However, these techniques usually include extraction and separation steps, causing professional technicians needed, time and chemicals consumed and pollution on environment. Therefore, chromatography technology cannot be used in situ or in the field, and cannot meet the in-line/online purposes. Moreover, due to the expensive chromatography instruments and the high cost of acquisition and operation of systems, the technologies are just used in large analytical laboratories and applied as a reference to other methods.

Being a well-established laboratory technique, MIR spectroscopy has been widely regarded as a reference analysis method for the main constituents of milk due to its high sensitivity and selectivity [23]. At present, Fourier-transform mid-infrared (FT-MIR) spectrometry is the most widely used method worldwide for compositional analysis and quality checks during routine liquid milk testing.

The changed dielectric properties with compositions in milk have also been used to detect fat and protein contents of milk. Dielectric spectroscopy has the advantages of high speed, little or no sample preparation, nondestructive measurement, wide wavelength range and multiple analyze from a scan. It has great potential for in-line/on-line quality analysis. Therefore, applying dielectric properties for determining the main nutrients of milk has great potential. However, since many factors including physical and chemical properties, such as structure, ions, water, fat, and protein, have a comprehensive influence on dielectric properties, applying dielectric properties to predict the main nutrients of milk precisely is a big challenge.

Compared with other rapid detection methods, chromatography has been widely utilized in the analysis of components such as fat, protein, lactose, mineral, and vitamins in milk due to its outstanding advantages of sensitivity, flexibility and specificity.

Due to the capability of spectroscopy and dielectric properties in realizing in-line/on-line detection, applying spectroscopy and dielectric properties to explore the physical sensors which are

accurate, fast, cheap and time-saving, as well as could be used in-line/on-line detection will have great potential in future.

IV CONCLUSION

This review focuses on the rapid detection techniques, that is, chromatography, spectroscopy, dielectric properties and sensors, and main nutritional constituents, that is, fat, protein, lactose, mineral and vitamins, in milk. The applications of these techniques in detecting each main nutritional constituent are summarized in this study. The advantages and limitations of these techniques are discussed. There is much room for the development of accurate detection technology which is suitable for rapid detection of main nutritional constituents in milk. There is no such instruments is available that measures the all parameters at a time in a single device. There is also no such device that portable. There is also an urgent need for further researches to make commercial grade equipment could be used in situ and in-line/on-line detection on nutritional constituents of milk.

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PERFORMANCE ANALYSIS AND EVALUATION OF RECOMMENDATION SYSTEMS USING TIME BASED TEMPORAL DATA MODELS

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Abstract: *Although idea drifts, also known as temporal dynamics in RS is an issue, recommender systems (RS) have seen a rising increase over the years due to its significant benefits in supporting users' demands by matching users to available products based on their observed inclinations towards items. The concept drift issues with standard RS techniques make them insufficient for offering correct suggestions, despite the fact that they have achieved substantial success in generating recommendations. These problems have spurred extensive research on the creation of dynamic recommender systems (DRSs), which is centered on the building of temporal models that will account for idea drifts and guarantee more accurate recommendations however, creating long-term and short-term models for users constitutes the majority of the work required to address the drift of interest. User interest drift cannot be dynamically monitored. In this position paper, we raise concerns about the technique of computing evaluation metrics for recommender systems as single numbers because these figures only represent average efficacy over often a lengthy period of time (e.g. a year or even longer). This method merely offers a hazy, static image of the data. We suggest that researchers studying recommender systems compute metrics over time-series like weeks or months and display the findings, for example, in a line chart, Results in this way demonstrate how an algorithm's efficacy changes over time, enabling more insightful predictions regarding an algorithm's performance going forward. This will make it possible to gather more data on an algorithm's performance over time, spot trends, develop more accurate predictions about how an algorithm will perform in the future, and ultimately come to more insightful decisions about which algorithms to use in a recommender system.*

Keywords: *Recommendation system (RS), Attention model (AM), Neural attentive item similarity (NAIS) model.*

1. INTRODUCTION

In order to deal with the exponential growth of information on the web and to deliver individualized content and services, recommendation systems (RSs) were developed. Providing users with services RSs are currently use in numerous fields, such as e-commerce, advertising, e-learning, document management, and news raising the likelihood of cross-selling and customer or consumer satisfaction and loyalty recommending goods those users may find interesting. RSs frequently employ the collaborative filtering (CF) method, which is based on user similarity values (or items). In other words, the CF strategy operates under the premise that customers are likely to favor comparable products in the future if they have previously exhibited similar accessing behaviors. The user's preferences can be based on a variety of factors, such as location, time, weather, and device kind. These criteria can provide us with useful information to enhance the functionality of RSs. In order to take into account the effects of ratings timestamps provided by users into the recommendation process, a novel recommendation approach is proposed in this work. In order to achieve this, a representation model of sequential patterns is initially established for the user ratings. To forecast the similarity between users in the future, a time-series of user similarities through time is created.

1.1 MEMORY-BASED APPROACHES

Based on it, algorithms try to locate similar users by scanning the entire user space, which are both a bad idea in theory and a time-consuming job. Every user is seen as a member of a group of individuals who share a common interest. These algorithms employ Pearson Coefficient correlation to calculate user similarity.

1.2 MODEL-BASED APPROACHES

It provides a method for the system to pick up knowledge from training data and then make wise predictions for test data. For numerical ratings, the SVD method and regression models can typically be used.

2. RELATED WORK

2.1 ATTENTION MODEL (AM)

The Attention Model (AM), first developed for machine translation, is today the most widely used concept in the literature on neural networks. AM can be easily explained by the fact that people's eyes focus more on things that attract them. Attention Model can therefore concentrate on the important information while disregarding the rest. In order to reduce the noisy information brought on by too much historical information, we can utilize the attention model to concentrate on the user feature relating to the user's present interests. However, we also think that consumers have some innate characteristics. For instance, the movie or the purchased item will have particular preferences if the user is a girl. The users own interests are also crucial for understanding their past behavior.

We provide a user modeling approach based on attention model to address the issue of user interest drift in recommendation systems. This method makes use of the attention model to drift in user interest is dynamically learned.

The two components of our suggested model's primary contributions are as follows:

1. To address the issue of user interest drift, integrate the attention model with RNN.

2. To express the user's static features and incorporate them with dynamic features, a user feature embedding is created separately.

2.2 NEURAL ATTENTIVE ITEM SIMILARITY (NAIS) MODEL

The neural attentive item similarity (NAIS) model Based on the attention model. The NAIS model assumes that the user's previous items have a distinctive influence on the target items by utilizing an attention model feature. The attention model dynamically determines the influence weight between items based on the item-based collaborative filtering model and determines which previous items in a user profile are more crucial for a prediction. Cheng et al. [12] create a new topic model to extract text information from items and utilize the attention model to learn the K-dimensional properties of things, different attention levels for each dimension.

2.3 TIME DEPENDENT MODELS

Neighborhood: Neighborhood models are CF techniques that produce suggestions by pooling the ratings of users who share similar interests. The neighborhood

model may generally be modified to describe dynamic changes in RS over time, either by integrating time dependent algorithms or by employing time–independent methods. In the following section, we describe numerous studies that, mentioned in mostly used time-dependent or time-independent algorithms for neighborhood-based RS. These comprise, among other things, weight or decay functions and window-based techniques.

2.4 TIME INDEPENDENT MODELS:

On the other hand, time-independent models make use of time as an extra context that has a big impact on understanding and forecasting user preferences. In other words, timestamps are explicitly employed in the model as an additional form of data. The literature on context-aware RS contains a sizable corpus of research. The time-aware neighborhood-based or factor-based models were two examples of studies that we notably focused on since they dealt with time precisely.

Table 2.1. Review of Models

Sr. No	Title of Paper	Performance metrics	Limitations	Conclusion
1	Attention based user Temporal model for recommendation	Historical behavior of user	In recommendation system users interest is not static and users interest drift makes impact on performance of final recommendation of recommendation system	In this paper proposed the model Attention based user temporal model (AUTM). This model commonly used in deep learning, model suggest that human eyes spent more attention on what they are interested in. this model focus on users historical behavior on target item.
2	Time–dependent Evaluation of recommender systems.	Performance of algorithm changes over time	Evaluating recommender system algorithm with single number metric is sufficient?	In this paper proposed that the performance of algorithm changes over time 90% of dataset. When more and more data is available, datasets split based on timestamp like weekly, Monthly, quarterly, and yearly. some

				algorithms improving while other decreases over time and no evidence find for algorithm follows different trends over time but ranking of algorithms not change over time.(MovieLens, Netflix, Amazon, Yelp).

3. PROPOSED METHODOLOGY

According to our study recommendations about recommendation algorithms are as

- The length of the user profile may affect the recommendation System.
- The popularity of the items a user rates may affect the recommendation's quality, i.e., a user may rate more popular items highly than less popular ones, affecting the recommendation's quality
- When comparing two algorithms, different metrics (e.g., MAE and recall) may produce conflicting results.
- Recommendation algorithms are typically integrated into RS that only offer users a small list of recommendations due to the complexity of the algorithms.

Methodology for evaluating and comparing recommendation algorithms is divided into three steps

Step 1: statistical analysis and partitioning
Step 2: optimization of the model parameters
Step 3: computation of the recall for the top-N recommendation.

3.1 Statistical analysis and partitioning

The partitioning of the dataset is performed by means of the m-fold cross-validation. Together with the partitioning we analyze the dataset in order to find groups of users and the most popular items based on the number of ratings. This will help us to identify the behavior of the model according to the length of the user profile and to the popularity of the items of the recommendation. In order to create groups of users we use the following method

a) Users are sorted according to the length of their profiles (i.e., the number of ratings).
b) Users are divided into two groups so that each of them contains the 50% of the ratings;
c) A group can be further divided into two subgroups (as previously described in b) in order to better analyze the behavior of a learning algorithm with respect to the length of the profiles.

Similarly, in order to find the most popular items, we adopt the following schema

a) Items are sorted according to the number of ratings;

b) Items are divided in two groups so that each of them contains 50% of the ratings.

3.1.1 Splitting Dataset into Training and Testing

Data can be divided in a certain ratio into training and test sets for training and testing purposes. Data can be divided based on the user, item, and rating. There are numerous choices Possible to divide the data. The rest of the users or items are chosen at random to serve as test data by loocv. Given n chooses N objects or users as test data and the remaining objects or users as train data. In order to read test data when reading all the data, the test data path needs to be in the same directory as the train data path.

3.2 Optimization of the model parameters

When we change the threshold that enables us to categorize an item as "to recommend" or "not to suggest," ROC curves can be used to show the trade-off between TPR and FPR. A family of ROC curves can be obtained by altering certain model parameters, such as the latent size of the singular value decomposition. We use two methods based on ROC curves, ROC1 and ROC2, to optimize the model parameters depending on the type of dataset. The 25% of the evaluated items for each user are randomly withheld in both strategies, which employ leave-k-out.

3.3 Computation of recall

We assess the recommendations quality using this method. The recall metric was selected because, in contrast to other metrics like MAE, it expresses the system's actual capacity for pursuing the top-N recommendation assignment. By choosing a user (referred to as the active user) and repeating the processes below for each of the favorably rated items in the test set, the computation of the recall is done. If a rating is higher than a specific threshold, or t, it is deemed positive according to the adopted rating scale. Be aware that on a binary scale, every rating is positive. Withholding a favorably rated item is the first stage, followed by generating predictions for the active user using the model that was previously built using the training set.

Recording the location of the item that was withheld in the forecasts sorted list. The length of the user profile and the level of popularity of the withheld item are the two criteria used to classify recalls.

4. Conclusion

This paper mention an algorithm's efficacy changes over time, enabling more insightful predictions regarding an algorithm's performance going forward. This will make it possible to gather more data on an algorithm's performance over time, spot trends, develop more accurate predictions about how an algorithm will perform in the future.

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Prediction of Employee Attrition Using Machine Learning Approach

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Abstract: ***In the world of technology, there are various zones through which different companies may adopt technologies which sustenance decision-making, Artificial Intelligence is the most creative advancement, generally used to help various companies and institutions in business approaches, authoritative aspects and individual's administration. As of late, consideration has progressively been paid to Human Resources (HR), since professional excellence and capabilities address a development factor and a genuine upper hand for organizations. Subsequent to having been acquainted with deals and showcasing offices, man-made brainpower is additionally beginning to direct representative related choices inside HR the board. The reason for existing is to help choices that are put together not with respect to emotional viewpoints but rather on target information investigation. The objective of this work is to break down how target factors impact representative weakening, to distinguish the fundamental driver that add to a specialist's choice to leave an organization, and to have the option to foresee whether a specific worker will leave the organization. After the testing, the proposed model of an algorithm for the prediction of workers in any industry, attrition is tested on actual dataset with almost 150 samples. With this algorithm best results are generated in terms of all experimental parameters. It uncovers the best review rate, since it estimates the capacity of a classifier to track down every one of the True positive rates and accomplishes a generally false positive rate. The introduced result will help us in distinguishing the conduct of representatives who can be attired throughout the following time. Trial results uncover that the strategic relapse approach can reach up to 86% exactness over another. There are the few algorithms that can be used for processing the data, K-Nearest Neighbour, logistic regression, decision Tree, random Forest, Support Vector Machine etc.***

Keywords*: Employees Attrition, Machine Learning, Support vector machine (SVM), KNN (K-Nearest Neighbour)*

I. INTRODUCTION

Today attrition is one of the serious issues looked by industry across the world. It is the most consuming issue for the business, and high whittling down rates lead to many issues in the limit of the association like losing the skilled assistances and information, cost identified with preparing and organization. It is seen that many ascribe lead to the steady loss of a representative. Which incorporates working climate, work fulfillment, behaviour of seniors, work timing, and most significant is payor motivating forces. Additionally, the expectation model assumes a fundamental part in discovering the conduct of representatives. Ideal conveyance of any assistance or item is the essential objective of any association lately because of high rivalry in enterprises. On the off chance that a capable employee will leave company, the organization can't do the job at characterized times. It might turn into the justification the deficiency of that organization. Thusly, organizations are keen on knowing the worker's weakening. They can make an appropriate substitute or game plans prior.

This framework can anticipate which representative might leave an association with what reason, so they can make a few restorative moves to guarantee that workers stay in the association and can lessen the steady loss. A portion of the worker maintenance methodologies to control weakening are spurring representatives, open workers to fresher jobs, taking steady input from workers, and so on. Following are the couple of algorithms that can be utilized for preparing the data Support vector machine (SVM), k-Nearest Neighbour, Decision Tree, Random Forest, logistic regression etc. Based on the accuracy measurement well performed algorithm will be used for this dataset.

AI is most significant innovation towards information examination for quality expectation and assessment. There are different calculations in AI which are utilized to anticipate the proper class of new or inconspicuous information. In our framework we utilized distinctive AI calculations to discover the purposes behind worker wearing down. The AI calculations which are utilized in framework are depicted beneath:

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A. Support Vector Machine (SVM)

The novel approach toward the attrition prediction is Support Vector Machine strategy. This approach utilized for grouping as well as relapse issues. It can tackle straight and non-direct issues. The calculation makes a stroke or a hyper plane what isolates the information into modules or classes [9]. At the point once, obscure information is assumed as information it detects which class it has a placed with. The edge amongst the hyper plane and the help vectors are pretty much as extensive as conceivable to decrease the blunder in grouping.

B. K-Nearest Neighbours

K-Nearest Neighbour is viewed as a lazy learning calculation that characterizes informational collections dependent on their closeness with neighbours. It is perhaps the most crucial and straightforward characterization techniques and probably the most ideal decision for an order investigation of the information [7]. The instruction using KNN comprise determining contiguous material emphases and afterward selecting the class reliant on on the classes of the neighbours.

C. Decision Tree

All Decision tree approaches recursively isolated insights hooked on twigs to develop a tree to further develop the forecast precision. Decision tree approach is a customary calculation utilized for execution characterizations reliant on the selections completed in one phase. This gives decision tree prearranged depiction of the choice groups [10]

D. Random Forest

The most significant approach is Random Forest approach which is utilized for Classification and Regression subjects in Machine Learning. It rests on the knowledge of group understanding, which is a course of joining numerous classifiers to tackle an intricate issue and to improve the exhibition of the model. Rather than relying upon one decision tree, the Random Forest receipts the anticipation from respectively tree and forecast which have larger part of votes will be the last yield. As the quantity of trees builds the precision too increments and keeps it from the over fitting issue.

II. IMPLEMENTED ALGORITHM

The proposed framework comprises of various AI procedures. To assemble prototypical, we take representative dataset which includes all over a significant time span records of the workers, then, at that point we perform information reprocessing Data Pre-processing is the development in which the statistics gets transformed, or encoded, to carry it to such an express that the machine container undoubtedly investigates it. Dataset is divided into two categories, the basic one is train information and second one is test information. The mainstream of the evidence is utilized for making and more unsure portion of data is utilized for testing. The point of preparing is to select a forecast accurately as regularly as could really be expected. The test information is utilized to perceive how well the machine can anticipate new answers and to approve AI model conduct. A short time later, utilizing distinctive AI calculations we have constructed the model. In the wake of building model, client can give the new information to the framework. Moreover, client can pick calculation as per their decision and actually take a look at the outcome. Yield of the framework is in two structures - one is graphical portrayal and other is in polar structure that is 'Yes' or 'No' design. In the wake of assessing result the purpose for the whittling down is additionally given by the framework All paragraphs must be indented. All paragraphs must be justified, i.e. both left-justified and right-justified.

A. Architecture of Algorithm

A calculation dependent on Machine Learning space is created as follows which is represented in Figure [1]. AI strategy is utilized to foresee the representative turnover and to anticipate the danger of a worker leaving. AI (ML) is the investigation of PC calculations that work on consequently through experience. It is viewed as a piece of man-made brainpower. AI calculations fabricate a model dependent on example information, known as "preparing information", to settle on forecasts or choices without being unequivocally customized to do as such.

1) *Data Collection:* The amount and nature of your information direct how precise our model is. The result of this progression is for the most part a portrayal of information which we will use for preparing. Utilizing pre-gathered information, via datasets from Kaggle, UCI, and so on, still squeezes into this progression.
2) *Data Preparation:* Wrangle data information and dataset it in the mood for getting ready. Clean what may require it Randomize data, which kills the effects of the particular solicitation wherein we accumulated or possibly regardless set up our data. Envision data to help with recognizing material associations between components or class unpredictable attributes or perform other exploratory examination. Split into getting ready and evaluation sets.

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3) *Choose a Model*: There are numerous approaches for different errands; select the right one.
4) *Train the Model:* The goal of getting ready is to address a request or make a conjecture precisely as consistently as could truly be anticipated. Direct backslide model: estimation would need to learn values for m (or W) and b (x is input, y is yield). Each accentuation of connection is a readiness step.
5) *Evaluate the Model:* Uses some quantity or mixture of capacities to "portion" target implementation of perfect approach. Test the algorithm against beforehand inconspicuous information. This inobtrusive material is envisioned to be justly descriptive of perfect implementation in reality.

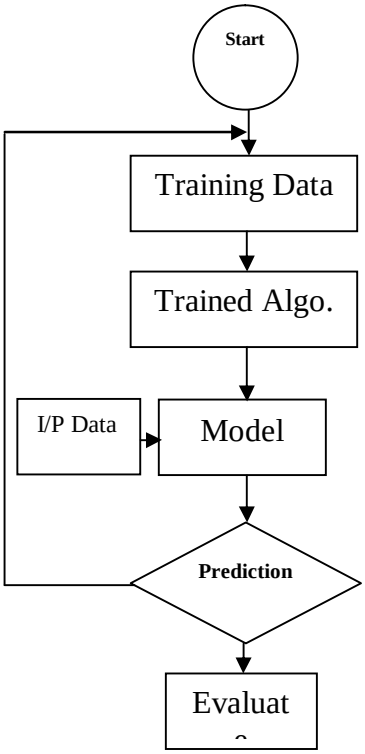


Figure [1] Block Diagram of Algorithm [1]

III.DATA ANALYSIS

Data gathering raises to the collection of relevant data from all available sources to perform analysis. The data used for this employee attrition analysis was obtained from GitHub Website [9]. This data set contains 1500 records and 50 attributes. The categorical values are converted to numeric values in order to make the classification algorithm more effectual. For example, categorical attribute 'Business Travel' contains three values such as Travel-Rarely, Travel Frequently, Non-Travel. Hence it is converted to 1, 2 and 3 respectively

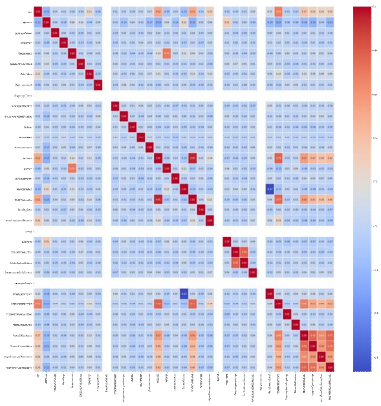


Fig. 1 Correlation Matrix

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A. Some Graphs with Explanation

While concluding the result and analysis, the several graphs generated by the system with respect to attrition:

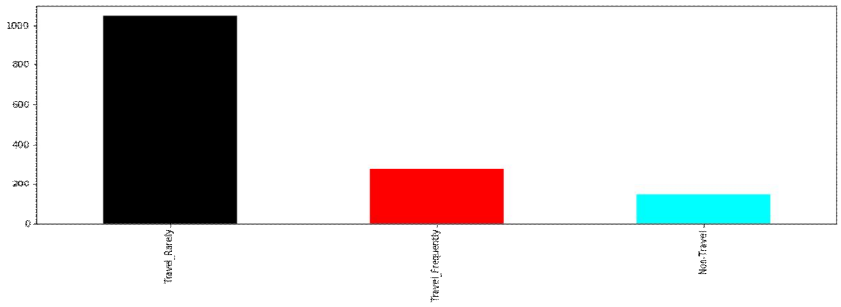


Fig. 3 Business Travel Vs Attrition

Fig. 3 depicts bar graph of evaluation between the Business Travel and respect to Attrition. Proportion of attrition with Travel Hardly is 16%, Travel Frequently is 25 % and Non-Travel is 10.00%. Attrition rate of Travel Frequently is more than other as there are 250 employees who are below the group of Travel Frequently and there remain 60 staffs who are leave-taking the organization. There are 1000 employees who Travel Rarely and out of which only 126 employees are send-off hence the attrition rate is low. For Non-Travel total 150 employees are there and 12 employees are leaving.

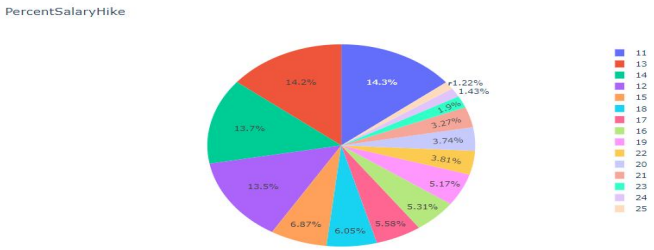


Fig. 4 Monthly Income

Fig. 4 signifies the bar graph of assessment among the monthly income in percentage salary with Attrition. Attrition rate of monthly income is increased.

B. Result and Analysis

For desired results, there are numerous characteristics like department, gender, overtime, business travel, etc. Grounded on these standards, algorithm is developed with the support of dissimilar machine learning algorithms. This algorithm will predict the behaviour of employees who would like to will leave the organization or not. The foretold standards are equated through test values to estimate the correctness of each algorithm. The graph given below in the fig. 5 describes various factors with the help of ROC curve final output, so we can effortlessly achieve which procedure is best for our model. After the graph, we conclude that this algorithm Random Forest gives uppermost accuracy on the HR Employee Attrition dataset whereas Logistic Regression rigidities the lowermost accurateness aimed at the similar dataset.

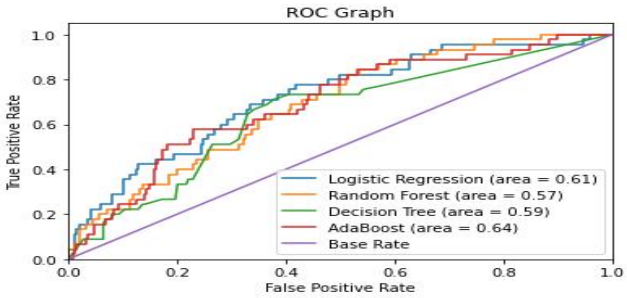


Fig. 5 ROC curve final output

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1) Logistic Regression

```
tab1 = confusion_matrix(pred_value,att1_y_test)
tab1
```

```
array([[176,  90],
       [ 76,  95]], dtype=int64)
```

```
accu = tab1.diagonal().sum() *100 / tab1.sum()
accu
```

```
62.013729977116704
```

2) Decision Tree

```
array([[212,   0],
       [ 40, 185]], dtype=int64)
```

```
tab2.diagonal().sum()*100/tab2.sum()
```

```
90.8466819221968
```

3) Random Forest

```
tab_rf
```

```
array([[231,   0],
       [ 21, 185]], dtype=int64)
```

```
rfc.feature_importances_
```

```
array([0.09116461, 0.01972206, 0.08322913, 0.01709955, 0.07459788,
       0.03287762, 0.03323994, 0.        , 0.0839118 , 0.04255988,
       0.01470773, 0.07439083, 0.03561796, 0.04536333, 0.04501948,
       0.0358541 , 0.0507122 , 0.13928889, 0.08064302])
```

```
accu1 = tab_rf.diagonal().sum() *100 / tab_rf.sum()
accu1
```

```
95.19450800915332
```

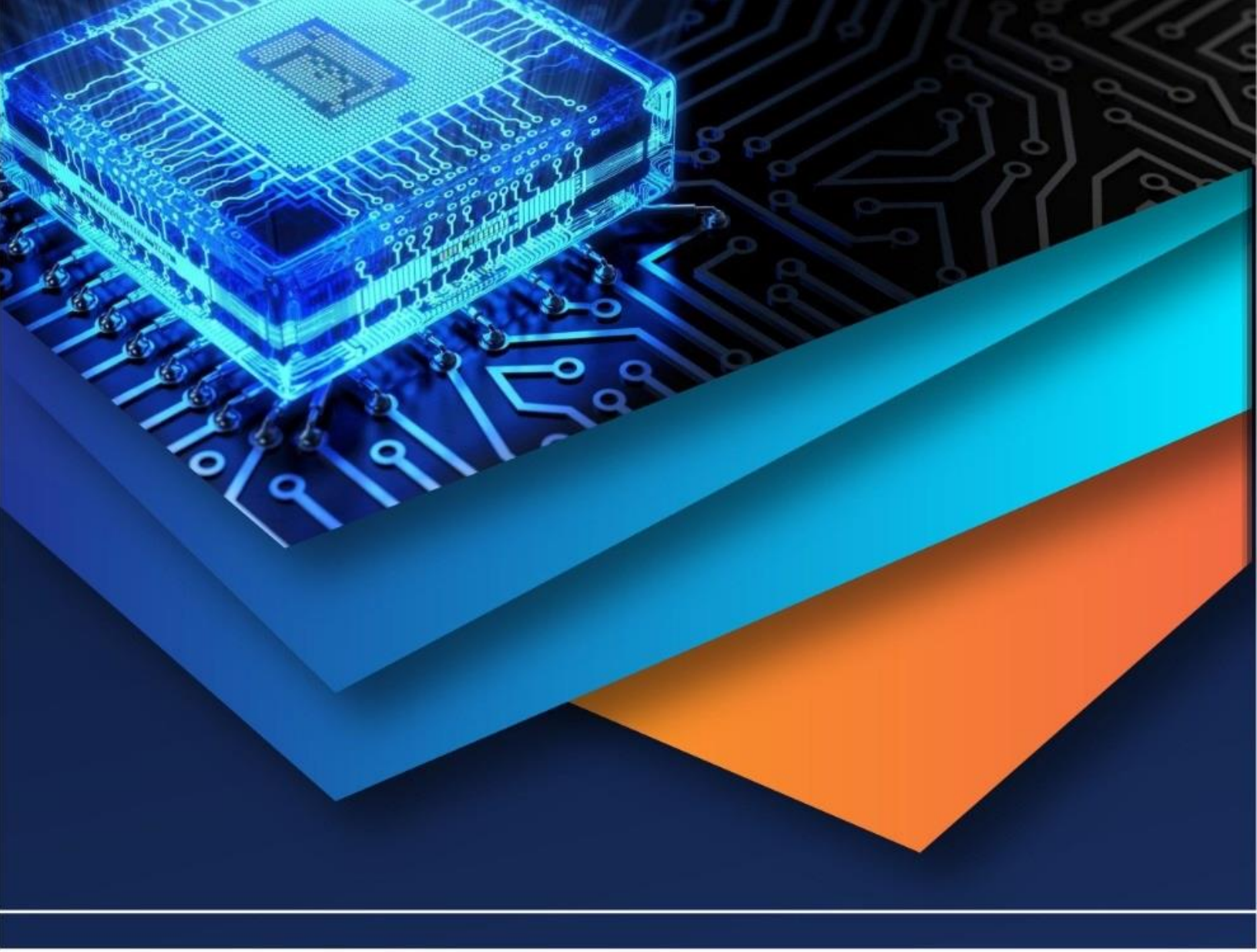
IV. CONCLUSIONS

On the basis of this result paper, algorithm for machine learning is performed precisely with desired results which predict or forecast the employees or workers behaviour who are interested to close the particular company or organization. Result showed that selected algorithm for predicting attrition performs accurately and more closely to desired outputs than any other algorithm. It is detected that; the reason of worker attrition is due to both external and internal factors. This study give strength help association for expressing the factors of employee attrition and can yield suitable stages to diminish the attrition rate.

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TECHNICAL INVESTIGATION BY USING GIS FOR FLOOD CONDITION ARISEN IN UPPER KRISHNA BASIN, MAHARASHTRA, INDIA.

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Abstract - The present paper attempts to analyse causes of floods occurred in recent years in upper Krishna basin of southern Maharashtra. Flood situation has become disastrous during recent years mainly part of July and early August in upper Krishna basin. It is also important to note that floods are serious phenomena by human and natural activities. About 27.72%of the geographical area of the upper Krishna basin of southern Maharashtra is affected by floods of which about 2.12% of total population of Upper Krishna basin has suffered in 2006. Since, the floods of rivers are responses of both natural and anthropogenic factors, the relative effects and causes vary from place to place. To analyse the causes of flood situation in the region under study, the statistical data and concerned information have been collected through personal visits and records available at Tehsil headquarters of Sangli, Kolhapur and Satara districts.

***Key Words*:** Flood, Catchment, Rainfall, Runoff, Infiltration, Groundwater.

1.INTRODUCTION

Design flood is the discharge adopted for the design of a hydraulic structure and it is obviously very costly to design any hydraulic structure so as to make it safe against the maximum flood possible in the catchment. During the months of July & August 2019, Sangli & Kolhapur districts in Krishna sub basin experienced extreme floods for long durations. Heavy losses to life, property & crops etc. had been reported. Different opinions at various levels were put forth concerning these flood events. Sangli & Kolhapur districts faced heavy flood situations in past also & floods of 2005 & 2006 were noteworthy. However, 2019 flood event was comparatively much more severe which lasted more than a week & losses experienced were also on higher scale. The floods of rivers are the responses of both natural and anthropogenic factors. The causes of floods of alluvial rivers are highly complex and their relative importance changes from place to place. The present paper aims to find on the probable causes of flood situation in upper Krishna Basin of Maharashtra.

2. OBJECTIVES OF STUDY

1. To carry out in-depth technical analysis using modern techniques and investigate causes of flood situation occurred in upper Krishna basin.
2. To specifically clarify based on hydrological studies, whether any downstream dam reservoirs (back water effect) from, create flood situation in Maharashtra.

3. METHODOLOGY

In order to accomplish the objectives of the study, various spatial and non-spatial (historic as well as contemporary) data were used. This section deals with the collection, processing, and analysis of the different datasets used in the present project. Required data and information have been collected from various sources. The vast statistical data and

concerned information have been collected through personal visits to tehsil headquarters of Sangli, Kolhapur and Satara districts. Number of affected villages have been visited to have discussion with the affected people and Government officers. The secondary data have been taken from socio-economic reviews and district statistical abstracts, census handbook and district gazetteer of Satara, Sangli and Kolhapur districts. Various articles published on flood situation in daily newspapers, journals, magazines, S.O.I. toposheets and reference books were also referred. To find out causes of floods in upper Krishna Basin, the relative information regarding the rainfall, area under irrigation, bridges on Krishna and other rivers, statistical information about flood affected area, population and other aspects were collected through primary and secondary sources of data.

4. STUDY AREA

Krishna River is the second largest river in Peninsular India. It originates in the Mahadev range of the Western Ghats near Mahabaleshwar, at an altitude of 1337 m above msl (13°.7‟/N to 19°20 „/N and 73° 22‟/E to 81°10‟/E) and flows through Maharashtra, Karnataka, Andhra Pradesh and drops into the Bay of Bengal in Andhra Pradesh state. Krishna Basin is having a total area of 2.59 Lakh sq. km, which is nearly 8% of the total geographical area of the country. The total length of river is about 1400 km. The basin is roughly triangular in shape and is bounded by Balaghat range on the north, by the Eastern Ghats on the south and the east by the Western Ghats on the west. Map of Krishna Basin of India is shown in Annexure “maps” (Map No.1) Krishna Godavari Commission had divided entire Krishna basin into 12 sub divisions & they are designated as K1 to K12 spread in all states i.e., Maharashtra, Karnataka & Andhra Pradesh (now divided into Andhra & Telangana). 5 basins K1, K2, K3, K5 & K6 are spread in Maharashtra state.

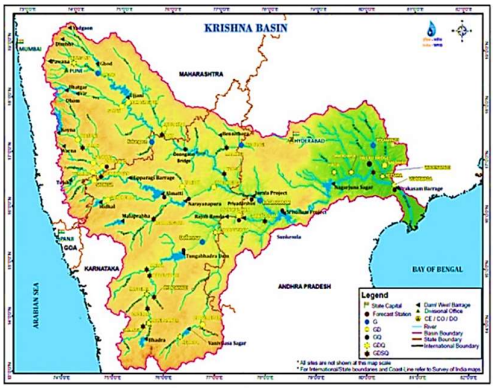


Fig -1: Index map of Krishna Basin

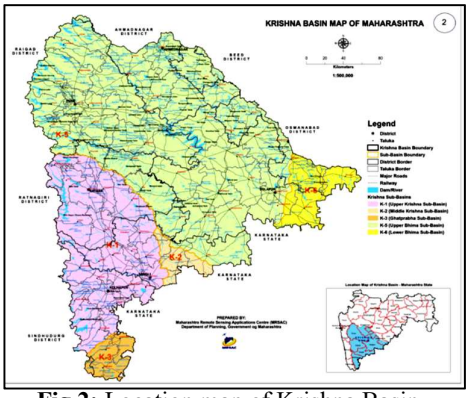


Fig 2: Location map of Krishna Basin

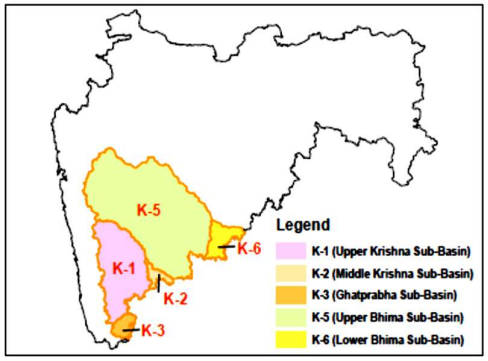


Fig 3: Index map of Krishna Basin Maharashtra in Maharashtra

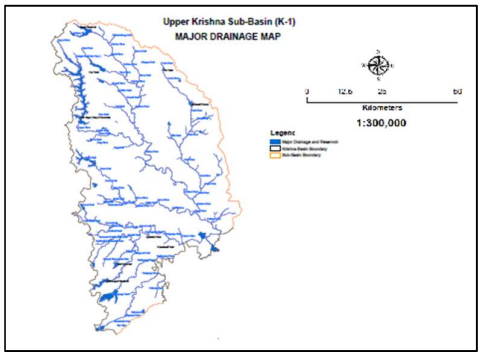


Fig 4: Major Drainage map of Krishna Basin

5. STATUS AND VULNERABILITY OF WATER RESOURCES SECTOR IN MAHARASHTRA DUE TO CLIMATE CHANGE

Out of 6 river basin systems, only 55% of the dependable yield is available in the four river basins (Godavari, Krishna, Tapi and Narmada) east of the Western ghats. The rest drains out in the westward flowing river basins into the Arabian Sea. Over dependency on ground water in a state where its recharge capacity is low, escalates vulnerability of systems dependent on the same such as irrigated agriculture, industries and drinking water. Maharashtra is prone to drought and floods. Out of the total geographical area of Maharashtra, 40% of the area is drought prone and 7% is flood prone. Rainfall trends indicate that Maharashtra could face an increase in rainfall variability, including droughts and dry spells, as well as increased likelihood of flooding in the future. This has direct bearing on ground water as heavy intensity rainfall gets lost as runoff while low intensity rainfall which contributes to recharge decreases in frequency. Climate change vulnerability assessments are necessary for designing targeted adaptation actions. The vulnerability analysis was carried out for different sectors at various levels of governance, on the basis of Macro Level Vulnerability Indices, estimated using the Indices of Exposure, Sensitivity and adoptive capacities to climate changes. This was done by the Department of Environment, Government of Maharashtra while preparing the Maharashtra State Action Plan on Climate Change in 2014. The Action Plan has also presented climate projections for future at 25km x 25 km resolution using the Hadley Centre regional climate model. Some of the projected changes in climate over Maharashtra are:

• Increase in mean temperature from 1.2 to 1.6 degree centigrade in 2030s.
• Rainfall is also projected to increase during the same period, with more rainfall projected as we progress from 2030 to 2050 to 2070 but it will be highly variable spatially.
• Annual rainfall shows highest increasing trend for Satara, Mumbai, Kolhapur and Sindhudurg and highest decreasing trend for Bhandara and Latur in 2030s.
• Extreme rainfall events with longer dry spells are projected to increase in all districts of Maharashtra.
• Numbers of dry days are likely to increase by minimum 3 to maximum 9 days in the state by 2030s.
• The sea level is expected to increase by 24 cm to 66 cm along the coastline in sync with the projections for global sea level rise, accompanied by an increase in wave heights, wind speeds, greater storminess and storm surges.

6. ABOUT THE EVENTS

During the year 2019, eight cyclonic storms were developed over Indian Seas. Arabian Sea contributed 5 out of these 8 cyclones against the normal of 1 per year, which equals the previous record of 1902 for the highest frequency of cyclones over the Arabian Sea. Out of 5 cyclones developed over Arabian Sea 2 were very severe, one was extremely severed and one was super cyclonic storm. Active spell of South West monsoon started from 27thJuly, 2019 and before it is fully dissipated; low pressure area was formed on the Bay of Bengal, which intensified into deep depression on 7th August. During the first spell catchment was fully saturated. Hence, during second spell almost all the rainfall converted into runoff causing severe inundation. During South-West Monsoon season over the country, rainfall over Maharashtra shows significant spatial and temporal variability. The state experiences extremes of rainfall ranging from 6000 mm over the Ghats to less than 600 mm in the interiors. Western coast of Maharashtra, the Konkan belt is often prone to heavy to very rainfall during active monsoon conditions due to favorable orography. The Western Ghats act as obstruction to the eastward-moving Monsoon cloud forcing it to rise ultimately leading to the heavy downpour on the windward side, while the leeward side forms the rain shadow area receiving less rainfall. Climatological records of the Satara, Sangli and Kolhapur districts indicate that, there is a large variation in space of rainfall. The western portions of these districts adjoining the Western Ghats and neighborhood get very high rainfall while near the eastern borders of the districts, receive very less rainfall

7. RAINFALL PATTERN

Rainfall data indicates that Konkan and adjoining Madhya Maharashtra experienced very heavy rainfall. In the beginning of the flood period i.e., from 27th Jul to 3rd Aug, the heavy rainfall events were localized in the northern part of the Konkan and adjoining North Madhya Maharashtra. Many stations in Pune and Nasik districts, recorded rainfall more than 150 mm/day during the period 3rd to 5th Aug. Towards the latter part of the week, rainfall belt shifted towards south Madhya Maharashtra. Mahabaleshwar recorded highest rainfall of 380 mm on 5th Aug. 2019. It is also observed that Kolhapur district continuously experienced heavy rainfall throughout the period with highest rainfall amounts on 6th Aug. 2019. Gaganbawda recorded its highest rainfall of 340 mm rainfall on 6th Aug. It is also seen that though heavy rainfall occurred in the western part of the districts in Madhya Maharashtra, their eastern parts were devoid of rainfall. It is further seen that during the heavy rain spell of Aug. 2019, many stations in Kolhapur district and western part of Satara district have crossed their previous record of 7 days rainfall. This indicates that compared to previous years, rainfall over the region was widespread and remained very intense for a long period during 27th July to 13th August 2019. Sangli, Kolhapur and Satara district received very heavy rainfall of 1918 mm in comparison to 333 mm normal rainfall during 27th July to 13th August. This was about 6 times the normal and at the same time, in the free catchment, downstream of the dams, it was about 18 times the normal. Such high range of continued rainfall in short duration resulted in extreme heavy flooding mainly in Sangli, Kolhapur town and few talukas situated near Krishna and Panchganga rivers. It is observed that, the Flood affected districts of Satara, Sangli and Kolhapur continuously received excess to large excess rainfall during the first fortnight of August. It was seen that the observed actual rainfall in various catchments to the upstream of dams varies from 5 to 19 times the normal. Average actual rainfall was about 6 times the normal rainfall in all these catchments bringing abnormal flood to downstream areas. The actual rainfall during the first 56 days of the monsoon (starting from 1st June 2019) was measured at 6 rain gauge stations, situated in the free catchments of these three districts. It is observed that the total rainfall during the peak period of 18 days (27th July to 13thAugust) measured at the same stations, was about 1.6 times the total rainfall during the previous 56 days (1st June to 26th July). Also, the actual rainfall during the event in free catchments was varied from 13 to 29 times the normal rainfall. The overall observed rainfall over the normal was about 18 times. Such abnormal high occurrence of rainfall even in free catchments also aggravated floods in Sangli & Kolhapur districts.

8. ANALYSIS & REASONS

To carry out in-depth technical analysis using modern techniques and investigate causes of flood situation occurred in Krishna basin

The flood disasters occurred during the monsoon of the year 2019, along river Krishna was primarily due to:

a) Persistent and simultaneous occurrence over large spatial areas, of heavy precipitation in short duration. Climatological records of the Satara, Sangli and Kolhapur districts indicate that, there is a large variation in space of rainfall. The rainfall in the belt, roughly 25 to 35 kms wide parallel to the crest of the Sahyadri Range, is considerably higher than in the rest of the district. While Mahabaleshwar at an elevation of 1372 metres gets an average annual rainfall of 5886.9 mm, other stations in this belt get annual rainfall ranging between 1684 and 2195 mm. Compared to Kolhapur and Satara, district of Sangli has relatively lesser average annual rainfall of about 670mm. The persistent intense rainfall activity over the region was in association with an active spell of monsoon started over Maharashtra from 27th July 2019 and resulted in flooding in many parts of Konkan and North Madhya Maharashtra. This was followed by another active monsoon spell from 3rd August 2019, in association with the formation of a low pressure over North East Bay of

Bengal and its subsequent intensification into deep depression and westward movement in the subsequent days causing severe flood conditions in South Madhya Maharashtra. This movement of deep depression system (an active low-pressure system with wind speed ranging between 52 to 61 kmph) across central India, resulted in enhancement of rainfall over west coast and in the ghat areas of Madhya Maharashtra with heavy to very heavy rainfall and extremely heavy rainfall events for more than a week period over these places, resulting in severe flood situations. Maharashtra State has an average annual precipitation of about 741mm.The rainfall in the state is controlled by south west and north east monsoon. About 90% of rainfall occurs during monsoon months from June to October, every year. The high intensity storms prevailing during the monsoon months result in heavy discharges in all the rivers. The continuous and heavy precipitation that occurs in the steep and undulating terrain, finds its way into the main rivers through innumerable streams and water courses. Flood event 2019 in Krishna basin is an example. Basin experienced an abnormally very high rainfall between 25th July to 13th August, resulting in severe flood in Sangli, Kolhapur, Satara districts. Average actual rainfall was about 6 times the normal rainfall in all dam catchments bringing abnormal flood to downstream areas. The overall observed rainfall over the normal was about 18times. Such abnormal high occurrence of rainfall even in free catchments also aggravated floods in Sangli & Kolhapur districts. It can be seen that the contribution of free catchment, in the discharge observed in river Krishna, at Irwin Bridge at Sangli, was 49%. Similarly, the contribution of free catchment, in the discharge observed at Rajaram weir on river Panchganga, was 84%. The discharge from free catchment, which was substantial and had no control.

b) Typical Topographical features and river meandering

By study of topographical features of the Krishna sub-basin including its tributaries in Maharashtra, it was found that the River Krishna originates at the highest altitude of 1310 m at Mahabaleshwar, and also the Koyna at the same place, they reach at Pritisangam, the confluence of Krishna and Koyna at Karad at the altitude of about 550 m. thereafter, there is sudden change in the river bed slopes in the Krishna River upto Sangli. While negotiating the Sangli city, the rivers Yerala and River Warna meets Krishna and thereafter within few kilometers there is confluence of River Panchganga leading Krishna to state border. The Krishna River reach from Sangli city to state border is only 30-40 kms long, having very flatter bed slopes and many meanders. This, typical topographical set-up plays major role in slowing down the flood dissipation beyond Sangli city. It was found that, in this reach of river, while there is drastic reduction in the velocities of the flow, the backwater effects of various confluences of its own tributaries further aggravate the problem. While the floods in main Krishna River are yet to dissipate this particular reach, the floods coming from tributaries by simultaneous raining cannot even enter in the main river course of Krishna. The situation was further aggravated as these tributaries could not drain out their own discharge, when river Krishna was already flooded, which was spread on the side banks of the tributaries. This peculiar situation resulted in long term inundation alongside the flood plains of tributaries like Warna and Panchganga, while increasing the backwater effect near confluences resulting in the higher flood levels at Sangli, Kurundwad and Kolhapur cities. The problem is further aggravated by the meanders in the same reach, because of which very large flood plains are created, submerging huge areas with almost stagnant waters for prolonged periods. During this time, the flood water even tends to create shortcuts, bypassing the meanders straight into the next stretch of the Krishna River, as an effort to dissipate the floods early.

c) Large Encroachments in Flood Plains and Reduction in flood discharge capacities of the rivers, due to many Structures built across Rivers

Due to the heavy developments around the river stretches and in city areas, there have been large encroachments, of building constructions, retaining walls, roads etc. in prohibited and restricted flood plains/zones and also in the natural drainage system. At many places, the debris in huge quantum is thrown in the river courses (or its tributaries), reclamation of lands, leveling of plots have been done, thus choking the waterways of natural drains. Many huge structures like Bridges, Barrages, weirs have been built across

the main Rivers, in very unscientific way, which obstruct the flood discharges at every such location, thereby creating an afflux and reduction in the velocities. The cumulative effect of all such structures may be in increasing the flood levels and stagnation of water for prolonged period.

d) Sedimentation in main rivers – at confluences, along meanders

Due to sudden changes in the river bed slopes and stagnation of floods for prolonged periods, sedimentation occurs in the river courses and also in natural drainages. This results in raising the river bed levels, thereby raising the flood levels and extended inundation areas. At the meanders, the sedimentation occurs in the inner side of the curves, thus deflecting the floods further to the outer sides.

e) Absence of flood absorption capacities in reservoir planning of existing dams

At the time of project planning, the reservoirs are never planned with the provision of special cushion for flood absorption neither in consideration of river regime in downstream. The dead storage is designed to accommodate the silts and live storages are planned for complete utilization of the water stored for the objectives planned throughout the year. The Reservoir Operation Schedules are designed to assure for full storages by the end of the monsoon period to fulfill these objectives. With this background and keeping in mind the historic drought prone area, the dams are not designed for the flood mitigation too. For ungated spillways or dams having fully automated gates, there is no manual control to moderate the incoming floods. However, considering all these facts, and after reviewing the reservoir operations of all the major dams during the flood event, it can be concluded that, having many constraints and in such a severe situation, the dam operators of Maharashtra tried to mitigate the flood in proper way, by keeping the outflow from the spills on lower scale.

9. ANALYSIS

To specifically clarify based on hydrological studies, whether due to any other reservoirs (back water effect) from Karnataka, create flood situation in Maharashtra.

One dimensional unsteady flow analysis, of the River Krishna from Karad to Almatti, along with its three tributaries in the State of Maharashtra viz. Yerala, Warna and Panchganga, has been done using Version 5.0 of the HEC-RAS software. Analysis has been done for the period of 25th July, 2019, 8.0 am too 17th August, 2019, 8.0 am. Steady state analysis for PMF condition was also done.

The important conclusions of this hydrodynamic analysis are:

a) Although this mathematical model study, has certain limitations, the study indicates that Almatti and Hippargi reservoirs in Karnataka and its flood operations, during the Flood Event of 2019, has not adversely affected the flood situation in the State of Maharashtra.

b) The discharge carrying capacity of the river Krishna was inadequate to accommodate the releases of Koyna dam, the contribution of tributaries and the runoff of the free catchment

c) The river Krishna flows, a near plain land, between Sangli and the State border. It is a general phenomenon that the river takes meandering course, while traversing on a plain land. Thus, River Krishna has so many curves and meanders. The velocity of the river is comparatively less while traversing curves and meanders, causing thereby more inundation on inner as well as outer sides of the curves and meanders as compared to straight reaches of the river. The Sangli city is on one of the curves of River Krishna and Kolhapur city is on the curve of river Panchganga

d) Flow stagnation in River Krishna from Sangli city to the State border, due to confluence effect. There exists series of confluences, Yerala-Krishna, Warna Krishna, Panchganga-Krishna and Dudhganga-Krishna within a reach of about 50 to 55 km length. At confluence points due to formation of stagnation zone velocity is reduced.

e) Generation of backwater effect in the tributaries and nallas meeting the River Krishna. Due to comparatively higher discharge in the River Krishna, the backwater effect is generated in the tributaries. The flooding in tributaries viz. Yerala, Warna, Panchganga and

other nallas like Bhilwadi, Nagthane was primarily due to backwater effect of the river Krishna. The situation was further aggravated, as these tributaries could not drain out their own discharge, till the flood in the river Krishna was receded. Water was spread on the side banks of the tributaries due to pounding effect. The river Krishna was flooded for a long duration from 5th August up to 13th of August. Consequently, the backwater spread in the tributaries and on floodplains could not return back to the river course. Thus, the floodplains were under water for a prolonged time.

f) The lateral slope of the flood plains is very gentle. The flood plains are almost flat. This has resulted into spreading of flood on larger area on both the banks of the river

10. CONCLUSION

Basin experienced an abnormally very high rainfall between 25th July to 13th August, resulting in severe flood in Sangli, Kolhapur, Satara districts. Average actual rainfall was about 6 times the normal rainfall in all dam catchments bringing abnormal flood to downstream areas. The overall observed rainfall over the normal was about 18times. Such abnormal high occurrence of rainfall even in free catchments also aggravated floods in Sangli & Kolhapur districts. Although this study based on mathematical model, has certain limitations, the study indicates that Almatti and Hippargi reservoirs in Karnataka and its flood operations, during the Flood Event of 2019, has not adversely affected the flood situation in the State of Maharashtra. Generation of backwater effect in the tributaries and nallas meeting the River Krishna. Due to comparatively higher discharge in the River Krishna, the backwater effect is generated in the tributaries. The river Krishna was flooded for a long duration from 5th August up to 13th of August. Consequently, the backwater spread in the tributaries and on floodplains could not return back to the river course. Thus, the floodplains were under water for a prolonged time.

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Seismic Analysis of High Rise Building Using Outriggers and Belt- Truss System

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Abstract –

Tall building development has been hastily growing international introducing new demanding situations that want to be met thru engineering judgment. In cutting-edge tall buildings, lateral loads induced by wind or earthquake are regularly resisted with the aid of using a machine of coupled shear walls. But while the constructing will increase in height, the stiffness of the shape will become extra crucial and creation of outrigger beams among the shear walls and outside columns is regularly used to offer enough lateral stiffness to the structure. A variety of various techniques has been hired to pick out the premier places of those outrigger beams under wind load. However, there may be a scarcity of clinical studies or case research coping with premier outrigger region beneathneath earthquake hundreds. This have a look at objectives to pick out the premier outrigger region in tall homes beneathneath earthquake hundreds. A 25 storey constructing changed into investigated and 3 extraordinary top floor acceleration to top floor speed ratios in every class of earthquake data have been included on this studies have a look at to offer a constant stage of approach. Response spectrum evaluation changed into performed and the behaviour of the constructing changed into decided thinking about reaction parameters along with lateral displacement and inter storey drift

1. INTRODUCTION

In standard the edifice of large constructing is developing swiftly across the world, elevating new problems that require being deal with the use of a variety of architectural/structural engineering techniques. The related shear wall structures withstand the lateral seismic hundreds of cutting-edge skyscrapers. However, because the peak of the constructing increases, the tension of the shape will become extra and further important. In common, earthquakes be capable of occur everywhere withinside the world, apart from due to the fact greater human beings stay in skyscrapers, unique interest have to be paid to the dangers related to skyscrapers, mainly beneathneath extreme seismic pressure. When with a outrigger structural device in a high-upward thrust edifice, the cantilever should be positioned withinside the excellent in all likelihood vicinity to create the shape stronger. The outrigger is the bounds that join the outside help to the primary middle partition of the skyscraper and gets lateral forces past the primary shape. Most ships use wood outriggers to counter the wind pressure of the sails. The middle of a tall shape may be likened to a deliver's mast, with outriggers performing as spreaders & outer pillars performing as deliver envelopes. The help enterprise can take in the lateral forces resulting from the earthquake & switch the burden to the inspiration through outside supports. Outriggertrusses in wall frames are one of the maximum green and cost-powerful systems in skyscrapers, with outer columns regarding the outer finishing as a bottom. Cantilever beams (outriggers) are used to govern the overturning second of the middle and switch the instant from the middle to the outer column via way of means of connecting the two. When a horizontal load is carried out to the shape, the partitions and cantilever trusses rotate, inflicting compression at the leeward columns and anxiety at the leeward columns. The cantilever brace is placed at the outer circumference and is hooked up to the inspiration through the outer help and is known as a belt trusses. The outrigger braces related among the centre & the outer column acts as a inflexible beam that falls beneathneath the transferring of the lateral load. The belt binder connects the outer peripheral column of the shape and affords a superb deal large circumference to set the aspect deflection of the layout deduction. This inexperienced structural form connects persuasive facilities and growth conflict to the outward column. The primary located primary targeted on every aspect and middle extending at the aspect of the configuration is detected.

METHODOLOGY

Following method are using for proposed work,

a. Collection of relvant research data from national internal journal, books web source etc.

b. software validation

c. Preparation of different models of structure which will be analyze

d. Result and Discussion

e. Conclusion

2. LITERATURE REVIEW

Sameer Chambulwar, Tejas S kadam 2021 [1]

Author are studied the RCC body shape irrespective of the outrigger and belt truss machine. According to him, the outrigger machine prevents it and consequently rotates to lessen strong float. Outrigger and belt's truss scheme is a inflexible machine, however the base component layout is wanted to be so strong. Outrigger ensures greater stiffness than decreasing records float throughout the earthquake. This association gives a predecessor as it takes a predecessor of the tip, however you want to find-out the location of the deployment of this scheme.

B. G. Kavyashree, Shantharam Patil & Vidya S. Rao (2021)[2]

Tries to mention improvement of outrigger structural device from traditional outrigger to damped outrigger. They try to spotlight the reimbursement of outrigger shape via semi energetic control & presentation improvement of outrigger device a few of the powerful strategy.

Pankaj Sharma and Gurpreet Singh (2018) [3]

Researchers had ended dynamic examination on 60 storey structure among outrigger also belt truss structure. This edifice tallness is 180m. They place outrigger according to Taranth Theory. According to them outrigger is horizontal associate which is linked to center core also allied to belt-truss.

Dilrukshie I. Samarakkody (2017) [4]

Researchers had ended dynamic exam on 60 storey shape amongst outrigger additionally belt truss shape. This edifice tallness is 180m. They area outrigger in keeping with Taranth Theory. According to them outrigger is horizontal partner that's connected to middle middle additionally allied to belt-truss.

Errol Dsouza and Dileep Kumar U (2017) [5]

Researchers studied G + forty four tale constructing are inspect outrigger & truss systems (OBS) in earthquakes and the way they must react. In this observe, we followed a linear evaluation approach and used the information of the EICentro earthquake as input. This observe considers outrigger. One is product of concrete and the alternative is product of metallic. After evaluation, they said that concrete cantilever outperforms metallic cantilever.

Chetan Patel Y.G.& Kiran Kuldeep K. N. (2017) [6]

Author is studied 96m peak of the constructing length 49.5mX 49.5m. For research they give 'X' form outrigger & entire evaluation. After evaluation they informed apability of lateral load transport & stiffness of shape boom after offer outrigger. Also they meant outrigger with belt-truss supplied shape is extra valuable than without a outrigger in addition to belt truss supplied constitution.

Goman W. M. Ho (2016) [7]

The potency of the structure depends on the lateral stiffness and resistance. in line with him, the cantilever and belt traverse system is used as a damper. The cantilever' encompassing structure converts lateral forces into compression (compression) and tension (tension), leading to hyperbolic rigidity. Therefore, the cantilever needed reverse and repetitive loads. He additionally shared the way to truly deploy this system.

Dennis C. K. Poon & Ling-en Hsiao (2012) [8]

Author has conducted a performance analysis of the city industrial building when construction. The building is 438m high and has eighty eight floors. The building has cantilever and belt truss systems. This building has five belt trusses. The paper introduces the performance evaluation of this building after the earthquake.

AbbasHaghollahi, Mohsen B. Ferdous and Mehdi kasiri (2012) [9]

They tries to beast location for stabiliser additionally belt truss system provide. They conceive for analysis twenty & twenty five structure building. to seek out out beast setting functions the uses non linear time history and response spectroscopic analysis method.

Willford and R. J. Smith (2008) [10]

They consider sixty storey 2 towers in Manila for study. For this study they consider lateral and every one kind of load subjected on building. For analysis they believe non linear time history analysis. They terminated over turning moment reduced even forces applied is a lot of by organized design.

N. Hearth, N Haritos, T Ngo and P. Mendis (2009) [11]

Researchers tries to find optimum location of outrigger in high building subjected to seismal loading. For this study they contemplate fifty storeys RCC structure made in consistent grade of concrete. For analysis work administrated exploitation response spectrum method.

For analysis they place stabiliser beam in numerous position. once Study they assert best location of outrigger is 0.44 to 0.48 height of building.

Jianguo Nie and Ran Ding (2013) [12]

They need done experimental study on outrigger & belt truss system. For this learn 'k' vogue steel outrigger system worn. He terminated after used this method load carrying capability and stiffness of structure increased.

3. CONCLUSIONS

1) The outrigger and belt truss system is best solution for reducing lateral load such as lateral displacement, storey drift, base shearon high rise building.

2) Analysis done G+25 storey structure and provided X type bracing, inv V type bracing and V type bracing and check which bracing gives best result.

3) Which type of breacing reduce amount of lateral load compare to other breasing.

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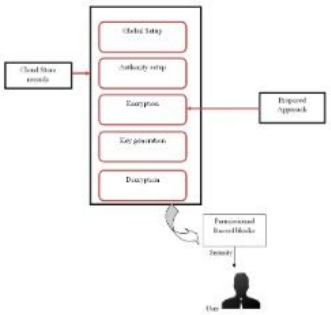
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Securing IoT system Access Control using Blockchain-Based Approach

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Keywords: IoT, cloud computing, blockchain, access control

ANNOUNCEMENTS

Information for Authors

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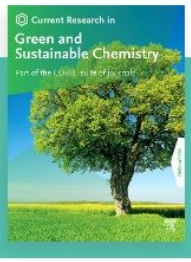
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Life Cycle Cost Analysis of Green & Conventional Building based on Rain Water Harvesting

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Abstract - *We live in a modern, consumerist and largely urban world consuming more energy and resources than we can replenish. Increasing global population, urbanization, rising income level and the resultant increase in consumption has resulted in unprecedented environmental damage shifting the global focus towards sustainable development. Green building can effectively solve the problem of resource shortage; however, the Green Buildings in India is very slow because of its higher cost, compared with conventional Buildings. In this paper, I analyze the construction and life cycle cost of Conventional building and Green Building based on Life-Cycle Cost Analysis Method. Objective of this study is to find out the cost of Energy savings and Water savings in Green Building over Conventional Building. Also this study gives Cost-Benefits Green Buildings. A comparative analysis between a Green Building and Conventional Building is adopted for this study. From previous literature review, the analysis shows that the construction cost of Green industrial manufacturing building is about 2-12 % higher than that of a Conventional building. However, operation, maintenance and end life cycle costs are in the range of 35 to 41 %, 26 to 30%, and 6 to 18 % respectively. It is expected that the outcome of this research would contribute to the organizational learning of Green built environment and there by uplift the use of sustainable construction in India.*

Key Words: Green Building, Green Materials, sustainable Energy, Green rating system in India, cost- Benefit analysis, Life cycle cost, and Life cycle cost Analysis.

1. INTRODUCTION

Building facility has been a human need for some activities platform such as social, economic and environmental. In the other hand, building construction has both positive and negative impacts that there are not only on construction phase but also on operational and maintenance phase. The building projects have cost associated with land, designing and planning, execution and operational, maintenance, which extend over its lifetime. Cost of operations and maintenance is intimately linked to the technology and materials chosen for construction. This is especially true for fully air-conditioned buildings that require continuous energy use over its life cycle. It is generally belief that the construction cost of a green building will be much more than conventional building, but some middle way is required to be found out how the cost of lifecycle is usually less than the cost of conventional building by analyzing the real situation and condition in the construction and operational phase throughout the green building. Green building thought in broader terms is a building which is planned, built, operated, maintained or reused with objectives to defend inhabitant health, improve employee efficiency, use wisely natural resources and reduce the environmental impact. Green construction or sustainable building which complements the building plan with concerns of economy, utility, durability and comfort. In other words, the green building procedure incorporates environmental considerations into every phase of the building structure. This process focuses on the design, construction, process and maintenance phases and takes into account the lot design and development effectiveness, energy and water effectiveness, resource efficiency, indoor environmental excellence, building-owner maintenance and the building 's overall impact on the environment. A Green Building is one which utilizes fewer water, optimizes energy efficiency, conserves natural resources, generates less waste and provides healthier space for occupants as compared to conventional buildings.

1.1 Green Building Concept

A green building is one, which uses less water, optimizes energy efficiency, conserves natural resources, generates less waste and provides healthier spaces for occupants, as compared to a conventional building. It is also known as a sustainable or 'high performance' building. It brings together a vast array of practices, techniques, and skills to reduce and ultimately eliminate the impact of buildings on the environment and human health. It often emphasizes taking advantage of renewable resources, e.g. using sunlight through passive solar, active solar and photovoltaic equipment, and using plants and trees through green roofs, rain gardens, and reduction of rainwater runoff. In general, costs of green buildings can be divided into two categories: pre-construction costs and post construction costs. Pre-construction costs include soft costs and hard costs. Soft costs are the costs related to design, commissioning, and documentation fees. Hard costs are construction, materials, and building services costs.

Post-construction costs are building operating costs of energy consumption, water use, maintenance, and management. Benefits though, include differing savings and financial gains during building construction and post

construction phases such as higher property market value, higher rents, fewer vacancies, and marketing opportunities resulting from social benefits, lower carbon taxes, higher energy savings, less sick leave, and higher productivity. From the literature survey, Conventional buildings worldwide consumes-

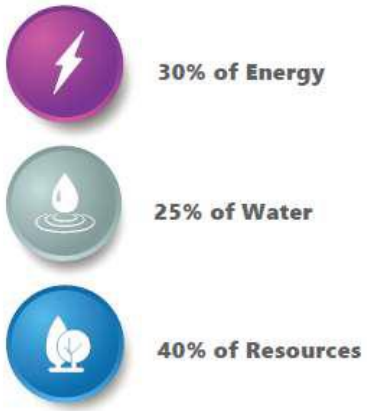


Fig. 1 Conventional building's Worldwide Consumes. And Conventional Buildings Worldwide Produces-



Fig. 2 Conventional building's Worldwide Generates.

1.2 Life Cycle Cost Analysis

LCCA is a process of evaluating the economic performance of a building over its entire life. Sometimes known as "whole cost accounting" or "total cost of ownership," LCCA balances initial monetary investment with the long-term expense of owning and operating the building. The purpose of an LCCA is to estimate the overall cost of the project alternatives and to select the design that ensures the facility will provide the lowest overall cost of ownership consistent with its quality and function. The LCCA should be performed early in the design process while there is still a chance to refine the design to ensure a reduction in life cycle costs [LCC]. The costs associated with LCCA are the initial cost of construction, energy and water cost, operation cost, maintenance cost, repair cost replacement costs and residual costs.

1.3 Rain water Harvesting

For our water requirement we entirely depend upon rivers, lakes and ground water. However, rain is the ultimate source that feeds all these sources. Rain water harvesting means to make optimum use of rain water at the place where it falls i.e. conserve it and not allow draining away to cause floods elsewhere. The rain water harvesting may be defined as the technique of collection and storage of rain water at surface or in sub-surface aquifer before it is lost as surface run off. The augmented resources can be harvested whenever needed.

Advantages of rain water harvesting:

- Promotes adequacy of underground water
- Mitigates the effect of drought
- Reduces soil erosion as surface run-off is reduced
- Decreases load on storm water disposal system
- Reduces flood hazards
- Improves ground water quality / decreases salinity (by dilution)
- Prevents ingress of sea water in subsurface aquifers in coastal areas
- Improves ground water table, thus saving energy (to lift water)
- The cost of recharging subsurface aquifer is lower than surface reservoirs
- The subsurface aquifer also serves as storage and distribution system
- No land is wasted for storage purpose and no population displacement is involved
- Storing water underground is environment friendly

2. METHODOLOGY

A comparative analysis between green building and conventional building is to be adopted for this study. The study is going to be carried out to an existing G+1 story residential building. It is constructed as per the conventional ways using all old non-green materials. It does not use any energy efficient methods to improve its performance. The performance of this conventional building can be improved by using Green building technology. This analysis enabled to identify the relationship between sustainable features and its impact on initial cost as well as LCC. Comparison is done between the buildings is for total Energy cost required for the life of 25 years. Above flow chart shows the Planning schedule of work adopted for the study.

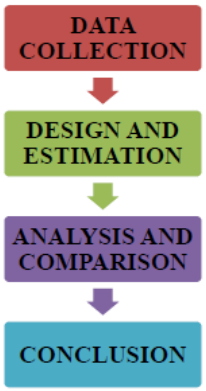


Fig. 3 Flow Chart for Methodology

2.1 Data Collection

The primary data required for this study is collected directly from the owner of Conventional Building. The source of data collected is through questionnaire which is close - ended questionnaire and discussion with the owner. Some data is used in this study is of secondary nature. The secondary data is collected from sources such as web sites, journals and books, etc.

In developing countries like India energy is one of the main constrain, more than 40% of energy is consumed by buildings. Buildings, in general, are categories into residential, commercial and industrial buildings. In this residential buildings place a major role in consuming energy due to the ever growing population. So to save energy we should implement an efficient method. There are few building methods which can reduce energy consumption such as green buildings, passive buildings, ZEBs etc.

2.2 Design and Estimation

a) Energy Cost Estimation

In this, Total Energy costs required for 25 years are calculated for Conventional as well as Green building. In conventional building there is no any Energy efficient system installed. In other case, in Green Building Solar Energy system is installed. So over all energy expenditure between both buildings is calculated as below.

Calculations for Conventional Building: -
Here for a residential Building let say 4 KW system required.
1 KW generates 4 units per day.

Hence for 4 KW= 4X4= 16 units per day.
Electricity Cost for per day = 16 unit's X 10 Rs. Per unit
= 160 Rs. per Day.
Electricity Cost for a month will be = 30 X 160 = 4800 Rs. per Month.
Electricity Cost for a year will be = 12 X 4800 = 57600 Rs. per Year.

Hence, for the Life of 25 years Energy cost for conventional building will be,
= 25 X 57600 = Rs 14,40,000. /25 Years.

Calculations for Green Building: -
To install 4 KW solar system, plant Initial cost will be,
For 1 KW approx. 75,000 Rs. Costs required.
Hence for 4 KW = 4X 75000 = Rs. 3,00,000 /-

From Government side there is subsidy for this. It is approx. 30 % of their benchmark cost, i.e. around Rs. 14,100 for 1 KW plant.

Hence for 4 KW = 4 X 14100 = Rs. 56,400 /- subsidy will be credited by Government in your account.
So, the amount will be now = 3,00,000-56,400
Rs. = 2,43,600 /-

2.3 Analysis and Comparison

From above calculations we got that, for Conventional building, monthly energy bill is around Rs. 4800/-. And annually it is Rs. 57600 /-

For the life of 25 years it goes around Rs. 14,40,000/- which is near almost the initial construction cost of building.

On other hand for Green building, initially only Rs.3,00,000/- required for the installation of Solar system, from which around Rs. 56400 will be given by Government for subsidy on solar system. Following table shows the Return on Investment on Solar Energy System for 4 KW
Plant installations,

Table No.1 Return on Investment (ROI)

Years ➔	1	2	3	4	5
Unit Generation with yield 1450 KWH/KWP /year	5800	5742	5700	5643	5587
Gross Unit Rate INR. 10.00	58000	57420	57000	56430	55870
Saving at the end of Year (INR)	58000	115420	172420	228850	284720

From the above Table, the ROI is between 4 to 4.5 years. That means within 4.5 years all invested money will be returned and there after next 25-4.5= 21.5 years the Electricity will be free of Cost.

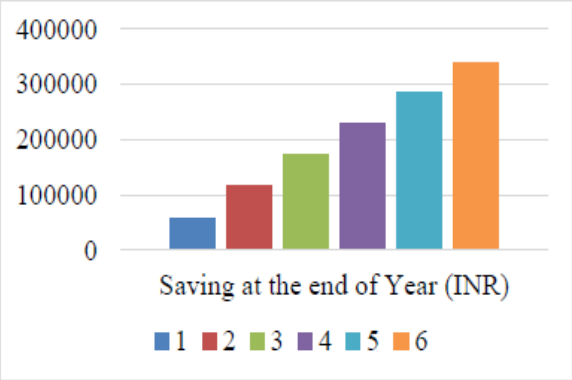


Chart No. 01 Return on Investment (ROI) on Energy cost for Green Building

b) Water saving Estimation

Estimation of Annual Rainwater Harvesting Potential

The annual rainfall(R) in is approx. 725 mm.
Considering a roof top area (A) of 103.87 square meter and runoff coefficient (C) of 0.85, the rain water harvesting potential from roof top is,

= A x R x C
= 103.87 x 0.725 x 0.85
= 64.01 cum or 64010 liters.

Hence we can collect 64010 liters Rain water from Roof top annually.

Requirement of Water in Liters: -

Here for a family of having 5 members water requirement for 365 days is as given below-

Water required per person per day = 30 liters Approx.
So for 5 members = 5X30 = 150 Liters Approx. per day.
Hence for 365 days, required amount of water is,

= 365 X 5 X 30

= 54750 liters.

Comparison-

From above calculations we can compare that,

Water harvesting Potential (64010 liters) > Water requirement (54750 liters).
Hence we can save 64010-54750 = 9260 liters Rain-fall water and it can be drained for Recharging Ground Water Aquifers.

3. COST-BENEFIT ANALYSIS FOR GREEN BUILDING

By comparing Green building with Conventional building, following table gives the cost-benefits of Green building as compare to conventional building: -

Table no. 2 Cost- Benefits of Green Building

2-12 %	Construction cost premium
25-30%	Savings in energy consumption
20-30%	Savings in water consumption
50%	Less wastage generation
35%	Reduced carbon emission
1.9-2%	Rental premium achieved in commercial buildings
30%	Reduction in building's operating expenses
40%	Increase in office space

4. CONCLUSION

The outcomes of our study provide clear support of the affordability of Green building. From the LCCA of both the buildings, it is clear that the total cost needed for a Green building for 25 years is much less than that of a conventional building. In the case of overall maintenance cost and environmental impact, Green building is showing high performance compared to the conventional building. Hence this study proves that Green Building Technology can effectively adapt to all building sector to maintain the sustainability of the environment. Green Building concept gives Tangible and non-tangible benefits from the stage of conceptualization of the project till the full useful life of the building, through initially in few projects the construction cost is higher than the base cost by approximately 16%, but this can be recovered within 2-3 years of lifecycle of the building by the way of saving in the operation of the green building. The main drawback of this technology is its high initial investment. To reduce the initial investment large scale constructions should start in the field of Green building, it can reduce the cost of energy efficient technologies. For that from government level awareness should be given to constructors about the benefits of Green Building Technology, which will help to attract more people to turn to sustainable technologies and can preserve our environment.

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BIOGRAPHY



Prof. A.S.Ingale, graduated in Civil Engineering in year 1987 from Walchand College of Engineering, Sangli, Maharashtra. He completed M.E. (Construction Management) from Shivaji University, Kolhapur, Maharashtra in year 2012. Presently working as Associate Professor, Department of Civil Engineering, Padmabhooshan Vasantraodada Patil Institute of Technology, Budhgaon (Sangli), Maharashtra. He is having wide teaching experience of 32 years in the field of Hydraulics & Water Resources Engineering.

A Comparative Study of Seismic Behavior of Flat Slab Structure and Conventional Framed Structure

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ABSTRACT:
Flat slabs is system of construction is one in which the beams used in the conventional methods of constructions are eliminated or provided at perimeter to increase the rigidity. Flat slab structure have been widely used in building construction due to their advantages over conventional framed structure such as economy in construction, its architectural appearance, flexibility, reducing storey height and speed of the construction. Due to absence of beams in flat slab, lateral stiffness is considerably reduced hence flat slab structure more flexible to seismic loading as compare with conventional framed structure. This objective of this work is to compare the seismic behavior of flat slab structure with conventional R.C.C. Structure. This work also study presence of opening on performance of flat slab structure.

Keywords: Flat slab RC structure, Seismic response, Static analysis, Dynamic analysis.

I.INTRODUCTION

Flat slabs is system of construction is one in which slab is directly rest on the column. The slab directly rests on the column and load from the slab is directly transferred to the columns and then to the foundation. To support heavy loads the thickness of slab near the support with the column is increased and these are called drops, or columns are generally provided with enlarged heads called column heads or capitals. These increasing thickness of flat slab in the region supporting columns provide adequate strength in shear and to increase the amount perimeter of the critical section, for shear and hence, increasing the capacity of the slab for resisting two-way shear and to reduce negative bending moment at the support. Flat slabs have been widely used in building construction due to their advantages in reducing storey height and construction period as compared with conventional structure, leading to a reduction of construction costs. Provision of the flat slab building in which slab is directly rested on columns, have been adopted in many buildings constructed recently due to the advantage of reduced floor to floor heights to meet the economical and architectural demands.

Because of absence of deep beam Flat slab building structures which are more significantly flexible than conventional framed structures, thus becoming more vulnerable to seismic loading. Thus the seismic analysis of these structures is necessary to know the vulnerability of these structures to seismic loading.

I. METHODS OF DESIGN OF FLAT SLAB

Following are the methods used for analysis

1. The direct design method
2. The equivalent frame method

METHODS OF SEISMIC ANALYSIS

A. Linear static analysis
B. Linear dynamic analysis

II. PROBLEM FORMULATION, MODELLING AND ANALYSIS

Following are the models used for analysis

Case 1)-

i. 8 storey Flat Slab RC structure having plan dimensions 30 m x36 m.
ii. 8 storey conventional RC Framed structure having plan dimensions 30 m x36 m.
iii. 8 storey flat slab structure with central opening (10m x10m) having plan dimensions 30 m x36 m.

Case 2)-

i. 12 storey Flat Slab RC structure having plan dimensions 30 m x36 m.
ii. 12 storey conventional RC Framed structure having plan dimensions 30 m x36 m.
iii. 12 storey flat slab structure with central opening (10m x10m) having plan dimensions 30 m x36 m.

Case 3)-

i. 18 storey Flat Slab RC structure having plan dimensions 30 m x36 m.
ii. 18 storey conventional RC Framed structure having plan dimensions 30 m x36 m.
iii. 18 storey flat slab structure with central opening (10m x10m) having plan dimensions 30 m x36 m.

All above model are analysed and comparison is made between these analyses. To know vulnerability of the structure to seismic loading.

Details of Modelling:

i. Storey height -3.2m
ii. Plinth level-0.8m
iii. Thickness of flat slab- 220mm
iv. Thickness of drop is -270mm.
v. Thickness of shear wall is- 150mm.
vi. Size of column -0.45m to 1.2m.
vii. Size of beam -300mm to 600mm.

Loading Details:

1. Gravity loads-
   i. Live load at typical floor-4 kN/m^2
   ii. Live load at top floor -2 kN/m^2
   iii. Floor finish load at typical floor -1.0 kN/m^2
   iv. Floor finish load at top floor -2.0 kN/m^2
2. Detail of Earthquake loading-

1. Static analysis

a. Location of zone- III.
b. The direction of excitation -X.
c. Importance factor -1
d. Response reduction factors- 5

2. Dynamic analysis-

a. Location of zone- III.

b. The direction of excitation -X.

c. Damping-5%.

III. RESULTS

1. Base shear - Base shear is the total design lateral force (V_B) along any principal direction, which is determined by following expression

$$V_B = A_h * W$$

Where
A_h = Design horizontal acceleration spectrum
W = Seismic weight of building.

TABLE I
BASE SHEAR COMPARISON of above models

Model	Linear static analysis	Response spectrum analysis
Case 1- 8 storey Structure		
Flat slab structure	1095.61	1015.73
Conventional Structure	2239.58	2053.48
Flat slab structure with opening	1011.93	940.48
Case 2- 12 storey Structure		
Flat slab structure	1467.99	1233.86
Conventional Structure	2650.81	2354.20
Flat slab structure with opening	1371.41	1149.08
Case 3- 18 storey Structure		
Flat slab structure	2253.82	1769.67
Conventional Structure	3175.29	2852.77
Flat slab structure with opening	2109.08	1647.69

From above result it is observe that flat slab structure are more flexible than conventional structure. The presence of opening to flat slab structure increase the flexibility of structure.

2. Storey drift-

Storey drift is the total lateral displacement that met in a single storey of a high-rise building. The drift in a storey is computed as a difference of deflections of the floors at the top and the bottom of the storey under consideration. It is one of the predominantly important engineering response quantity and indictor of structural performance, in particular for multi-storey buildings. Storey drift is considered as unique standard for structural behaviour conclusion.

According IS 1893 (Part 1): 2002 maximum allowable storey drift Should not be exceed shall 0.004 times the storey height under consideration. For all the analysis of the above model storey drift should not exceed 12.8mm.

Comparison of Storey Drift for different cases

Case 1- 8 storey structure

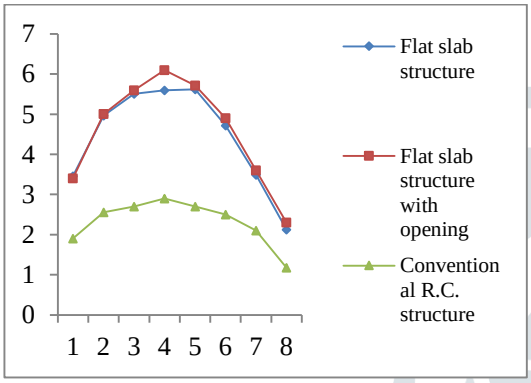


Figure 1. Linear Static Analysis

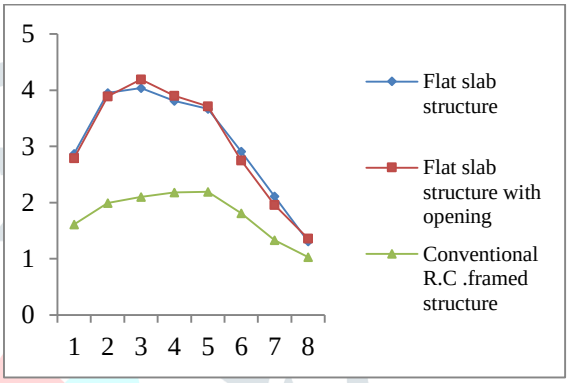


Figure 2. Linear Dynamic Analysis.

The plot of drift values shows that in case of 8 storey structure, drift values does not vary much from conventional RC framed structure and does not tend to exceed permissible limit.

Case 2- 12 storey structure

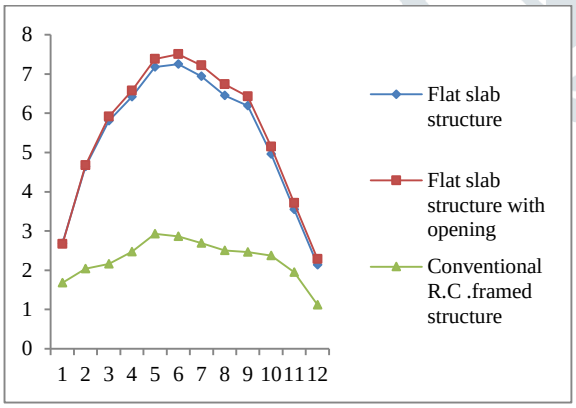


Figure 3.Linear Static Analysis.

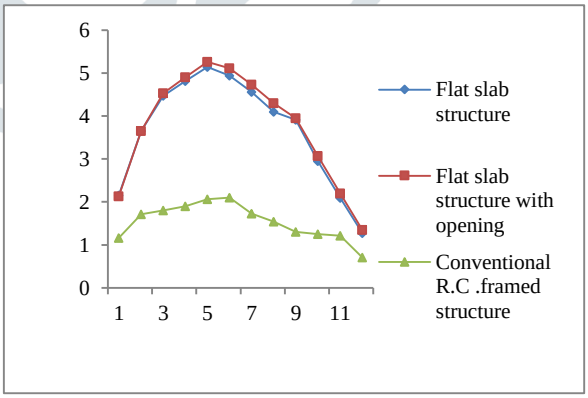


Figure 4.Linear Dynamic Analysis

Figure 3 and 4 shows variation of storey drift for all 3 cases considered above, it is found that drift values are within permissible limits.

Case 3- 18 story structure

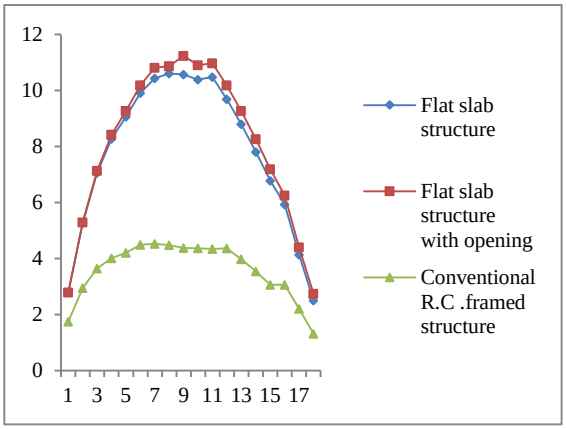


Figure5. Linear Static Analysis

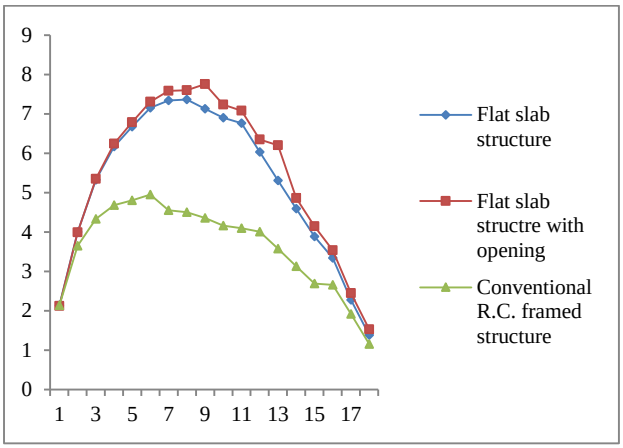


Figure 6. Linear Dynamic Analysis

The plot of drift values shows that for all 3 cases considered above, drift values are within permissible limits but for flat slab structure and flat slab structure with opening drift values are closer to the permissible values.

Comparison of Displacement for different cases

Case 1 -8 storey structure

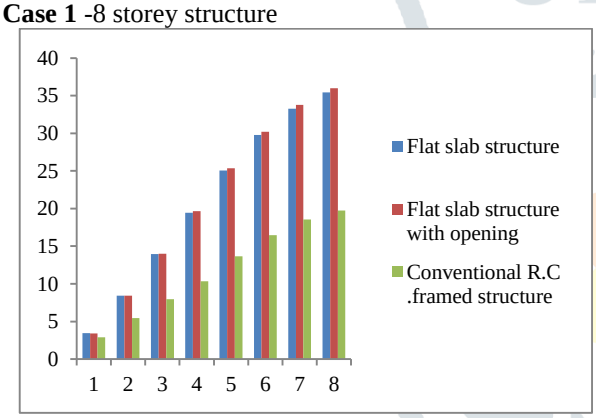


Figure 7. Linear Static Analysis.

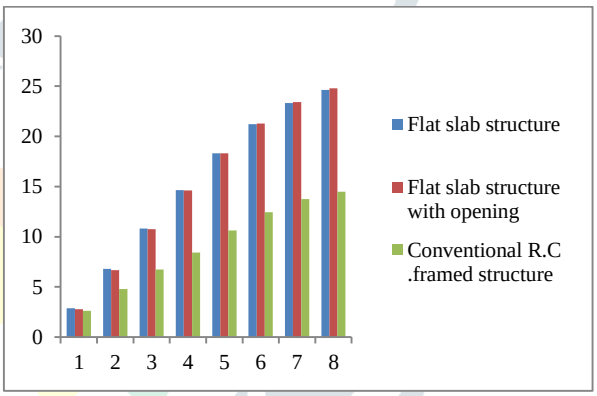


Figure 8. Linear Dynamic Analysis

Maximum displacement attained by conventional structure is much lesser than that in case of flat slab structure and flat slab structure with opening by both the analysis viz. linear static analysis and linear dynamic analysis.

Case 2-12 storey structure

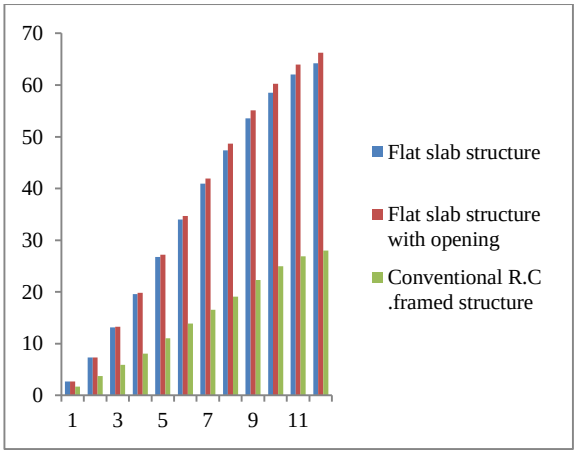


Figure 9. Linear Static Analysis

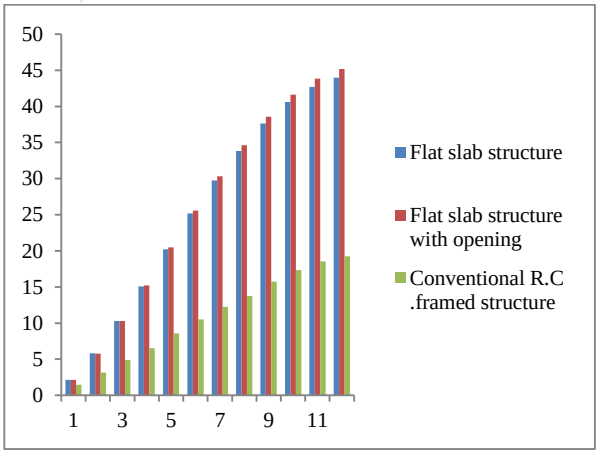


Figure10. Linear Static Analysis.

In case of 12 storey structure, flat slab and conventional framed structure does not exceed the maximum permissible value. Also, flat slab structure with opening does not undergo significant displacement as compared flat slab structure without opening.

Case 3- 18 storey structure

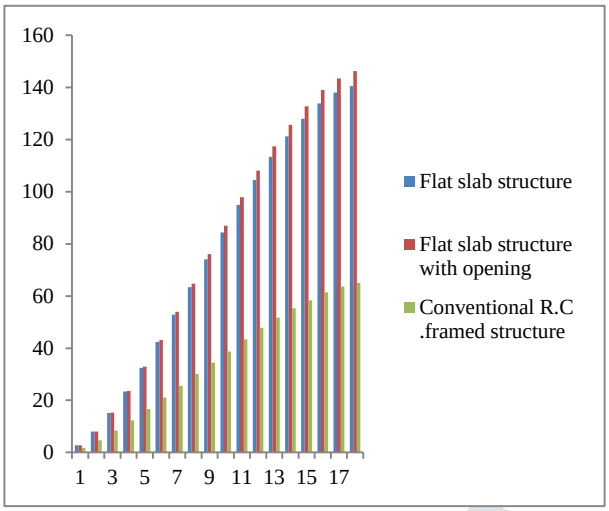


Figure11. Linear Static Analysis.

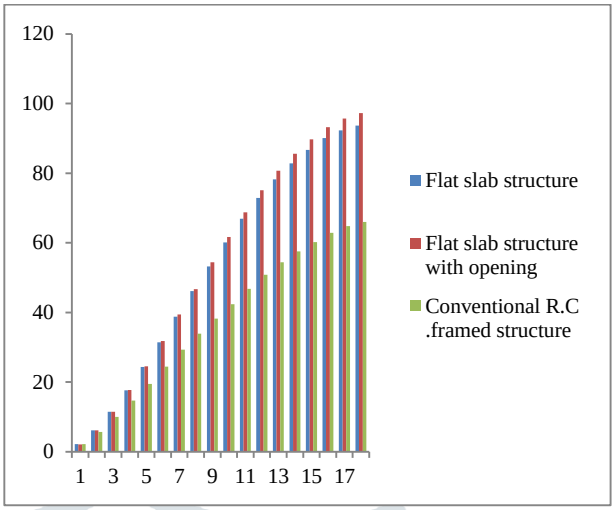


Figure12. Linear Dynamic Analysis

In case of 18 storey structure too, flat slab structure with opening does not undergo significant displacement as compared flat slab structure without opening.

IV. CONCLUSION

1. For all case, flat slab structure design base shear less as compare with conventional structure which is due to the flexibility of flat slab structure.
2. In case of flat slab storey drift is more as compare with conventional RC framed structure. This storey drift found to be maximum at middle storey and minimum at top and bottom storey.
3. From analysis result it seen that displacement of the flat slab structure is more as compare with conventional structure.
4. The presence of opening in flat slab structure does not make appreciable difference in results (maximum displacement and drift) when compared with flat slab structure without opening.

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Review on Leukemia Detection and Classification Frameworks

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ABSTRACT

Technology in this era is moving exponentially high. Adoption of technology in almost every aspect of our lives at all times can be found easily. From a decade, we have been studying the various approaches for the automated detection and classification of Acute Lymphoblastic Leukaemia (ALL) using the different technologies. However none of the techniques seems to be perfect by considering the robustness and reliability of prediction. While working with the leukaemia detection and its classification into L1, L2, and L3 classes the key steps under considerations are the accurate segmentation of overlapping blood cells and appropriate features extraction technique. Recently the deep learning methods gains the significant attentions in which the automated features extracted, however such methods most based on automated features extraction and learning which leads the high dimensional features. The high dimensional features extracted from the raw input image not only lead the higher computation complexity but also may degrade the performance in case of large datasets. The recent deep learning based method is introduced just at initial level in which the key steps are missing such as pre-processing and segmentation and evaluated only on small scale dataset. The performance of such methods affected due to lack of appropriate noise reduction and segmentation techniques.

KEYWORDS: *Cancer, Machine learning, Leukemia, Acute leukaemia detection and classification.*

1. INTRODUCTION

In the medical field, among various concerning area, cancer research is considered as the interesting and important. In order to reduce the mortality rate of humans, it is required to diagnose it at the earlier. Different categories exist, among them Leukaemia is a form of bone marrow cancer or categorization of blood by an uncommon increase in undeveloped WBCs known as "blasts" and is further characterized by thick word covers a various diseasescollection. This forms a section of wider group of diseases which affectsblood, bone marrow and lymphoid system, all known as haematological neoplasms [1, 2].

Acute Lymphoblastic Leukaemia is a type of leukaemia in young children and Acute Myelogenous. Leukaemia commonly occurs highly in adults than children, men when contrasted by women. Some sorts of symptoms were shown by leukaemia, which resembles at the initial stage to normal minor disease it is very difficult to identify, but it is very tedious to recognize it at the earlier stage, so manual analysis isn‟t much feasible [3, 4].

The demerits of the conventional methods can be overcome by recognizing the leukaemia and its classification using an automated system. So, this is feasible by recognizing the leukaemia image and classify it into its respective type, with the help of digital image processing.Here, input of these systems were considered as the microscopic blood cell images of various kinds of leukaemia. Image processing comprises of various techniques likepre-processing, segmentation, extraction of featureand classification [5, 6].

2. LITERATURE REVIEW

AML is a kind of intense leukemia, which is predominant among grown-ups [7]. The requirement for coinputerization of leukemia identification emerges since current techniques includes manual

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assessment of the images of blood as the first step towards conclusion. Right now, basic procedure that consequently distinguishes and fragments AML in blood spreads is displayed. So as to build a powerful list of capabilities, a few distributed articles were examined, and their element choice procedure was watched. lt was noticed that specific highlights were broadly utilized as they gave a decent classification. We executed these highlights on entire pictures in our framework. Those highlights were considered to support the classifier execution.

Precise and ear1y expectation of cancer can help human services experts to devise convenient storative techniques to avoid sufferings and the danger of casualty [8]. For the most part, an Al (ML) based prescient framework in human services utilizes informations to foresee object esteems disease discovery. RO classifier has been used for futher classification. Prescient exactness is the principle worry for choice emotionally supportive networks particularly in human service spaces. The advancement of GE microarray information supportive choice emotionally supportive networks is the key region of research these days. Writing signifies and hence shows the features of the examples are significant in these frameworks. Hereditary framework of an individual (solid or sick subject) might be critical for building up a proficient DSS.

Breast cancer, as the second most disease in the world after the lung cancer and this particularly demise in ladies [9]. And in US it is the most general disease for ladies after skin cancer. Practically a large portion of the ladies who partake in the screening for 20 years (453 of every 1,000) have in any event one extra assessment. This speaks to 156 a bigger number of ladies than in the 1,000 who don't take an interest in the screening. The Fuzzy C means algorithm is implied for the recognition of lekemia [10]. The agreement upgrade is finished as the straight forward expansion and subtraction activity to isolate the cores. The morphological shape division identifies the edges of cores and dispose of the typical white platelets from the minute blood picture. At that point the surface, geometry, shading and factual highlights of cores is assessed to decides the different elements of hernia. At long last it is prepared with the help of Fuzzy C mean bunching of single line highlight vector of every cell is utilized to characterize cancer from white platelets. The Acute leukemia classification methods are supportive of four main categories like threshold , limit, locale as well as half and half. The greater part of the systems joins limit and district criteria. Limit based strategies, for example, Otsu and histom sections the WBCs straight forwardly from the blood smear picture utilizing the level of force.

A smart decision support system suggested the Neoh et al[11] for an immediate diagnosis of lymphoblastic leukaemia from microscopic images of the blood. In particular we formulate the proposed inter-cluster assessment according to trade-off of many inter- cluster steps of feature extraction approaches. Huge classifiers have been introduced for lymphocyte or lymphoblast separation. Proposed SDM-based clustering rectifies theFuzzy C-mean‟s shortcomings that has been computed with the ALL-IDB2 database, which concentrates much on within-cluster scatter variance. For nucleus-cytoplasm separation, it beats the Linear Discriminant Analysis and Fuzzy Compactness and Separation.

Mohapatra, et al [12] suggested a quantitative microscopic method, which works towards differentiatinglymphoblast (malignant) and lymphocyte (normal) from stained blood smear samples and bone marrow samples.Its output is contributed to computer- aided ALL screening development. With the aid of segmentationof image, extractionof feature and stained blood films classification over light microscopic images, we can achieve automated lymphoblast identification. Experimental analysis was conducted and the result is acquired and distinguished over the available image data set, resulting in a classifier collection resulting in 99 percent accuracy when distinguished with other standard classifiers.

For automatic recognized and segments AML of blood smears, Agaian et al [13] gave a simple technique. The method proposed differs from other approaches in: 1) simplicity; 2) classification of entire blood smear images instead of sub-images; and 3) utilizationof these algorithms for segmenting and identifying nucleates. This work distinguishes the output on sub-images and whole

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images of the proposed algorithms and contrasts the effects of some of existing systems with proposedmethod. We test 80 microscopic blood images to find lymphoblast cells, and further segregate them from the sub-images and full images.

For automatically detecting image based acute leukaemia, Kumar, et al [14] presented an algorithm. With the help of basic enhancement, morphological filtering and segmentation techniques for extracting region of interest via k -means clustering algorithm, this method has been expected. An accuracy of 92.8% were attained in this experiment and further it has been checked with the Nearest Neighbor (KNN), Naïve Bayes Classifier on 60 samples dataset.

Zhao et al[16] suggested an automated identification as well as classification method of WBCs, and used peripheral blood images. This algorithm is utilized to distinguish WBCs of microscope images, which works according to simple R, B relationship and morphological process colors. Second, for distinguishingbasophiland eosinophil from other WBCs, we apply the granularity function and SVM.Finally, we use the neural convolution networks to extract high-level features of WBCs automatically, and a random forest has been implemented for classifying other three WBCstypes:lymphocyte, monocyte andneutrophil. Proposed method of detection has a better effect and is verified by an experiment conducted on a Cellavison database and ALL-IDB database, and is nearly better compared to an iterative threshold approach with reduced cost of time.

Ahmed et al [17] gave a new method for diagnosing leukaemia subtypes from microscopic images of blood cells via a convolutionary neural network (CNN). Huge amount of training data needs to be collected for this. Therefore the author synthetically analysed the effect of data increase on high-training samples. ALL-IDB and ASH Image Bank have been the commonly used leukaemia data source. Therefore seven different image processing methods have been applied as the data increases. CNN architecture was designed to identify entire subtypes of leukaemia, and the author also addressed various machine learning algorithms like naive Bayes, supporting vector machine, decision tree and k-nearest neighbour; a number of experiments were measured, using 5-fold cross- validation and test resultsdemonstrated that 88.25 per cent and 81.74 per cent accuracy of our performance in the CNN model.

S. NO.	AUTHOR NAME	METHODS	MERITS	DEMERITS
1.	Neoh et al [2015] [11]	Intelligent decision support system	outperforms	Time consuming
2.	Mohapatra, et al [2014] [12]	Quantitative microscopic approach	High accuracy.	Computationally slower.
3.	Agaian et al [2014] [13]	Simple technique	obtain 98% accuracy	Need to use other classifiers to improve the performance.
4.	Kumar, et al [2018] [14]	Automated image based acute leukaemia detection systems.	Achieved good accuracy.	Very expensive
5.	Madhloom et al [2015] [15]	Histogram equalization and arithmetic addition	Robustness	It is not a complete computer-based acute leukaemia diagnosis system
6.	Zhao, et al [2017] [16]	Simple colors R, B relation and morphological Operation	Better accuracy	Lymphocyte classification has to be enhanced

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7.	Ahmed et al [2019] [17]	CNN architecture	Helping to solve the overfitting problem	It is so expensive in execution time.

3. SIGNIFICANCE OF RESEARCH

The scope of this work is to present the enhanced deep learning based framework to detect and classify the leukaemia from the raw input medical images. The significance is to overcome the scalability, reliability and robustness challenges of existing techniques. The framework consists of pre-processing, segmentation, convolution neural network (CNN), features reduction using PCA, and Long Short Term Memory (LSTM) for the classification. The proposed framework is called as Segmented (S)-CNN-PCA (P)-LSTM model i.e. S-CNN-PCA-LSTM. For pre-processing we may try and apply the various methods to suppress the noise from the images which could enhance the performance of the algorithm. These methods include median, mean, unsharp filters, Gaussian smoothing, conservative smoothing, and frequency filter. After the pre-processing we propose the segmentation technique to effectively extract the region of interest. To obtain the region of interest in the current research, we propose a simple segmentation approach based on simple threshold method, which results in an efficient way. Further the segmented images passed to the deep learning model called CNN which extracts the features from the segmented images. As the size of features vector is large, we apply the PCA to select the more unique features for the LSTM based classification.

4. CONCLUSION

In this research work, we have studied, analysed and compared the various automatic leukaemia detection and classification methods. It is the descriptive study as it aims an in-depth analysis on relationship standard methods in leukaemia detection and classification. This study covers the title of the study, significance, objective, detailed literature and comparison of various researches in this area. Several recent approaches are discussed in literature for the detection and classification of ALL using image processing and machine learning terminologies. Segmentation is taken under consideration a significant step inside the automatic diagnosing of assorted pc systems. It had been found that a lot of strategies supported cluster based mostly and color based inside the literature have shown promising results. As per the analysis it's prove that K-Means Cluster and Color based mostly combine technique gives accurate segmentation then K-means. Thus In proposed work consider color and K-Means cluster based segmentation technique and it Reduce time because only extract B from LAB color and M from CMYK color. Then extract the Contrast, Energy, Homogeneity, Correlation, etc. and Shape Features (i.e. Area, major and minor axis, perimeter etc.) from segmental image and also the applicable. Features are employed in supervised Random Forest classifier to classify ALL and its subtypes i.e. L1-L2-L3. In Future system can use for subtypes of CML and CLL classification.

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Exponential Grey Wolf Optimization Technique for Quick Centroid Assessment in Data Clustering

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ABSTRACT

Current things in bunching tell that molecule swarm grouping (PSC) might be a precise instrument for settling distinctive bunching undertakings. This work updates a few sections of the PSC calculation and shows why and how the necessities are to be an endeavour for enhancing its proficiency and duplications of PSC. In this current work, we alluded to it as quick centroid appraisal (RCE). RCE makes effortlessness in updating of PSC rules and unequivocally decreases general computational many-sided quality by expanding the effectiveness of the molecule courses. On standard assessments with a manmade datasets which has eighty measurements and a size of 5000, Rapid Centroid Estimation variations having emphasis time of under 0.1s, which it analyses to the redundancy times of 2s for PSC and altered PSC (mPSC). On UC Irvine (UCI) machine learning datasets, RCE deviations are a lot faster than PSC and mPSC, and make groups with the greatest cleanliness and exceptionally upgrade in advancement speeds. For instance, the RCE variations are more than 100 times quicker than PSC and mPSC in view of the UCI bosom tumour dataset. It can be chosen that the RCE variations are more slender and quicker than the PSC and mPSC and that the current streamlining strategies ought to likewise expand the predominance of bunching and duplicability. Keywords: RCE, PSO, Computational Complexity, Dataset.

1. Introduction

As human-PC collaboration and distinctive programming advances rise fastly, information stacking and maintaining legitimately turns out to be exceptionally pivotal and troublesome by human's ability. A huge number of databases is being valuable in undertakings administration, government organization division, logical and designing information administration, and distinctive different applications [21]. It is pointed out that number of such a family of databases continually refreshing and overhauling quickly due to the attainable quality of various new methods inside database administration frameworks. This last undertaking is considered because of the utilization of already verifiable information which ought to be important for appealing choices on the most recent assignments. Data pressure from the databases is successfully arranged under an information mining theme. Information mining inputs an arrangement of various utilitarian modules for duties, for example, affiliation, order, group examination, and advancement. Bunching can be characterized as the unverified characterization of examples into gatherings. Grouping is the assignment of joining several articles into divergent subsets to such an extent that items which are alongside a similar bunch are massively like each other [22]. Bunching has many utilize, for example, picture division, data recovery, website page gathering, showcase division, arrangement examination, human hereditary grouping, and logical and building investigation.
As a rule, bunching calculations can be isolated into two critical gatherings: various leveled and partitional grouping [11]. The various leveled bunching approach creates a chain of importance of groups in which each bunch is fitted inside the bunch at a more elevated amount of the pyramid. Be that as it may, Partitional bunching strategies make a one-level (unnested) dividing of the information focuses. On the off chance that K is the coveted number of bunches, at that point partitional approaches normally discover all K groups without a moment's delay. These partitional bunching techniques are extra ordered in two classes: hard and fluffy [9]. Hard techniques for bunching assigns each question into a one of a kind gathering, while fluffy strategies acclimate enrollment degrees among objects and the distinctive gatherings of the dataset [10]. K-implies is one of the famous and standard calculations for firm grouping which discover the endeavoring in finding the best bunches because of its iterative air.

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Their shortcoming comprises in the way that the arrangement start by them is regularly imperfect just [4]. Likewise, k-implies grouping calculations consider just the similitudes between objects inside a bunch by tumbling the scatterings of the bunch. Once more, it tends to all the innards also amid the way toward tumbling the dissemination. In any case, unique scenes have phenomenal discriminative capacities in real applications [1].
Lately, utilization of transformative calculations or swarm insight to best bunching is by all accounts a conventional decision on how to solid this algorithmically hard grouping issue [4]. For instance, the first and pioneer improvement calculation called, GA [12] is connected for grouping essentially and after that, PSO calculation [13], Artificial Bee Colony [14], Bacterial Foraging Optimization [15], Simulated Annealing [20], Differential Evolution Algorithm [16], and Evolutionary calculation [17] and Firefly [18] are along these lines connected for bunching. From that point onward, mixture calculations are in the field of doing bunching process over the datasets to apply the welfares of both the calculations considered for hybridization. Here, two improvement calculations are pooled to do the grouping errand as like, GA with PSO [19]. The current headway is building up the powerful target capacity to locate the best grouping yields utilizing enhancement based centroid estimation or crossbreeding the advancement calculation for quick estimation of discovering bunch comes about.

2. Literature Review

The literature presents various algorithms and techniques for data clustering using optimization algorithms like Particle Swarm Optimization (PSO), Genetic Algorithm (GA), and Firefly Algorithm. In [2], the Cuckoo Search Algorithm was utilized for data clustering which utilizes the kernel-based objective function, and [3] utilized the Memetic Algorithm which utilizes the adaptive niching strategy. Mitchell Yuwono et al. [6] developed the clustering process using the PSO algorithm which estimates the centroids very rapidly. Then, two algorithms are hybridized to obtain effective results as like [4, 5, 7, 8]. Accordingly, Josef Tvrdík et al. [4] hybridized the differential evolution with the K-means algorithm and R.J. Kuo et al. [5] hybridized the kernel clustering with Bee Colony Optimization. Similarly, Jonathon K. Parker et al. [7] hybridized the Single-Pass Fuzzy C-Means (SPFCM) and progressive sampling. Telmo M et al. [8] have developed a hybrid approach by combining the Fuzzy C-Means (FCM) with improved PSO.

Table 1: Literature Review

Authors	Contribution	Advantages	Disadvantages
Xiaohui Huang *et al.* [1]	Integrating intracluster compactness and intercluster parting with k-means.	This is a vigorous algorithm and balances the intracluster compactness & intercluster separation	K means clustering is much delicate to preliminary cluster assignment.
D. Binu [2]	Cuckoo search with kernel-based objective function.	The better capability of changing the condition for various complex tasks.	Traditional cuckoo search algorithm is sensitive to exploitation and exploration problems.
Weiguo Sheng *et al.* [3]	Adaptive Niching Based Memetic Algorithm.	It can be able to trace suitable clustering answers with the precise count of clusters.	Adaptive Niching based Memetic algorithm is having much computational effort for high dimensional data.
Josef Tvrdík *et al.* [4]	Hybridization of Differential evolution with k-means.	This technique is more consistent and well-organized particularly in the problematic tasks	Re-cluster assignment of k-means is having a chance of getting local minimum solutions.

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R.J. Kuo *et al.* [5]	Hybridization of the kernel clustering with Bee Colony Optimization.	Kernel function increases the clustering capability.	The casual task of the scout bee may have the casual approach of receiving saturated results.
Mitchell Yuwono *et al.* [6]	Rapid centroid estimation using PSO algorithm.	Possibly it is valuable for verdict solutions in big datasets of maximum dimensionality.	Fitness function (sum of squared distance) is found directly from the data space which is not much differentiable.
Jonathon K. Parker *et al.* [7]	Hybridization of single pass fuzzy c-means (SPFCM) and progressive sampling.	This algorithm is scalable for exploration.	This technique is very sensitive to sample the size and selection of sample data.
Telmo M *et al.* [8]	Hybridization of FCM with improved PSO.	It delivers better equilibrium among the exploration and exploitation phase by avoiding tumbling into local minima quickly.	Fixing the level of cluster fuzziness is a very challenging one for getting better results for different valued data.

3. Challenges

Grouping gets a test of finding the best centroids which ought to be finest to inlet the information into k number of the divider. Along these lines, bunching tricky can be verbalized as a perfect examining issue. It shall indicated that the k number of centroids ought to begin out from the information space conveyed for the info information. As of late, the grouping seeking issue is explained in [6] utilizing molecule swarm bunching (PSC). In PSC, the centroid estimate was made utilizing the area refreshing recipe made by them. Once more, the appraisal of each centroid is finished utilizing the measure of squared separation. While looking at the PSC calculation, these are undertakings that are distinguished to promote extended the work:

i) PSC has the chance to participate in occupant ideal arrangements (or) bunches because of the arbitrary task of weights.

ii) The molecule area updation does not contain the information elements to vow the group centroids so this may wind up plainly basic due to broad information spreading, time arrangement qualities, and expansive measurement.

iii) It objectives to locate the overall centroids all through the procedure, instead of meeting on the introduction part.

iv) The end system has not made the uniting method to know about the quality change of centroids.

v) As per [2], the algorithmic adequacy is chosen by target work yet this work [6] misuses the Sum of the Squared Distance (SSD) as unprejudiced capacity even though a considerable measure of enhanced target capacities are displayed in the writing.

vi) Also, information space-based target work shake joining execution in light of qualities of the datasets, for example, the scope of the qualities, measurement, picture and information sort (whole number).

4. Proposed Methodology

This section presents the proposed EGWO algorithm for clustering of input database. The proposed EGWO algorithm is developed by modifying the existing GWO algorithm with an exponential weighted function. GWO [24] is one of the recent optimization method developed based on the hunting behavior of grey wolves. Here, gray wolves are categorized into four categories such as, alpha, beta, omega, and delta which are the search agents for hunting. The major advantages of the EGWO algorithm are given as below. The social chain of importance helps EGWO to spare the best arrangements got so far finished the

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course of the cycle. The enclosing system characterizes a circular-shaped neighborhood round the arrangements those can be able to reached out to greater measurements as a hectic-circle. An arbitrary parameters A and F help for the hopeful answers having hyper-circles with various irregular radii. The chasing technique enables competitor answers to find the plausible position of the prey. Investigation and abuse are ensured by the versatile estimations of an A. The versatile estimations of parameters enable GWO to easily change amongst investigation and abuse. The primary periods of the GWO calculation contain three stages:

i) Following, pursuing, and moving towards the prey,

ii) Pursuing, encompassing, and badgering the prey until the point that it quits moving and,

iii) Attack towards the prey.

These three stages are numerically displayed for the inquiry enhancement issues.

This work plans to adjust the GWO calculation for grouping as the primary goal is to gauge or disclosure of centroids for the given number of bunches. The current GWO calculation refreshes the position of each pursuit operator in light of the a lpha, bête, and delta specialists without allotting the numerical weights. From the definition given in [24], we understand that alpha is the first best search agent, beta is the second-best search agent, and delta the third-best agent. But, these best agents are then utilized to generate new positions by assigning equal importance but the top best agent should have more weightage in the updating formulae. We consider this problem in the GWO algorithm and the solution is given using an exponential function.

The proposed EGWO algorithm is performed using four important steps:

4.1 Initialization:

The grey wolf population is initialized with a position of q wolves. The elements in the population will be within the lower and upper bound. The population is represented as,

$$P = \{P1,P2,P3,\ldots..Pq\}$$

Also, the coefficient vectors such as A and F are initialized with and the component a Here, a is linearly decreasing from 2 to 0 over the course of iterations.

4.2 Fitness:

Once the initialization is performed, the fitness is computed for all the search agents using the fitness function. Based on the fitness function, search agents are categorized into three categories. Such as alpha, beta, and delta. Alpha is the search Agent having the best ability, beta is a search agent having the second-best capability and delta is the searching segment having the third-best capability function. Grey wolves majorly find as per the location of the alpha, beta, and delta respectively. These are separate from each other to find for the prey and congregate to attack on the prey. Search agents to apprise their location depending on the locations of the beta, alpha, and delta attacks in the direction of the prey.

4.3 Updating of search agents:

These grey wolves have the capability to recognize the place of prey and enclose them for attack. The quest is generally steered by the alpha wolf. Every search agent is then updated their location based on alpha, beta, and delta. The beta and delta may likewise endorse chasing occasionally. In any case, in a unique pursuit space, we have no clue about the area of the ideal (prey). Keeping in mind the end goal to precisely replicate the chasing conduct of dim wolves, we assume that the alpha (best hopeful arrangement) beta and delta have better data about the potential area of prey. Along these lines, we spare the initial three best illuminations got up until this point and oblige the other pursuit operators (counting the omegas) to refresh their areas as indicated by the area of the best inquiry specialists. The refreshing of the populace should be possible utilizing the accompanying condition in GWO.

$$P(t+1)=(Px+Py+Pz)/3$$

4.4 Termination:

The above process is repeated until the number of iteration is greater than the user given threshold t and the search agent having

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the best capability or alpha is taken as the final output from the defined algorithm.

The algorithmic sequentional steps of the EGWO algorithm are given below:

Table 2: Pseudo code of the EGWO algorithm

```
1   An algorithm: EGWO
2   Input:   D□Input database
3            k□Number of cluster
4   Output:
5            X□□ Best search agent
7   Begin
8       Initialization of grey wolf population
    P
9       Initialize a , A and F
10      While t <MaxIteration
11          Find fitness of each search agent
12          For each search agent
13              Find P_x , P_y and P_z
14              Find W_x , W_y and W_z
15              Update P(t +1)
16          End For
17          Update a , A and F
18          Update Xα, Xβ, Xδ
19          t =( t+1)
20      EndWhile
21      Return Xα
22  End
```

5. Conclusion

This work depicts as well as test varieties of a calculation which is carried out as the RCE. This work also displays a relative investigation of the aftereffects of Particle Swarm Clusters, modified Particle Swarm Clusters, and Rapid Centroid Estimation calculations on the various datasets like Banknote, Iris, Wine and utilizing distinctive methodologies. Outcomes proposes that the Rapid Centroid Estimation variations are more speedier, deliver improved groups, and conceivably helpful for searching clarifications in big size datasets of greater dimensionality. These swarm, particle change, and replacement approaches increase the repeatability of algorithm.

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Prediction of Employee Attrition Using Machine Learning Approach

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A B S T R A C T

Employees are considered as backbone of an organization. Success or failure of the organization depends on the employees who work for an organization. The organizations have to face the problems when trained, skilled and experienced employees leave the organization for better opportunities and many other reasons. This project aims to predict whether an employee of a company will leave or not. The study was mainly undertaken to identify the dissatisfaction factor of employees and for what reasons they prefer to change their jobs.Once the dissatisfaction factor/s of employees has/have been identified, the organization can take actions accordingly and it may help them to reduce the attrition rate. This project based on build a system which will predict employee attrition based on Employee dataset from GitHub website. Following are the few algorithms that can be used for processing the data, K-Nearest Neighbor, logistic regression, decision Tree, random Forest, Support Vector Machine etc. Based on the accuracy measurement well performed algorithm will be used for this dataset. Which gives accurate solution of the problem statement.This system suggests reasons which optimize the employee attrition in any organization.

Keywords: Employees Attrition,MachineLearning, Support vector machine (SVM),KNN (K-Nearest Neighbor) Introduction:

1. Introduction:

Employee resignations are a reality for any business. However, if the situation isn't handled properly, key staff member's departures can lead to a downturn in productivity. The organization may have to employ new people and train them on the tool that is being used, which is time consuming. Most organizations are interested in knowing which of their employees are at the risk leaving.Employee Attrition is a reduction in manpower in any organization where employees resign. Employees are the valuable assets of any organization. It's necessary to know whether the employees are dissatisfied or are there any other reasons for leaving the respective job. These days for better opportunities, employees are eager to jump from one organization to other. But if they leave jobs unexpectedly, it may cause huge loss for organization. New hiring will consume money and time, also the freshly hired employees take time to make the respective organization profitable. Retention of skilled and hardworking employees is one of the most critical challenges faced by many organizations. Hence, by improving employee satisfaction and providing a desirable working environment, we can certainly reduce this problem significantly. The reasons of leaving the organization could be better-paying job outside, a bad relationship with boss, pursuing higher studies, relocating due to family reasons, fired from organization, job Dissatisfaction, salary not as per expectation, poor relationship with team members, poor working environment, lack of opportunity for career development, overtime, workload etc. In order to tackle this issue, this system developed that uses employee data to analyze reasons for employee attrition. This system is able to predict which employee may leave an organization with what reason, so that they can take several corrective actions in order to ensure that employees stay in the organization and can reduce the attrition. Some of the employee retention strategies to control attrition are motivating employees, expose employees to newer roles, taking constant feedback from employees, etc. Following are the few algorithms that can be used for processing the data Support vector machine (SVM), k-Nearest

Neighbor, Decision Tree, Random Forest, logistic regression etc. Based on the accuracy measurement well performed algorithm will be used for this dataset

1.1 Technologies used in the proposed system

Machine Learning is most important technology towards data analysis for quality prediction and evaluation. There are various algorithms in machine learning which are used to predict the appropriate class of new or unseen data. In our system we used different machine learning algorithms to find out the reasons for employee attrition. The machine learning algorithms which are used in system are described below:

2 SVM (Support Vector Machine)

Support Vector Machine is kind of classification technique. It is a model used for classification and regression problems. It can solve linear and non-linear problems. The idea of SVM is simple: The algorithm creates a line or a hyper plane which separates the data into classes [9]. When unknown data is given as input it predicts which class it belongs to. The margin between the hyper plane and the support vectors are as large as possible to reduce the error in classification

3 K-Nearest Neighbours

K-Nearest Neighbour is considered a lazy learning algorithm that classifies data sets based on their similarity with neighbours. It is one of the most fundamental and simple classification methods and one of the best choices for a classification study of the data [7]. The classification using KNN involve determining neighbouring data points and then deciding the class based on the classes of the neighbours.

4 Decision Tree

As the name implies all decision tree techniques recursively separate observations into branches to construct a tree for the purpose of improving the prediction accuracy. Decision tree is a conventional algorithm used for performing classifications based on the decisions made in one stage. This provides tree structured representation of the decision sets [10]

5 Implemented Algorithm

The proposed system consists of different machine learning algorithms. To build model, we take employee dataset which includes all past and present records of the employees, then we perform data preprocessing (Data Preprocessing is that step in which the data gets transformed, or encoded, to bring it to such a state that the machine can easily analyze it). We have divided dataset into two parts one is train data and second one is test data. Most of the data is used for training and smaller portion of data is used for testing (Train: 70%, Test: 30%). The aim of training is to make a prediction correctly as often as possible. The test data is used to see how well the machine can predict new answers and to validate machine learning model behavior. Afterward, using different machine learning algorithms we have built the model. After building model, user can give the new input data to the system. Furthermore, user can choose algorithm according to their choice and check the result. Output of the system is in two forms - one is graphical representation and other is in polar form that is ‘Yes’ or ‘No’ format. After evaluating result the reason behind the attrition is also given by the system

6 Architecture of Algorithm:

An algorithm based on Machine Learning domain is developed as follows which is illustrated in Figure [1]. Machine learning technique is

used to predict the employee turnover and to predict the risk of an employee leaving. Machine learning (ML) is the study of computer algorithms that improve automatically through experience. It is seen as a part of artificialintelligence. Machine learning algorithms build a model based on sample data, known as "trainingdata", in order to make predictions or decisions without being explicitly programmed to do so

1. Data Collection: The quantity & quality of your data dictate how accurate our model is. The outcome of this step is generally a representation of data which we will use for training. Using pre-collected data, by way of datasets from Kaggle, UCI, etc., still fits into this step

2. Data Preparation: Wrangle data and prepare it for training. Clean that which may require it (remove duplicates, correct errors, deal with missing values, normalization, data type conversions, etc.). Randomize data, which erases the effects of the particular order in which we collected and/or otherwise prepared our data. Visualize data to help detect relevant relationships between variables or class imbalances (bias alert!), or perform other exploratory analysis. Split into training and evaluation sets.

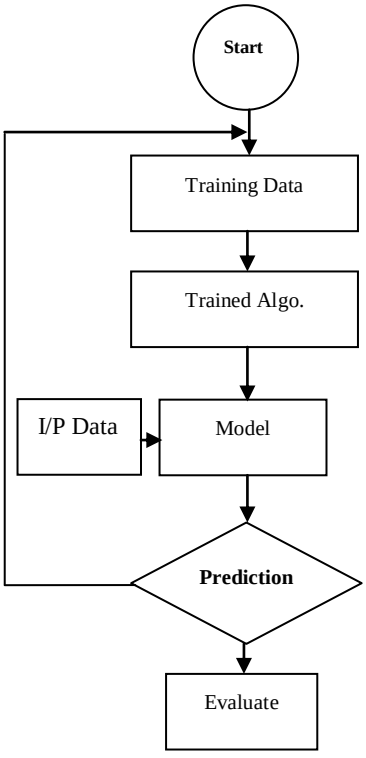


Figure [1] Block Diagram of Algorithm [1]

3. Choose a Model: Different algorithms are for different tasks; choose the right one.

4. Train the Model: The goal of training is to answer a question or make a prediction correctly as often as possible. Linear regression example: algorithm would need to learn values for *m* (or *W*) and *b* (*x* is input, *y* isoutput). Each iteration of process is a training step.

5. Evaluate the Model: Uses some metric or combination of metrics to "measure" objective performance of model. Test the model against previously unseen data. This unseen data is meant to be somewhat representative of model performance in the real world, but still helps tune the model (as opposed to test data, which does not). Good train/eval split? 80/20, 70/30, or similar, depending on domain, data availability, dataset particulars, etc.

7 Experimental Parameters:

In this section, the results of various machine learning approaches are illustrated. All the approaches are evaluated on the precision, recall, accuracy. Various performance parameters are described below (Alduayj & Rajpoot, 2018; Powers, 2011)

1-Accuracy:

$$\text{Accuracy}=\frac{TP+TN}{TP+TN+FP+FN} \quad \text{[Eq. 1]}$$

2-Precision:

$$\text{Precision} = \frac{TP}{TP+FP} \quad \text{[Eq. 2]}$$

3-Recall

$$\text{Recall} = \frac{TP}{TP+FN} \quad \text{[Eq. 3]}$$

8 Conclusion:

This paper presented the effect of voluntary attrition on organizations, and why predicting it is important. It further outlined various classification algorithms based on supervised learning to solve the prediction problem

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Prediction of Employee Attrition Using Machine Learning Approach

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Abstract: ***In the world of technology, there are various zones through which different companies may adopt technologies which sustenance decision-making, Artificial Intelligence is the most creative advancement, generally used to help various companies and institutions in business approaches, authoritative aspects and individual's administration. As of late, consideration has progressively been paid to Human Resources (HR), since professional excellence and capabilities address a development factor and a genuine upper hand for organizations. Subsequent to having been acquainted with deals and showcasing offices, man-made brainpower is additionally beginning to direct representative related choices inside HR the board. The reason for existing is to help choices that are put together not with respect to emotional viewpoints but rather on target information investigation. The objective of this work is to break down how target factors impact representative weakening, to distinguish the fundamental driver that add to a specialist's choice to leave an organization, and to have the option to foresee whether a specific worker will leave the organization. After the testing, the proposed model of an algorithm for the prediction of workers in any industry, attrition is tested on actual dataset with almost 150 samples. With this algorithm best results are generated in terms of all experimental parameters. It uncovers the best review rate, since it estimates the capacity of a classifier to track down every one of the True positive rates and accomplishes a generally false positive rate. The introduced result will help us in distinguishing the conduct of representatives who can be attired throughout the following time. Trial results uncover that the strategic relapse approach can reach up to 86% exactness over another. There are the few algorithms that can be used for processing the data, K-Nearest Neighbour, logistic regression, decision Tree, random Forest, Support Vector Machine etc.***

Keywords*: Employees Attrition, Machine Learning, Support vector machine (SVM), KNN (K-Nearest Neighbour)*

I. INTRODUCTION

Today attrition is one of the serious issues looked by industry across the world. It is the most consuming issue for the business, and high whittling down rates lead to many issues in the limit of the association like losing the skilled assistances and information, cost identified with preparing and organization. It is seen that many ascribe lead to the steady loss of a representative. Which incorporates working climate, work fulfillment, behaviour of seniors, work timing, and most significant is payor motivating forces. Additionally, the expectation model assumes a fundamental part in discovering the conduct of representatives. Ideal conveyance of any assistance or item is the essential objective of any association lately because of high rivalry in enterprises. On the off chance that a capable employee will leave company, the organization can't do the job at characterized times. It might turn into the justification the deficiency of that organization. Thusly, organizations are keen on knowing the worker's weakening. They can make an appropriate substitute or game plans prior.

This framework can anticipate which representative might leave an association with what reason, so they can make a few restorative moves to guarantee that workers stay in the association and can lessen the steady loss. A portion of the worker maintenance methodologies to control weakening are spurring representatives, open workers to fresher jobs, taking steady input from workers, and so on. Following are the couple of algorithms that can be utilized for preparing the data Support vector machine (SVM), k-Nearest Neighbour, Decision Tree, Random Forest, logistic regression etc. Based on the accuracy measurement well performed algorithm will be used for this dataset.

AI is most significant innovation towards information examination for quality expectation and assessment. There are different calculations in AI which are utilized to anticipate the proper class of new or inconspicuous information. In our framework we utilized distinctive AI calculations to discover the purposes behind worker wearing down. The AI calculations which are utilized in framework are depicted beneath:

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A. Support Vector Machine (SVM)

The novel approach toward the attrition prediction is Support Vector Machine strategy. This approach utilized for grouping as well as relapse issues. It can tackle straight and non-direct issues. The calculation makes a stroke or a hyper plane what isolates the information into modules or classes [9]. At the point once, obscure information is assumed as information it detects which class it has a placed with. The edge amongst the hyper plane and the help vectors are pretty much as extensive as conceivable to decrease the blunder in grouping.

B. K-Nearest Neighbours

K-Nearest Neighbour is viewed as a lazy learning calculation that characterizes informational collections dependent on their closeness with neighbours. It is perhaps the most crucial and straightforward characterization techniques and probably the most ideal decision for an order investigation of the information [7]. The instruction using KNN comprise determining contiguous material emphases and afterward selecting the class reliant on on the classes of the neighbours.

C. Decision Tree

All Decision tree approaches recursively isolated insights hooked on twigs to develop a tree to further develop the forecast precision. Decision tree approach is a customary calculation utilized for execution characterizations reliant on the selections completed in one phase. This gives decision tree prearranged depiction of the choice groups [10]

D. Random Forest

The most significant approach is Random Forest approach which is utilized for Classification and Regression subjects in Machine Learning. It rests on the knowledge of group understanding, which is a course of joining numerous classifiers to tackle an intricate issue and to improve the exhibition of the model. Rather than relying upon one decision tree, the Random Forest receipts the anticipation from respectively tree and forecast which have larger part of votes will be the last yield. As the quantity of trees builds the precision too increments and keeps it from the over fitting issue.

II. IMPLEMENTED ALGORITHM

The proposed framework comprises of various AI procedures. To assemble prototypical, we take representative dataset which includes all over a significant time span records of the workers, then, at that point we perform information reprocessing Data Pre-processing is the development in which the statistics gets transformed, or encoded, to carry it to such an express that the machine container undoubtedly investigates it. Dataset is divided into two categories, the basic one is train information and second one is test information. The mainstream of the evidence is utilized for making and more unsure portion of data is utilized for testing. The point of preparing is to select a forecast accurately as regularly as could really be expected. The test information is utilized to perceive how well the machine can anticipate new answers and to approve AI model conduct. A short time later, utilizing distinctive AI calculations we have constructed the model. In the wake of building model, client can give the new information to the framework. Moreover, client can pick calculation as per their decision and actually take a look at the outcome. Yield of the framework is in two structures - one is graphical portrayal and other is in polar structure that is 'Yes' or 'No' design. In the wake of assessing result the purpose for the whittling down is additionally given by the framework All paragraphs must be indented. All paragraphs must be justified, i.e. both left-justified and right-justified.

A. Architecture of Algorithm

A calculation dependent on Machine Learning space is created as follows which is represented in Figure [1]. AI strategy is utilized to foresee the representative turnover and to anticipate the danger of a worker leaving. AI (ML) is the investigation of PC calculations that work on consequently through experience. It is viewed as a piece of man-made brainpower. AI calculations fabricate a model dependent on example information, known as "preparing information", to settle on forecasts or choices without being unequivocally customized to do as such.

1) *Data Collection:* The amount and nature of your information direct how precise our model is. The result of this progression is for the most part a portrayal of information which we will use for preparing. Utilizing pre-gathered information, via datasets from Kaggle, UCI, and so on, still squeezes into this progression.
2) *Data Preparation:* Wrangle data information and dataset it in the mood for getting ready. Clean what may require it Randomize data, which kills the effects of the particular solicitation wherein we accumulated or possibly regardless set up our data. Envision data to help with recognizing material associations between components or class unpredictable attributes or perform other exploratory examination. Split into getting ready and evaluation sets.

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3) *Choose a Model*: There are numerous approaches for different errands; select the right one.
4) *Train the Model:* The goal of getting ready is to address a request or make a conjecture precisely as consistently as could truly be anticipated. Direct backslide model: estimation would need to learn values for m (or W) and b (x is input, y is yield). Each accentuation of connection is a readiness step.
5) *Evaluate the Model:* Uses some quantity or mixture of capacities to "portion" target implementation of perfect approach. Test the algorithm against beforehand inconspicuous information. This inobtrusive material is envisioned to be justly descriptive of perfect implementation in reality.

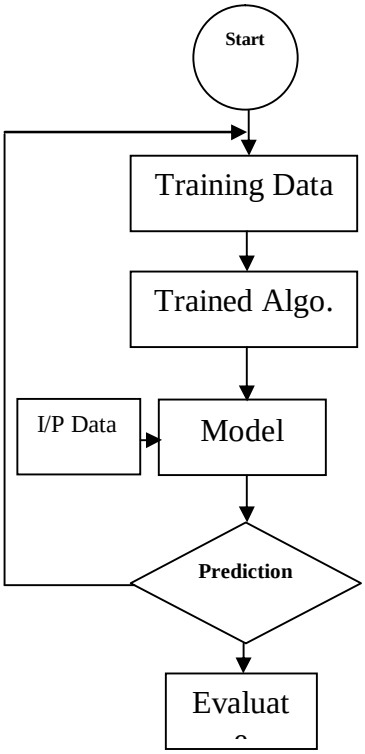


Figure [1] Block Diagram of Algorithm [1]

III.DATA ANALYSIS

Data gathering raises to the collection of relevant data from all available sources to perform analysis. The data used for this employee attrition analysis was obtained from GitHub Website [9]. This data set contains 1500 records and 50 attributes. The categorical values are converted to numeric values in order to make the classification algorithm more effectual. For example, categorical attribute 'Business Travel' contains three values such as Travel-Rarely, Travel Frequently, Non-Travel. Hence it is converted to 1, 2 and 3 respectively

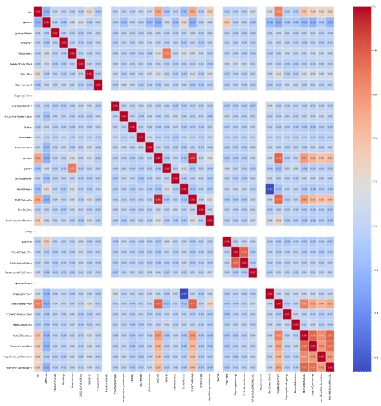


Fig. 1 Correlation Matrix

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A. Some Graphs with Explanation

While concluding the result and analysis, the several graphs generated by the system with respect to attrition:

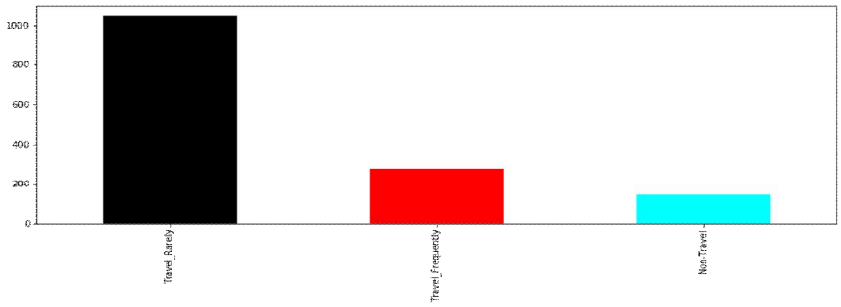


Fig. 3 Business Travel Vs Attrition

Fig. 3 depicts bar graph of evaluation between the Business Travel and respect to Attrition. Proportion of attrition with Travel Hardly is 16%, Travel Frequently is 25 % and Non-Travel is 10.00%. Attrition rate of Travel Frequently is more than other as there are 250 employees who are below the group of Travel Frequently and there remain 60 staffs who are leave-taking the organization. There are 1000 employees who Travel Rarely and out of which only 126 employees are send-off hence the attrition rate is low. For Non-Travel total 150 employees are there and 12 employees are leaving.

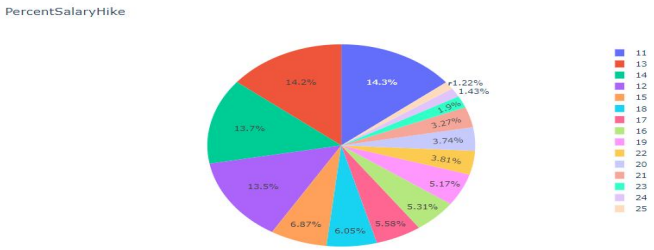


Fig. 4 Monthly Income

Fig. 4 signifies the bar graph of assessment among the monthly income in percentage salary with Attrition. Attrition rate of monthly income is increased.

B. Result and Analysis

For desired results, there are numerous characteristics like department, gender, overtime, business travel, etc. Grounded on these standards, algorithm is developed with the support of dissimilar machine learning algorithms. This algorithm will predict the behaviour of employees who would like to will leave the organization or not. The foretold standards are equated through test values to estimate the correctness of each algorithm. The graph given below in the fig. 5 describes various factors with the help of ROC curve final output, so we can effortlessly achieve which procedure is best for our model. After the graph, we conclude that this algorithm Random Forest gives uppermost accuracy on the HR Employee Attrition dataset whereas Logistic Regression rigidities the lowermost accurateness aimed at the similar dataset.

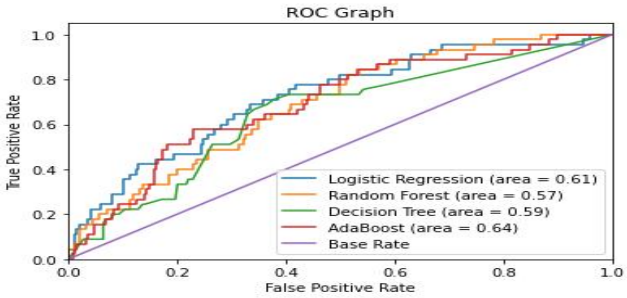


Fig. 5 ROC curve final output

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1) Logistic Regression

```
tab1 = confusion_matrix(pred_value,att1_y_test)
tab1
```

```
array([[176,  90],
       [ 76,  95]], dtype=int64)
```

```
accu = tab1.diagonal().sum() *100 / tab1.sum()
accu
```

```
62.013729977116704
```

2) Decision Tree

```
array([[212,   0],
       [ 40, 185]], dtype=int64)
```

```
tab2.diagonal().sum()*100/tab2.sum()
```

```
90.8466819221968
```

3) Random Forest

```
tab_rf
```

```
array([[231,   0],
       [ 21, 185]], dtype=int64)
```

```
rfc.feature_importances_
```

```
array([0.09116461, 0.01972206, 0.08322913, 0.01709955, 0.07459788,
       0.03287762, 0.03323994, 0.        , 0.0839118 , 0.04255988,
       0.01470773, 0.07439083, 0.03561796, 0.04536333, 0.04501948,
       0.0358541 , 0.0507122 , 0.13928889, 0.08064302])
```

```
accu1 = tab_rf.diagonal().sum() *100 / tab_rf.sum()
accu1
```

```
95.19450800915332
```

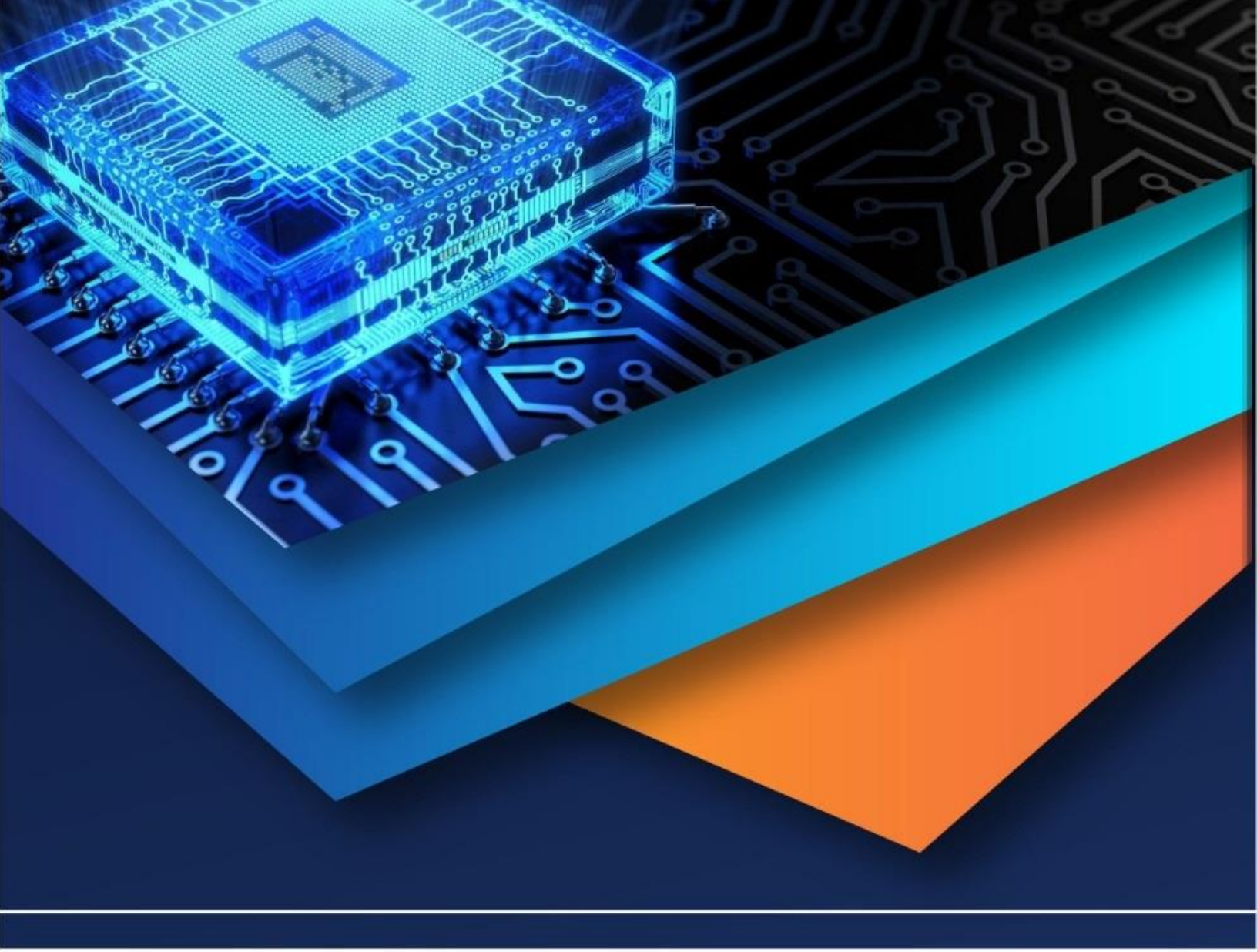
IV. CONCLUSIONS

On the basis of this result paper, algorithm for machine learning is performed precisely with desired results which predict or forecast the employees or workers behaviour who are interested to close the particular company or organization. Result showed that selected algorithm for predicting attrition performs accurately and more closely to desired outputs than any other algorithm. It is detected that; the reason of worker attrition is due to both external and internal factors. This study give strength help association for expressing the factors of employee attrition and can yield suitable stages to diminish the attrition rate.

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6.1 IMPACT FACTOR

Preprogramming Enabled Lego Robot and its Use in Robotics Education.

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Abstract

In the age of automation the scientists and researchers are always looking for the smart and efficient technologies to get the work done .The habit of human is always to ease the efforts by trying out the different solutions. The increasing usage of robotics in the field of technology has definitely scored over the traditional techniques. Initially in Automobile sector has started the application of robotics in the assembly line. But in now days the area has been expanding. From hotel industry to the healthcare everyone has started the automation wherever possible. Robotics is a need of hour today, as every aspect of life is diverting towards the implementation of robotics. Industries are welcoming robots for doing labors task. Space organizations like NASA, European Space Agency, and JAXA are using robots to explore our own Earth and other planets like Mars, asteroids, Moons and beyond. Households are adopting humanoid robots for luxury and entertainment. Robots are making us modern, tech savvy and smart. Education is one of the important domain where researchers are trying to carry out the robotics related affairs. This article is a small effort to put up the usability and programming of Lego Mindstorm ev3 educational robot in the field of education. [1]

***Keywords*:** Robotics, Educational Applications of Robotics, Mindstorm EV3, Robotics Automation.

1. Introduction

A robot is a machine (Mechanical device) especially one programmable by a computer capable of carrying out a complex series of actions automatically. One of the first uses of a mechanical device built to carry out a particular task occurred around 3000 B.C. Egyptian water clocks used human figurines(Human like looking structures) to strike and ring the bells to specify time. In modern times George Devol Jr. an American inventor and entrepreneur (Best known as the inventor of first industrial robot named unimate) filed and later owned a patent on digitally operated programmable robotic arm, which marks the beginning of robotics in industry. Later resulted into 'Unimate' a first widely produced and used industrial robot. Robotics gave us another hand to be efficient worker to do dangerous work like mining to explore new things like planets their moons, asteroids and beyond, in future robots may help us to find another habitable planet like Earth to enable humans to become multi planetary species.

Basic concepts of robotics:-[2]

1. **What is Robotics**

The branch of technology that deals with the design, construction, operation and application of robots. Automatons (objects that move automatically) are the early ancestors of robotics we find lots of history off automatons in Greek mythology. The Writing boy automaton built by famous watchmaker Pierre Jaquet-Droz built in 1770's is a well-known machine that can be e programmed to write is a best example of mechanical cam lever driven robot. Letter in late 1950's unimate became the first vastly produced industrial automation robots which revolutionized the manufacturing in industries. Today the robots like Sophia, Boston dynamic's cheetah, Valkyrie by NASA these robots revolutionizing every aspect of life.

Principles of Robotics [3]

As the existence of the robot is for the sake of human, some moral regulations should be followed while performing the works related to the robotics. The popular three laws of robotics are established by Isaac Asimov. Still the rounds of discussions are going on about these laws in the age of machine learning.

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.

2. A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.

3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.

Basic parts of robotics:-[4]

1. **Control System:-[5]**

   We can relate robots control system to the human brain. Human brain get feedback from various parts of body and processes information to give command, similarly robots control system take information from various parts using sensors and then command to its actuators to act accordingly. In human brain there is a gigantic number of neurons are present which helps to take decisions in robots brain the silicon chips are collectively call central processing unit or CPU. So robots brain uses feedback to take its decisions as human does; however the use of feedback to alter the decisions of machine dates back in 1745 firstly used by English lumber mill owner Edmund Lee to control direction of windmills using fantail.

2. **Sensors:-[6]**

   Sensors play a very important role to give feedback to control system. Sensors and its connections mimic the function of neural system in human body. Various sensors include IR sensor, cameras, light dependent resistor sensors, humidity sensors, piezoelectric sensors, resistive sensors and many more. The robot's CPU gets signals from sensors and adjusts its actuators accordingly.

3. **Actuators:-[7]**

   Actuator is a part where the mechanical movement is done. The actuators are Mechanical, Electrical Hydraulic, and Pneumatic and so on depending on requirement and application. Robots CPU gets signal from sensors computes it in its brain and adjust actuators accordingly to get desired motion. In modern robotics the sensors are embedded into actuators to achieve better precision and accuracy.

4. **Power Supply:-**

   Human being gets their energy from food similarly robots require energy for their function. In ancient times machines used water power, steam power for their functioning. In modern times robots mostly use electrical power. Stationary robots are directly coupled to power supply. The robots which are non-stationary use battery power. the robot which are designed to land and explore on other planets like Curiosity, Opportunity rovers are designed to collect power from solar panels and store in its battery for further operation.

Lego robot Mindstorm EV3:-

Lego Mindstorm EV3 it is educational robot by company named Lego. It is humanoid robot means it looks like humans walking on two legs and having two hands. It can be programmed using software provided with it. It can roll; it can turn backward, turn around do specific actions as per his accessories provided on his front limbs. It is provided with sensors like encoder (built-in motors), IR sensor for avoiding obstacles which makes it intelligent. The Robot is easy to build and can be built in two hours with provided assembly manual. Various parts of these robots are batteries brain LAN cables motors sensors accessories.

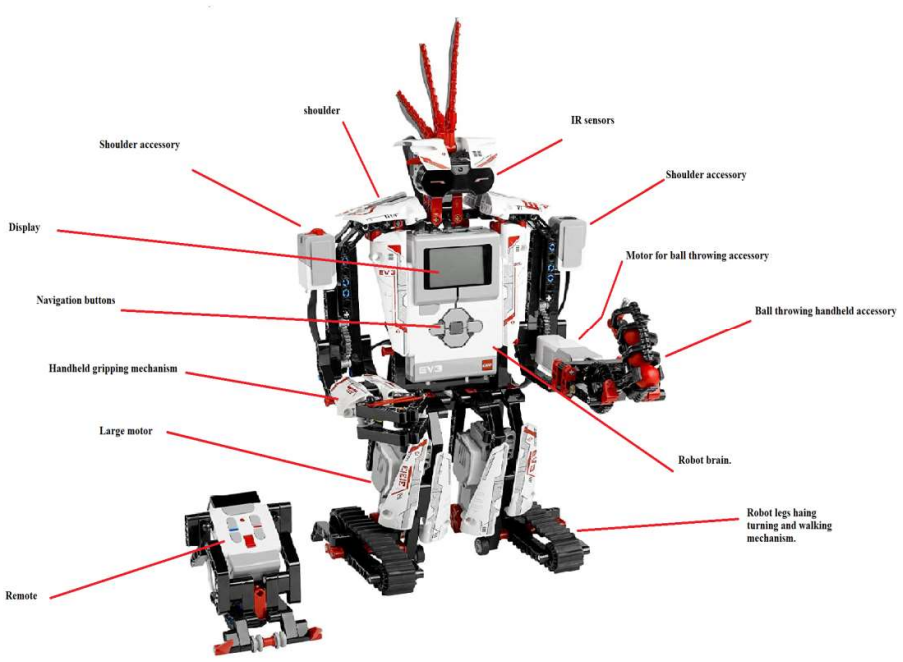


Figure1. Lego Mindstorm EV3

How to program Lego robot Mindstorms EV3:- [8]

The robot can be programmed using Lego Mindstorm EV3 robot software powered by Labview. Software supporting computers having 2GB RAM or above configuration. This software is also available for Android operating system mobile phone and iPhone operating system mobile phones. The programming is very simple and it is based on pick and drop technique it contains various blocks specifying parts of robot having its various motors like steering motor, large motor, accessories motor, display, sound, and light. We can take any block and drop in program to connect various blogs to give certain commands to robot a specific program is as shown in picture.

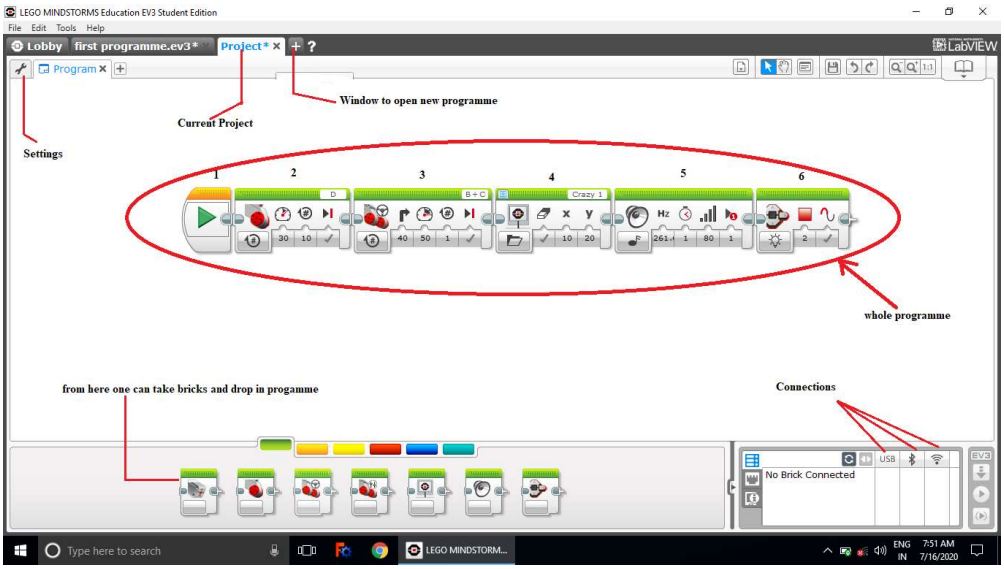


Figure 2. Example of Programme.

The programme consist of

1. Block specifying start of the program, from here through start button one can start running of this programme when laptop/Mobile is connected to robot using LAN cable, Wi-Fi, Bluetooth etc.

2. Block specifying large motor running for 10 rotations in straight direction with a speed factor of 30 and stop.
3. Block specifying steering motors to turn by 90 degree with a speed factor of 50 and stop.
4. Block specifying displaying of image name crazy 1 on a screen on the coordinates of P (10, 20).
5. Block specifying producing a given sound with 260 Hertz frequency having 60% volume and a repetition of one time.
6. Block specifying displaying of a given red color with a pulsating frequency.

The simplicity and provisions like pick and drop technique for programming, connecting connectivity using LAN cable, Bluetooth, Wi-Fi and ability to save programs directly in brain of robot enables children's to use it very easily to boost their creativity and knowledge.[9]

Applications in education:-

Since this robot has C language programming support has simplicity of programming this robot can perform vital task of teaching children's like few I have explained below

1. This robot can be programmed to a task like walk to particular class of school and give students information regarding their next class recess or lunch break.
2. This robot can be programmed to teach students regarding maintaining basic hygiene and cleanliness using its voice recording and repetition feature.
3. The robot can be controlled by remote or Wi-Fi from laptop so one can arrange robots football matches having each individual kid as a driver of particular robot for competition.

Conclusion:-

Robotics is an emerging trend in current time, it is in early adoption phase, and in near future it is expected to grow tremendously. Robotics and its applications are widening day by day and it is expected to be a vital part of human life in near future. The next inter admission in the robotics is Artificial Intelligence, Machine Learning and Robotic Process Automation, and it will perform a significant role in human life in near future. We have to adopt to those emerging trends for the sustenance of our next generation. In this regard the educational robots like Lego Mindstorms ev3 could play a major role. The application of robotics in the educational field will be definitely a revolutionary step. Especially the order of world is changing after the situation of Covid-19. Sanitization and social distancing are becoming the essential and compulsory practices. The above robots can be used for sanitization of classrooms and the premises of institute too. Also it will be helpful for maintaining the academic records of the institute.

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3D Printing Technology, Material Used For Printing and its Applications

Mr. A. A. Shinde[1], Mr. R.D. Patil[2], Mr.A.R.Dandekar[3],Dr.N.M.Dhawale[4]

Abstract:-This is research paper on the 3D-printer in which reader introduced basic components operation materials used for making objects and applications. Now a day we are growing every day and every second. We adopt new technology with new invention and create new invention and create new things for enjoys life very easily. There are lots of new technologies we adopted in our daily life. In this technology one of them is 3D-printer. This is one of innovation on this we can make many objects.

Keywords: 3-D Printer,Manufacturing, Rapid Prototyping, Application of 3D Printing

1. Introduction[1]

The birth of 3D-printer was 1974, David E. H. Jones laid out the concept of 3D-printing. In 1984, chuck hall of 3D system corporation filled his own patent. The 3D-printing it is the process in which making 3D objects from digital file. In this process objects made by printing layers on one another of specific material until entire object complete. This is one of the best process to create any complex objects in minimum time without complex process and large machines.

2. Basic components of 3D-printer[1]

2.1 Print bed

The print bed is flat surface where the extruder deposits the filament from solid objects. This bed is heated while printing but it is depends upon which filament or material we are going to use. Most of the beds are made of aluminum but now a days there is also glass print beds available.

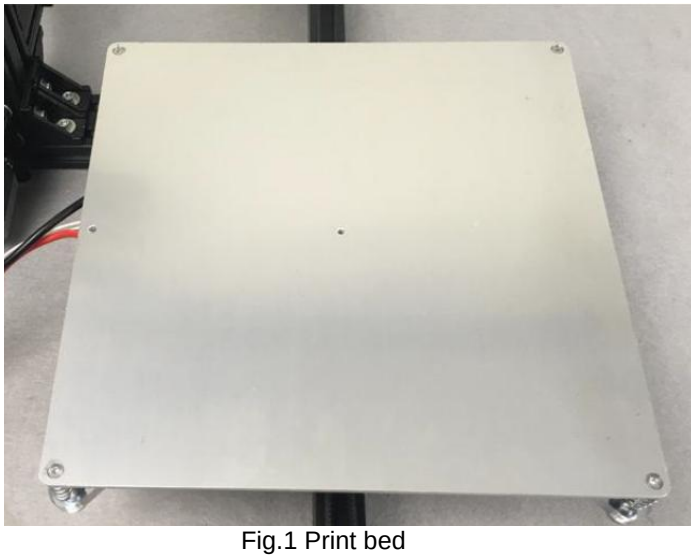


Fig.1 Print bed

2.2 Extruder

The extruder is the part that feeds heated filaments on the bed. This plays very important role in printing objects. Firstly in extruder filament exerts then it is heated. Due to heating filament starts melting and it starts depositing on print bed. Important part of extruder is Nozzle which also commonly known as named as tip of extruder. Through the nozzle melted filament deposits on the print bed. The size is varies from 0.25mm to 0.75mm. the most common size of nozzle is 0.5mm.

The extruder also has two types-

1) direct – Filament is fed directly to print bed
2) Bowden- Filament is fed from a certain distance.

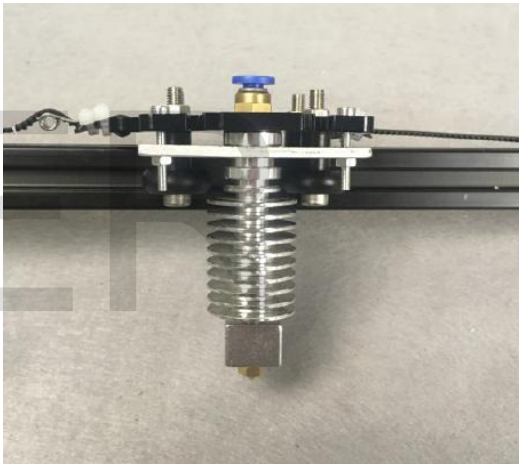


Fig.2Extruder

2.3 Filament

It is material which is inserts in extruder for making object. Commonly for 3D-printing 1.75mm or 3mm diameter filament is used. This material is in the form of wire which feed to extruder through motor. The most commonly PLA and ABS material used for printing. Filaments available in various types of material which we will discuss further.

2.4 Mother board or controller board

The mother board or controller board is brain of the 3D-printer. It directs the motion of components of 3D-printer.

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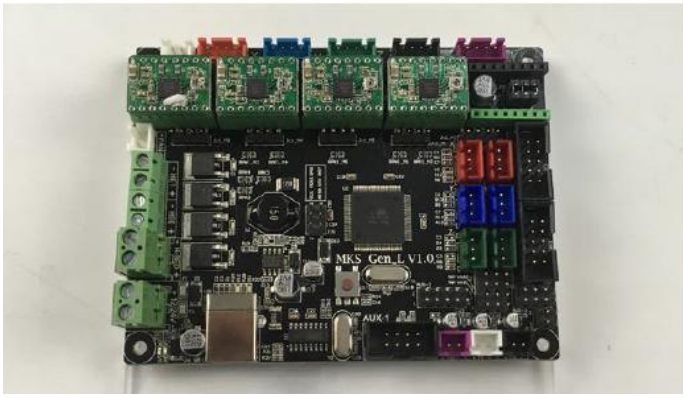


Fig.4Mother board or controller board

3.Operationof 3D-printer

3.1 Step-1

This step contains drafting of 3D objects which we want to print in CAD software. But we can't use 3D objects file as it is. These files needs to converts in to STL file format. There are many software available in market which can used for drafting and modeling also. Some of these are fusion360, Solid Works, Auto CAD etc. Also now day's 3D scanners are also available for making programmer file. This program sends to main board of printer by using computers also by the pen drives or memory card.

3.2 Step-2

This is the last step of 3D-printing. When the program given to the printer as per requirement material starts to heating in extruder and filament starts to melt. This melting material deposited on print bed as per programed and object made by depositing materials layer by layer on one another. The layers are horizontal, cross, zigzag way with each other also in hexagonal or honey comb structure.

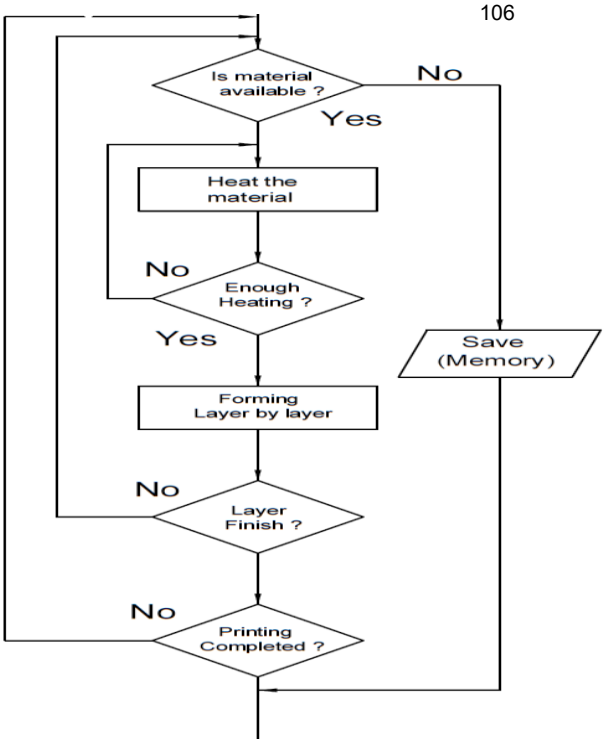


Fig.5Flow chart of 3D printing operation

4 Materials used in 3D-printing technology[2]

In the 3D-printing needs high quality materials for making high quality devices. 3D-printers technology is capable to making high quality devices by using of many types of material like metals ceramics and their combination forms.

4.1 Plastic[3]

This most common material used for 3D-printing. This is most diverse material for 3D Printed toys and household products. This available in transparent and also in colors like green red yellow etc. Plastic is light in weight also high durability its surface smoothness very well. The types of plastic used in this process are usually made from one of the following materials

1) Polyastic acid (PLA)

This is eco-friendly material. PLA made up of from sugar cone and corn starch therefore biodegradable. This is available in two forms soft and hard. Plastics are made from polyastic acid so it is ued in industries hard polyastic acid are stronger and therefore they used for making ideal products.

2) Acrylonitrille butadiene styrene (ABS)

ABS is best option of home based 3D-printiners. It is valued for strength and safety. ABS is available in various colors. This makes the material suitable for products like stickers and toys. ABS also used to make jewelry and vases.

3) Polyvinyle aicohol plastic (PVA)

It is used in low end home printers. It is low cost. This material used for temporary used items.

4) Polycarbonate (PC)

PC is only used on this printer which feater nozzle is designed and operates on high temperature. This is less frequently used.

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4.2Powders

Today's 3D-printers use powdered materials to construct objects or products. This powders is melted inside the printer and distributed in layers unit the preferred thickness and pattern are made. There are many powders used in printers but most common are

1) Polyamide (Nylon)

Nylon strength and flexibility is very therefore it is used for joining pieces and interlocking parts in 3D models.

2) Alumide

This powder makes the strongest products. This is mainly used for makes industrial models and prototypes.

4.3Metal[4]

The second most popular material in industry of 3D-printing is metal. The properties of this material is strong hard more life and long lasting life. The properties of metal is good hence we make complex shapes human organs and aerospace's parts. They also make jewelry. Various metals used for products are below

1) Stainless steel-printing out utensils cookware and other items that could ultimately come in contact with water.
2) Bronze -Used for vases and other products.
3) Gold -Printed for jewellery likes ring d earing brackets etc.
4) Nickel-Used for printed coins
5) Aluminium -Used for printed thin metal objects
6) Titanium -It is best option for strong solid fixtures

4.4Resigns

Resigns properties are less flexible and strength. This is generally founds in transparent black and white but certain printed items are produced in orange red blue and green. This is less used materials used in 3D-printing There are available in three categories

1) High details reigns:-These are used for small models
2) Paintable resign :-Used in smooth surface 3D prints
3) Transparent resigns :-Used in strongest class and smother to that rouch and transparent in appearance.

In 3D-printers also used other materials like carbon fiber graphite and graphene nitinol paper

5. Applications[5]

There are many sectors where we can use this technology these are

1) Aerospace:-In this field many are directly made by using 3D-printer. The aerospace and defence industries contributed 16% of 3D-printing. SLA and material jetting are used to produce high details smooth scale models of aerospace design.
2) Food :-Additives manufacturing of food is being developed by using 3D-printing. NASA also worked on this technology which is making food on 3D-printer in the space. A larger no. of variety of foods are making on 3D-printers such as the chicalotes candies pizza flat food. This technology helps to limit food waste.[6]
3) Automobile industry:-In our automobile industries developed very fast new innovations are comes out from industry. Now a days industries adopted 3D-printing technology for making products.
4) Medical application :-This technology also used in medical application for printing skin bones drug organs medical equipment's tissues pharmaceutical research. 3D-printing also can be used to create human organs.[7]
5) Art and jewellery :-By using this technology also used for printing jewellery. This used for printing many decorative parts.[8]

5. Conclusion

3d printing have large scale industrial area where we can developes new things.New 3D printing technologies take less time for making products.This products making highly precise product in less time and less cost without any big equipment and machine,so is plays very important role in our industrial areas.This research paper helpful for studies on future scope of 3D printing and also new technologies and their applications.In world wide,big market available for this type of technology.

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EMPIRICAL MODELING AND PERFORMANCE COMPARISON OF DECENTRALIZED PI/PID CONTROLLERS FOR TWO-TANK INTERACTING PROCESS

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Abstract

In this paper, a decentralized PI controller tuning method for two-input two-output (TITO) processes is proposed to control Two-tank interacting process. In this method, the practically desired closed-loop diagonal transfer functions and the dynamic detuning factors to reduce the interactions are proposed. Then the ideally desired multi-loop controllers are inversely derived, however, which are involved with time delays in a complex manner. Therefore, to avoid difficulty in realization, the mathematical Maclaurin series expansion is utilized to represent them in a conventional PI form. To obtain empirical model (Transfer function matrix) of this process, it is interfaced to Emerson Delta-V DCS system and excited with PRBS (pseudo-random-binary-sequence) inputs. The designed decentralized PI controller is implemented in computer using Emerson Delta-V DCS system and real time test is carried out to show practical applicability of design method. The performance of Liu et al. method is compared with prevalent techniques like Tavakoli et al. method and Wang et al. method. The corresponding readings and analysis is mentioned in the results section. The results obtained with the proposed method are much encouraging.

Keywords: MIMO process; Maclaurin series; Experimental model; PRBS input

Introduction

Most chemical processes are basically multi-input multi-output MIMO systems, and moreover, a large number of MIMO processes with I/O's beyond two can be treated as several TITO subsystems in engineering practice Lengare [1], Musmade [2], Mokadam [3]. However, compared with SISO counterparts, MIMO systems are more difficult to control due to the existence of interactions between input and output variables. Adjusting controller parameters of one loop affects the performance of the others, sometimes to the extent of destabilizing the entire system. To ensure stability, many industrial decentralized controllers are tuned loosely, which causes inefficient operation and higher energy costs. For easier field implementation, it is desirable to apply well established single loop PID tuning principles to these MIMO processes Astrom [4] . Many methods have been proposed in literature and can be classified as follows Chiang 2003:

1) Detuning methods
2) Sequential loop closing methods
3) Iterative or trial-and-error methods.
4) Simultaneous equation solving or optimization methods
5) Independent methods
6) Relay auto-tuning [5]

It should be noted that most of the recently developed decentralized and centralized PI/PID controller design methods were based on numerical calculation and iteration and, therefore, are time-consuming and troublesome for implementation from the viewpoints of control engineers and practitioners, even though all of them were capable of achieving remarkably improved control performance in comparison with previously developed methods based on the simple controller design formulas or tuning rules. In addition, there always exists the unmodeled dynamics of an actual TITO process in practice. Therefore, model-based control methods are desired to be capable of on-line tuning so as to cope with the process uncertainties, which again seems to be impossible for many existing multiloop control methods. In this paper, simple decentralized PI controller method proposed by Liu et al. which overcome the above-mentioned deficiencies, is effectively applied to laboratory Two-tank interacting TITO process Liu 2005 Liu [6] .

Decentralized Tito Structure Controllability

Let the stable TITO process transfer function matrix is represented as

$$G(S) = \begin{bmatrix} g_{11}(s) & g_{12}(s) \\ g_{21}(s) & g_{22}(s) \end{bmatrix} \quad (1)$$

Consider the general transfer function matrix form of TITO processes with time delays as given in equation 1. Each matrix element $g_{ij}(s) = g_{oij}(s)\exp^{-\theta_{ij}(s)}$ and i,j=1,2 of which $g_{oij}(s)$ is the delay-free part and a physically proper and stable transfer function. Figure 1 shows the commonly used multiloop control structure, where c1 and c2 are the multiloop controllers, and u1 and u2 denote the controller outputs respectively.
The closed-loop system transfer matrix can be obtained as

$$H = GC(I + GC)^{-1} \quad (2)$$

Where C represents diagonal controller matrix, i.e., $C = \text{diag}\{c_1, c_2\}$. Here it should be noted that absolute decoupling regulation of the binary system outputs is impractical within the framework of a multiloop control structure. In fact, the multiloop control structure shown in Figure 1 can be rearranged for analysis as the block diagonal closed-loop structure shown in Figure 2. Here G is composed of the Diagonal transfer functions of the process transfer matrix, i.e., $G = \text{diag}\{g_{11}, g_{22}\}$, which connects the desired pairings between the binary system inputs and outputs. Meanwhile, $G - \bar{G}$ is regarded as the additive uncertainty of the diagonal transfer matrix G.

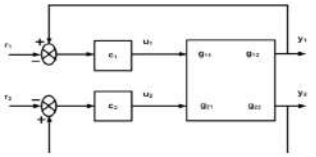


Fig. 1: Decentralized TITO control structure

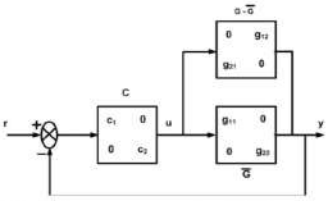


Fig. 2: Block diagram representation of additive uncertainty

The Desired Closed-Loop Diagonal Transfer Functions

From Figure 2, the nominal transfer function matrix of the block diagonal closed loop system without the additive uncertainty is

$$\bar{H} = \bar{G}C((I + \bar{G}C)^{-1}) \quad (3)$$

Hence, following some linear algebra, the diagonal controller matrix is derived as

$$C = \bar{G}^{-1}(\bar{H}^{-1} - I)^{-1} \quad (4)$$

Therefore, the multiloop/decentralized controllers are obtained in the following form.

$$c_i = \frac{1}{g_{ii}} \frac{h_i}{1-h_i}, i = 1,2 \qquad (5)$$

Note that $g_{ii}(s) = g_{0ii}(s)\exp^{-\theta_{ii}(s)}$ contains time delay θ_{ii} It can be seen from equation 5 that if the desired transfer function h_i, connecting the system input r1, and output y1, were not to include θ_{ii}, the corresponding controller ci, would have to behave in a predictive manner. In addition, if g_{ii} has any right-half-plane (RHP) zeros, they should be included in hi such that the resulting controller ci will not include them as unstable poles. Hence according to the H2 optimal performance objective of the IMC theory, the desired closed-loop diagonal transfer functions are proposed as,

$$h_i = \frac{e^{-\theta_{ii}s}}{(\lambda_i s+1)^{U_i}} \prod_{K=1}^{V_i} \frac{(-z_{ik}s+1)}{(z_{ik}s+1)}, i = 1,2 \qquad (6)$$

Where λ_i is an adjustable parameter for obtaining the desirable ith system output response, Ui is the relative degree of g_{0ii}, z_k^{-1} is the RHP zero of g_{ii}, and Vi is the number of these RHP zeros. However, substituting equation 4 into 2, the transfer matrix of the perturbed block diagonal closed-loop system with the additive uncertainty $G - \bar{G}$ shown in Figure 2 is,

$$H = G(\bar{G} + \bar{H}(G - \bar{G}))^{-1}\bar{H} \qquad (7)$$

The diagonal transfer functions will not be in the form of equation 6. if the decentralized controllers are to be directly derived from equation 5, To implement the desired closed-loop diagonal transfer functions shown in equation 6. A diagonal dynamic detuning matrix $D = \mathrm{diag}\{d_1, d_2\}$ is used to modify the diagonal system transfer function matrix shown in equation 3

$$D\bar{H} = \bar{G}C(I + \bar{G}C)^{-1} \qquad (8)$$

The decentralized controller matrix obtained as follows.

$$C = \bar{G}^{-1}(\bar{H}^{-1}D^{-1} - I)^{-1} \qquad (9)$$

Hence the actual decentralized system transfer matrix obtained as

$$H = G(D^{-1}\bar{G} + \bar{H}(G - \bar{G}))^{-1}\bar{H} \qquad (10)$$

Therefore, if one lets

$$\mathrm{diag}\{G(D^{-1}\bar{G} + \bar{H}(G - \bar{G}))^{-1}\} = I \qquad (11)$$

Hence the dynamic detuning factors obtained by substituting equation 1 and 6 into equation 11

$$d_1 = \frac{2g_{11}g_{22}}{[(h_1 - h_2)g_{12}g_{21} + g_{11}g_{22} + ((-1)^m)\sqrt{[(h_1 - h_2)g_{12}g_{21} - g_{11}g_{22}]^2 - 4g_{11}g_{22}g_{12}g_{21}(1-h_1)h_2}]} \qquad (12)$$

$$d_2 = \frac{2g_{11}g_{22}}{[(h_2 - h_1)g_{12}g_{21} + g_{11}g_{22} + ((-1)^m)\sqrt{[(h_1 - h_2)g_{12}g_{21} - g_{11}g_{22}]^2 - 4g_{11}g_{22}g_{12}g_{21}(1-h_1)h_2}]} \qquad (13)$$

Where

$$m = 0, g_{11}(0)g_{22}(0) > 0$$
$$m = 1, g_{11}(0)g_{22}(0) < 0 \qquad (14)$$

Note that the choice of m in equation 14 is to guarantee d1(0) = d2(0) = 1. Combining the equations 6

and 8 with equations 12-13, the diagonal transfer matrix for deriving the desired decentralized controllers such that to implement the H2 optimal closed-loop diagonal transfer functions is given in equation 15.

$$\bar{H} = D\bar{H} = \text{diag}\left\{\frac{d_i e^{-\theta_{ii} s}}{(\lambda_i s+1)^{v_i}} \prod_{k=1}^{V_i} \frac{(-z_{ik}s+1)}{(z_{ik}s+1)}\right\}, i = 1,2 \qquad (15)$$

Decentralized Pi Controller Design

The ideally optimal decentralized controller obtained by substituting proposed diagonal transfer matrix given in equation 15 in equation 9 as follows

$$C_{i-ideal} = \frac{1}{g_{ii}} \frac{d_i b_i}{1-d_i b_i}, i = 1,2 \qquad (16)$$

Note that, ideally optimal decentralized controller in equation 16 will be involved with time delays in a complex manner and also pole-zero cancellation is possible. For simplicity, an analytical approximation method based on the Maclaurin series expansion is proposed as follows. Also the controllers given in equation 16 have a integrating property. Therefore, let

$$M_i(s) = sc_{i-ideal}(s), i = 1,2 \qquad (17)$$

Using the Maclaurin series expansion, the rational approximation of equation 16 is obtained as,

$$C_{i-Mac}(s) = \frac{1}{s}\left[M_i(0) + M_i'(0)s + \frac{M_i''(0)}{2!}s^2 + \ldots\ldots + \frac{M_i^n(0)}{n!}s^n\right] i = 1,2 \qquad (18)$$

Hence, using two terms of above equation a standard PI controller is,

$$C_{i-PI}(s) = K_{ci}\left(1 + \frac{1}{T_{Ii}s}\right) i = 1,2 \qquad (19)$$

Simulation Examples

The two Simulation examples are incorporated in order to evaluate effectiveness and performance of the Liu et al. decentralized PI controller design method. The results of Liu et al. method are compared with those of some prevalent techniques like Tavakoli et al. [7] method and Wang et al. [8] .

A. Example 1: Wood and Berry (WB) Distillation Column

The WoodBerry binary distillation column process is typical TITO process with strong interaction and significant time delays Wood [9], Liu [6]. The process has the following transfer function matrix is,

$$G(s) = \begin{bmatrix} \frac{12.8e^{-s}}{16.7s+1} & \frac{-18.9e^{-3s}}{21s+1} \\ \frac{6.6e^{-7s}}{10.9s+1} & \frac{-19.4e^{-3s}}{14.4s+1} \end{bmatrix}$$

In Liu et al., Tavakoli et. al. and Wang et. al. method, take adjustable parameters $\lambda_1 = 25$ and $\lambda_2 = 16$ in order to obtain the similar set-point response rising speed with the above two methods. The Liu-PI controller is given as follows

$$\text{Liu} - \text{PI} = \begin{bmatrix} 0.3724 + \frac{0.07812}{s} & 0 \\ 0 & -0.4097 - \frac{0.05155}{s} \end{bmatrix}$$

The Tavakoli-PI controller is given as follows

$$\text{Tavakoli} - \text{PI} = \begin{bmatrix} 0.4100 + \dfrac{0.0740}{s} & 0 \\ 0 & -0.01200 - \dfrac{0.0240}{s} \end{bmatrix}$$

The Wang-PID controller is as follows,

$$\text{PID} = \begin{bmatrix} 0.019 + \dfrac{0.019}{s} - 0.202 & 0.0073 + \dfrac{0.010}{s} - 0.411 \\ 0.028 + \dfrac{0.006}{s} - 0.264 & -0.0094 - \dfrac{0.0075}{s} + 0.0099 \end{bmatrix}$$

In the simulation study, first and second outputs of resultant control system, to unit step set-point changes were sequentially introduced into the individual loops are shown in Figures 3-4. The performance indexes such as damping ratio (ξ), time

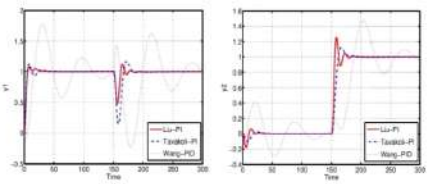


Fig. 3: First and second output to a unit step in the first input (Example 1)

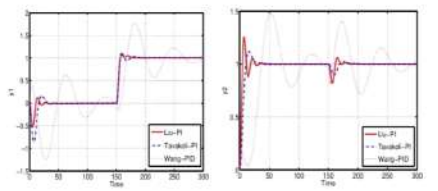


Fig. 4: First and second output to a unit step in the second input (Example1)

Delay (Ts), integral absolute error (IAE), integral square error (ISE), integral time absolute error (ITAE) are given in Table 1. From figure 3-4 and Table 1 the performance of Liu-PI

Controller	Loop	ξ	Ts	IAE	ISE	ITAE
Liu-PI	1	0.69	29.13	8.35	3.89	696
	2	0.83	21.28	6.78	3.02	280
Tavakoli -PI	1	0.79	27.14	13.88	7.57	1553
	2	0.58	33.49	8.79	4.76	273
Wang PID	1	0.11	199.05	98.91	61.66	12949
	2	0.22	167.07	64.55	31.72	571

Table I: Performance indexes for Examples 1

Controller results better performance as compared to Tavakoli-PI, and Wang-PID controllers.

B. Example 2: Vinate and Luyben (VL) Distillation Column
Consider the Vinate and Luyben plant Liu2005 and Wang2008. The plant has following transfer function matrix

$$G(s) = \begin{bmatrix} \frac{-2.2e^{-s}}{7s+1} & \frac{1.3e^{-0.3s}}{7s+1} \\ \frac{-2.8e^{-1.8s}}{9.5s+1} & \frac{4.3e^{-0.35s}}{9.2s+1} \end{bmatrix}$$

For Liu et al.'s method $\lambda_1 = 3$ and $\lambda_2 = 5$. The Liu-PI controller obtained as below.

$$\text{Liu} - \text{PI} = \begin{bmatrix} -2.5178 - \frac{0.4545}{s} & 0 \\ 0 & 2.1423 - \frac{0.2325}{s} \end{bmatrix}$$

The Tavakoli-PI controller is given as follows

$$\text{Tavakoli} - \text{PI} = \begin{bmatrix} -3.7960 + \frac{0.6671}{s} & 0 \\ 0 & 1.8250 + \frac{0.2137}{s} \end{bmatrix}$$

The Wang-PID controller is as follows,

$$\text{PID} = \begin{bmatrix} -0.100 - \frac{0.123}{s} + 0.655 & 0.012 + \frac{0.029}{s} - 0.368 \\ -0.234 + \frac{0.110}{s} + 0.643 & 0.020 + \frac{0.049}{s} - 0.623 \end{bmatrix}$$

In the simulation study, first and second outputs of resultant control system, to unit step set-point changes were sequentially introduced into the individual loops are shown in Figure 5 and 6. The performance indexes such as damping ratio (ξ), time delay (Ts), integral absolute error (IAE), integral square error (ISE), integral time absolute error (ITAE) are calculated and given in Table II From Figures 5-6 and [6] [8].

Controller	Loop	ξ	Ts	IAE	ISE	ITAE
Liu-PI	1	0.86	17.13	3.23	1.86	149
	2	1	17.41	3.24	1.46	176
Tavakoli-PI	1	0.88	17.34	3.02	1.74	169
	2	090	17.36	3.07	1.48	120
Wang PID	1	0.54	59.71	13.88	6.88	614
	2	0.32	64.67	33.68	21.88	3.61 x 103

Table II: Performance indexes for Examples 2

The performance of Liu-PI controller results better performance as compared to Tavakoli-PI, and Wang-PID controllers.

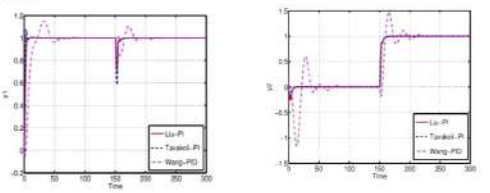


Fig. 5: First and second output to a unit step in the first input Example2)

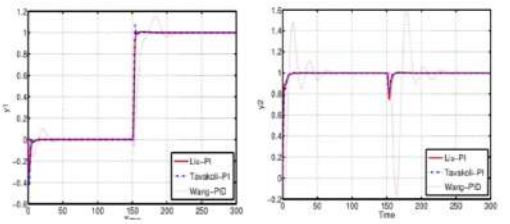


Fig. 6: First and second output to a unit step in the second input (Example 2)

Real Time Application

To show the practical applicability, decentralized PI controller design method presented in Sections 2-4 are studied for a laboratory Two-tank interacting TITO process as shown in Figure 7. The experimental set-up of Two-tank interacting process consists of control components like two interacting tanks, level transmitters, magnetic flow meter, vertex flow meter, pneumatic control valves and pumps. The process inputs are an inflow rates (infow rate-1, infow rate-2) through control valves for loop 1 loop 2. Also the first and second outputs of the process are liquid levels (level-1, level-2) in the tanks for loop 1 and loop 2. The process is interfaced to personal computer through Emerson's Delta-V DCS system and it is used to implement the controllers. The experimental model of the Two-tank interacting process is obtained by exciting the system dynamics using PRBS (pseudo random binary sequence) inputs. There are numerous types of input sequences which can provide useful information about the process, the input is usually changed according to a PRBS pattern Heidelberg [10], Khandekar [11], Malwatkar [12], Maghade [13]. A PRBS is added to the inputs of process and its effects on liquid levels recorded for 1400 seconds. The input and output data are used to build an experimental model of the process using MATLABs identification toolbox. The process inputs and outputs are shown in following Figures 8-13



Fig. 7: Photograph of Two tank Interacting Process.

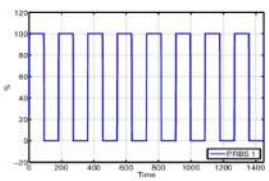


Fig. 8: PRBS input for infow rate-1.

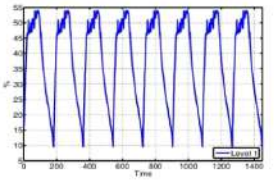


Fig. 9: Measured liquid level-1.

The process transfer function matrix is obtained using four models relating inflow rates to liquid levels. An empirical

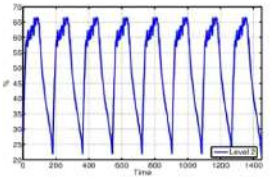


Fig. 10: Measured liquid level-2

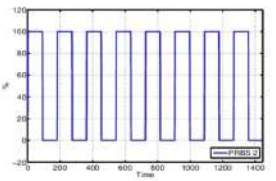


Fig. 11: PRBS input for inflow rate-2.

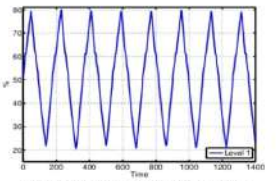


Fig. 12: Measured liquid level-1

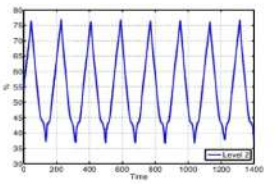


Fig. 13: Measured liquid level-2.

The process transfer function matrix is obtained using four models relating inflow rates to liquid levels.

An empirical model of two tank interacting process is,

$$G(s) = \begin{bmatrix} \frac{0.5581e^{-1.2655s}}{123.2113s+1} & \frac{1.0047e^{-9.5196s}}{71.6628s+1} \\ \frac{0.5269e^{-7.2787s}}{164.08215s+1} & \frac{4.3e^{-0.25s}}{121.4398s+1} \end{bmatrix}$$

For Liu et al. method, consider $\lambda_1 = 100$ and $\lambda_2 = 100$ in order to obtain the similar set point response rising speed.The Liu-PI controller is given as follows,

$$\text{Liu} - \text{PI} = \begin{bmatrix} 211.8149 + \frac{1.79138}{s} & 0 \\ 0 & 109.4506 + \frac{0.92577}{s} \end{bmatrix}$$

The Tavakoli-PI controller is given as follows

$$\text{Tavakoli} - \text{PI} = \begin{bmatrix} 22.68 + \frac{1.741}{s} & 0 \\ 0 & 9.7785 + \frac{0.8527}{s} \end{bmatrix}$$

In the simulation study, first and second outputs of resultant control system, to unit step set-point changes were sequentially introduced into the individual loops are shown in Figure 14 and 15. The performance indexes such as damping ratio (ζ), time delay (Ts), integral absolute error (IAE), integral square error (ISE), integral time absolute error (ITAE) are given in Table III. The Liu et al. controller and Tavakoli et. al. controller are

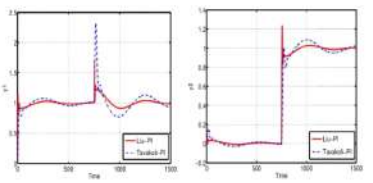


Fig. 14: First and second output to a unit step in the first input for Two Tank Interacting Process.

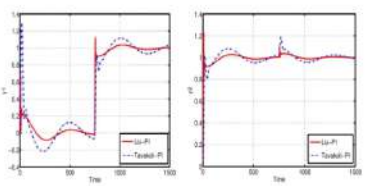


Fig. 15: First and second output to a unit step in the second input for Two Tank Interacting Process tested using Emerson's Delta-V DCS system, where Tavakoli et al. controller is used for comparison purposes. The set points 70 % and 62 % at time t = 0 second are given for loop 1 and loop 2. Similarly set points 50 % and 42 % at time t = 380 seconds are introduced for loop 1 and loop 2. The corresponding responses are shown in Figure 16 for Liu et al. and Tavakoli et. al. controllers. From Figures 14-16 and

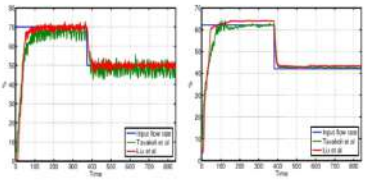


Fig. 16: Real time testing for Two-tank interacting process.

Controller	Loop	ζ	Ts	IAE	ISE	ITAE
Liu-PI	1	0.628	837	145	47	1.13 X 105
	2	0.621	839	62	10	3.08 X 104
Tavakoli-PI	1	0.745	346	157	49	7.89 X 104
	2	0.747	344	62	10	3.08 X 104

Table III: Performance indexes for Two Tank Interacting Process

Table III, the performance of Liu-PI controller results, better performance as compared to Tavakoli-PI controller

Conclusion

It is apparent from simulation and experimental study the Liu et al. PI controller performs well as compared to Tavakoli et. al. controller. The real time experimental results, as shown in figure 16 shows the practical applicability of the Liu et al. controller hence, this controller design method can be conveniently applied to various TITO processes in industry. The Liu et al. method can also be extended for designing the PID controller for TITO processes.

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Madhukar S.Chavan

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Abstract: Aircraft are becoming unmanned increasingly popular as demands for increasing population and agriculture are being met. With the right cameras, detectors and components, Drones will contribute to a simple, effective and accurate cultivation. The solutions proposed for these drones can help improve things even further if they are integrated into various machine learning concepts and internet concepts. This document highlights the related work in this area along with suggested solutions that can be integrated into drones using the result of the Microcontroller 8051 module.

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Abstract: Pomegranate is one of India's most commonly cultivated fruit crops. manual expert observations are being used to detect leaf diseases that take longer time for further prevention. Fruit diseases are causing devastating disadvantages in worldwide agricultural business economic losses in production .in this journal, the answer is proposed and valid by experiment for the identification and classification of fruit disorders. The objective of proposed work is to analyze the illness utilizing picture preparing and artificial intelligence techniques on pictures of pomegranate plant leaf. In the proposed framework,

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Pitch Estimation using Time Domain Algorithm

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Abstract: Speech is classified into voice, unvoiced and silence. The voice speech is the periodic vibration of vocal folds. Background noise affects the speech signals. In many speech applications calculation of pitch plays a major role. The paper proposes a pitch detection algorithm based on the short-time average magnitude difference function (AMDF) and the short-term autocorrelation function (ACF). Detecting the Pitch within the speech signal is important in most of all the speech related applications. Detection of Pitch is useful in identification of speaker. One solution to get detect with the pitch

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K-SVD: Dictionary Developing Algorithms for Sparse Representation of Signal

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Abstract - *Now days trend in study of sparse representation of signals. In spare representation having overcomplete dictionary that contain prototype signal-atoms, signals are elaborated by sparse linear combinations of these atoms. There are many applications in sparse representation which include compression, consistency in inverse problems, feature extraction, and more. We concentrated basically on study purpose of pursuit algorithms that decompose signals with respect to a given dictionary D. We are developing method the K-SVD algorithm generalizing the K-means clustering process. K-SVD is a mathematical method that develop the algorithm alternates between sparse coding data using the dictionary D and apply process for updating the dictionary atoms to get the correct data. After updated dictionary columns which is combined with an update of the sparse representations. The developed K-SVD algorithm is adaptable. It can also work with any type of pursuit method.*

***Key Words*: Basis pursuit, dictionary, FOCUSS, K-means, K-SVD, matching pursuit.**

1. INTRODUCTION

Sparse representations using learned dictionaries D are being more helpful with success in various types of data processing and machine learning applications. The accessibility of large amount of training data necessitates the development of suitable, robust and better dictionary learning algorithms. For algorithmic stability and generalization of dictionary learning algorithms we are using two cases:

1. Complete: a system {yi} in X is complete if every element in X can be arbitrarily well in norm by linear combinations of elements in {yi}.

2. Overcomplete: if removal of an element from the system {yi} results in a complete system. The arbitrary approximation in norm can be thought as a representation somehow.

K-SVD algorithm for studying dictionaries D. We explained its development and analysis, and formalized applications to establish its usability and the advantage of trained dictionaries D. Diversities of the K-SVD algorithm for learning structural constrained dictionaries are also showcased. Out of those constraints are the non-negativity of the dictionary and shift invariance property. K-SVD deals with development of a state-of-the art image denoising algorithm. This case study is important as it nourishes the message that the general model of sparsity and redundancy, along with fitted dictionaries as also used here, it is the good practical applications in image processing.

1.1 Sparse Representation of signal

Let us consider the overcomplete dictionary matrix D ∈ Rn×K that include K prototype signal atoms for columns, {dj} K j=1, a signal, here y ∈Rn can be represented as a linear combination of these atoms. That present the y = Dx, or y ≈ Dx, ||y−Dx|| p ≤ Ɛ. The vector x ∈ R^k contains the representation coefficients of the signal y. In some method, for measurement of the deviation we are using the l^p -norms for p = 1,2 and ∞. Here we are focusing on the case of p = 2. If n < K and D is a full-rank matrix, several alternative methods are available for the representation problem. The solution with nonzero coefficients is certainly an applicable for representation. This sparsest representation is the solution of either (P0) min ||x||0 for finding approximating solutions have been extensively investigated and indeed, several effective decomposition algorithms are available.

2. Methodology

K-SVD Algorithm two steps, one is Sparse Coding that contain producing sparse representations matrix X, given the current dictionary D. Another one is Dictionary Update D include updating dictionary atoms, given the current sparses representations.

2.1K-SVD frame

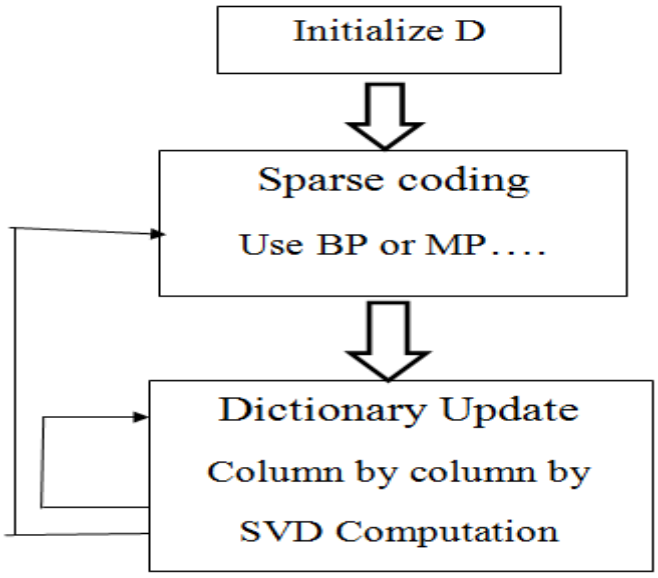


Fig: Basic Frame of K-SVD

2.2 Basic Algorithm of K-SVD

1. Input: Signal set Y, initial dictionaries D0, target sparsity S, number of iteration L.

2. Output: Dictionary D and sparse matrix X such that Y=DX.

3. Init: set D =D0

4. for n=1, ……..L do

5.$\forall i: xi = Arg\ min||yi - Dx||$ subject to ||x||0 ≤ S

6. for j=1, …. K do

7. dj=0

8. I= {indices of the signals in Y whose representations use dj}

9. E=Yi=D Xi=Yi-$\sum_{i\neq j} dj\ Xl, I$

10.{d, g}=$Arg\ min_{d,g} ||E - dg^T\ ||_f^2 \quad subject\ to\ \|\ d\ \|_2^1 = 1$

11.dj =d;

12.Xj, I=g^T

13.end for

14.end for

Initially, we set D and to search the better coefficient matrix. According to given data searching the optimal is difficult. By using pursuit method, we will calculate coefficients, it can provide a solution data with a fixed. When that step is done, next step is showing to find for a best dictionary. This task updates only one column at a time, fixing all columns in rather than one and searching a new column and new values for that coefficients will helpful for better decreases the MSE. We change the columns

in sequence manner and permit to changing the respective coefficients. Once we modify the search column according to K-means then ready to procced to next generalization of the K-mean

We designed dictionary for performance of K-SVD in synthetic and real image application. In recent days K-SVD algorithm have more demand, especially when the dimensions of the dictionary increase, or the number of training signals becomes large. Initially apply the K-SVD algorithm on synthetic signals method, for checking is this algorithm occupies the original dictionary D that originating from the data and to compare its results with related algorithms. Generation of the data train that describes a random matrix (referred to later as the generating dictionary) of size 20 x50 was generated with uniformly distributed entries. Each column was normalized to a unit l^2-norm. Then, 1500 data signals of dimension 20 were produced, each of them made by a linear combination of three various dictionary atoms, with uniformly distributed coefficients in random and independent locations. White Gaussian noise with varying signal-to-noise ratio (SNR) was added to the resulting data signals. Applying the K-SVD, the dictionary was initialized with data signals. The coefficients were found using OMP with a fixed number of three coefficients. The maximum number of iterations was set to 80. Comparison to other reported works we implemented the MOD algorithm and applied it on the same data, using OMP with a fixed number of three coefficients and initializing in the same way. We executed the MOD algorithm for a total number of 80 iterations. We also executed the MAP-based algorithm of Kreutz-Delgado. This algorithm was executed as is, therefore using FOCUSS as its decomposition method. Here, again, a maximum of 80 iterations were allowed.

3. CONCLUSION

According to work we proposed the problem of generating and using overcomplete dictionaries. We developed an algorithm the K-SVD for training an overcomplete dictionary which is better for group of given signals. From this we generalized K-means algorithm, implement designed for solving a same but related problem. We also proved that dictionary which found by K-SVD. On that performance we will apply for both synthetic and real image in different applications. We used all this technology for filling in missing pixels and compression and outperforms alternatives such as the non-decimated Haar and over complete or unitary DCT.

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K-SVD: Dictionary Developing Algorithms for Sparse Representation of Signal

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Abstract: ***In recent year, there has been growing interest in study of sparse representation of signals. In spare representation having overcomplete dictionary that contain prototype signal-atoms, signals are elaborated by sparse linear combinations of these atoms. There are many applications in sparse representation, which include compression, consistency in inverse problems, feature extraction, and more. Proposed work concentrated on study purpose of pursuit algorithms that decompose signals with respect to a given dictionary D. For developing method, the K-SVD algorithm generalizing the K-means clustering process. K-SVD is a mathematical method that develop the algorithm alternates between sparse coding data using the dictionary D and apply process for updating the dictionary atoms to get the correct data. After updated dictionary columns which is combined with an update of the sparse representations. The developed K-SVD algorithm is adaptable. It can also work with any type of pursuit method.***

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I. INTRODUCTION

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II. LITERATURE REVIEW

R. Coifman, [1] this article combines the Haar -Fisz transform with Bayesian wavelet shrinkage to obtain a new method for modelling the evolutionary wavelet spectrum of a locally stationary wavelet process. new method produces excellent and stable spectral estimates and this is demonstrated via simulated data and on differenced infant electrocardiogram data.

A major additional benefit of the Bayesian paradigm is that we obtain rigorous and useful credible intervals of the evolving spectral structure.

We show how the Bayesian credible intervals provide extra insight into the infant electrocardiogram data.E. P. Simoncelli [2] Orthogonal wavelet transforms have recently become a popular representation for multi-scale signal and image analysis. One of the major drawbacks of these representations is their lack of translation invariance: the content of wavelet subbands is unstable under translations of the input signal.

Wavelet transforms are also unstable with respect to dilations of the input signal, and in two dimensions, rotations of the input signal. J. L. Starcko [3]The curvelet transform uses ridgelet transform as a component step, and implements curvelet subbands using a filter bank of à trous wavelet filters. A strategy for digitally implementing both the ridgelet and the curvelet transforms. The resulting implementations have the exact reconstruction property, give stable reconstruction under perturbations of the coefficients, and as deployed in practice, partial reconstructions seem not to suffer from visual artifacts. B.A. Olshausen, [4]The receptive fields that emerge from this algorithm strongly resemble those found in the primary visual cortex, and also those that have been previously deduced by engineers to form efficient image representations.S. Mallat [5] Matching pursuits are general procedures to compute

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adaptive signal representations. With a dictionary of Gabor functions a matching pursuit defines an adaptive time-frequency transform.They derive a signal energy distribution in the time-frequency plane, which does not include interference terms, unlike Wigner and Cohen class distributions. A matching pursuit isolates the signal structures that are coherent with respect to a given dictionary.

III. ALGORITHM FOR K-SVD

In atom decomposition process sparse representation coding is the process for finding the coefficient based on signal y having the dictionary D by using the equation(P0) min ||x||0 subject to y = Dx.where ||·||0 is the l^0 norm, counting the nonzero entries of a vector.To detecting the sparse representation coding signal have to prove an NP hard problem .It means NP-hard considered as H . For polynominal extracted L towards H another thing it can be solved in polynominal time it require a reduction since completion of NP problem conversion of G towards H .Few years ago pursuit algorithm have been processed .it consist of MP and OMP .These are the simple and easy method .It involves computness of inside production in between signal and column of D .Second popular method is basis pursuit using equation 1 And replace the l^0 norms with l^p norms put the values of P less than equal to Hence overall problem will become iterative method based on reweighted least square that handle the l^p norm and weighted norm.

1) *Generalization of K –Means Algorithm:* Relative information of sparse representation and vector quantization are considered as cluster of mean error signal. In clustering, a set of descriptive vectors $\{d_k\}_{k=1}^{K}$ is learned. In the sparse representation atom of signal focusses on decompose the signal and in future system all signal coefficient multiply by only one. It can be variant of the vector quantization coding method called gain-shape VQ, where this coefficient may be fluctuate. K-means process applies two steps per each iteration: i) given $\{d_k\}_{k=1}^{K}$ to their nearest neighbor and ii) given that as update $\{d_k\}_{k=1}^{K}$. In sparse coding initially find the coefficient dictionary by using above equations. When upgraded dictionary familiar with constant coefficients. In this proposed system all algorithms are differs each other .That are useful in calculation of updating dictionary .It is the easiest way to find the dictionary in various manner.
2) *Maximum Likelihood Methods:* In this method of construction of dictionaries D.The relation always suggest that y=Dx+ v .In sparse representation consist of Gaussian white residual vector v also various with σ. There are two consideration in specific manner that are independently with each other and provide the equation

$$P(Y|D) = \prod_{i=1}^{N} P(yi|D) \qquad (1)$$

The second assumption is critical and refers to the “hidden variable” .The ingredient of the likelihood function are computed using the relation

$$P(yi|D) = \int P(yi, x|D) \int P(yi|x, D).P(x)dx \quad (2)$$

By assuming relation 2 we have

$$P(yi|x, D) = Const.exp\left\{\frac{1}{2\sigma^2}||Dx - yi||^2\right\}$$

For dictionary D the equation of algorithm approaches towards the dictionary entries .That coefficient near about the zero mean. This situation can be done by constraining the l^2-norm .For iteration there are two steps i) By using gradient method need to find the coefficients Xi and then ii) upgraded dictionary using the equation

$$D^{(n+1)} = D^{(n)} - \eta \sum_{i=1}^{N} (D^{(n)}xi - yi)xi^T$$

This idea of iterative refinement, mentioned before as a generalization of the -means algorithm, was later used again by other researchers, with some variations. .The MOD method: The MOD approach tries to update a dictionary D based on the current coefficients W.

$$min_D ||Y - DW||_F^2$$

The optimal dictionary is obtained by solving the following equation.

$$\frac{\delta||Y-DW||_f^2}{\delta D}$$

This algorithm regarded with k-mean .This method is easy explain and implemented. After applying the MOD method there is still chances to improve techniques. All above methods are not faster .In that method matrix inversion step included because of this one update the MOD second order formula dictionary column are updated before turning to recounting the coefficient .Well defined objectives are the main to measure the quality of solution obtained that algorithm trying to improve the representation of square mean error or sparsity.

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A. K-mean Algorithm

Obtain possible codebook using data sample $yi_{i=1}^{N}$ by nearest neighbor for solving $min_{C,X}\{||Y - CX|\ \ |_F^2\}$ subject to $\forall i, xi = ek\ for\ some\ k.$

-Fix $C^{(0)} \in R^{nxk}$

-set J=1 do the process upto next step.Sparse coding initialize values of Y.

$$R_1\ (J-1), R2(J-1) \ldots\ldots . R_k\ (J-1)$$

$$R_k^{J-1} = \{i|\forall i \neq k, ||yi - c_k^{J-1}||_2 < ||yi - c_k^{J-1}||_2$$

C Update the steps: In every column k in $C^{(x-1)}$ update it by

$$c_k^{(J)} = \frac{1}{|R_{k|}} = \sum_{i \in R_K^{J-1}} yi$$

- Set J=J+1 sentation MSE per is defined as

$$E = \sum_{i=2}^{k} e_i^2 = ||Y - CX||_F^2$$

$$min_{C,X}\{||Y - CX||_F^2\}\ subject\ to\ \forall i, xi = ek\ for\ some\ k$$

This algorithm using the K-SVD is flexible in dictionary D for pursuit algorithm. It is simple and designed using K-means algorithm. When it comes under the algorithm at that time raise the gain-shape VQ and again reproduces the K-means algorithm. It is highly durable becouse of coding and updated gaussian method. Algorithm steps are coherent with each other, K-SVD algorithm derive description of direct extension

The approaches to dictionary D design that have been described in two steps

1) *Sparse Coding:* Producing sparse representations matrix X, given the current dictionary
2) *Dictionary Update:* Updating dictionary atoms, given the current sparses representations.

B. K-SVD Algorithm

Task- Find the best dictionary to represent the data samples

$$min_{D,X}\{||Y - DX||_F^2\}\ subject\ to\ \forall i ||xi||_0 \leq T_0$$

Initialization: set the dictionary matrix $C^{(0)} \in R^{nxk}$ with normalized l^2columns. Sparse Coding Stage

$min_{Xi}\{||Yi - Dxi||_2^2\}\ subject\ to\ ||xi||_0 \leq T_0$ Codebook Update stage: k=1, 2….K in $D^{(J-1)}$ modify it by

1) Use the atom in group of signal $\omega k = \{i|1 \leq i \leq N, x_T^k(i) \neq 0\}$
2) Find the complete error matrix E_k by $E_k = Y - \sum_{j \neq k} djx_T^j$
3) Avoid E_k by selection of respective column ωk and find E_K^R
4) Apply SVD decomposition $E_K^R = U\Delta V^T$ Choose the updated dictionary column dk to be the first column of U. Update the Coefficient vector x_R^k to be the first column of V multiply by $\Delta(1,1)$.
5) Set J=J+1

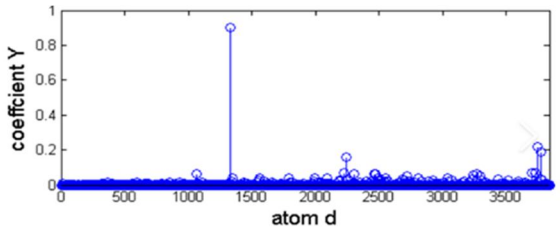


Fig1:Siganl representation of Coefficent Y vs atom d

In K-SVD algorithm method ,used all are approximate methods with fixed number of coefficient .In this method FOCUSS is that method give to work best of each iteration .In this point view of runtime .OMP method is overall give the more efficient algorithm. In many times in OMP method .The direct apply some properties about mathematical eqution .All improvement based on the pursuit algorithm which implemented OMP by sorting the selected atoms using algorithm .They achieve the complexity on similar to implementation on the dictionary atom which remove atom of signal .There are different acceleration techniques process for solving the more efficient problem l^2 OMP method. A common way to represent real-valued signals is with a linear superposition of basis functions. This is way to encode a high-dimensional data space, here the representation is distributed. Hence Fourier or wavelet can transfer a useful representation of signals, but they are less, because they are not special for the signals under consideration.

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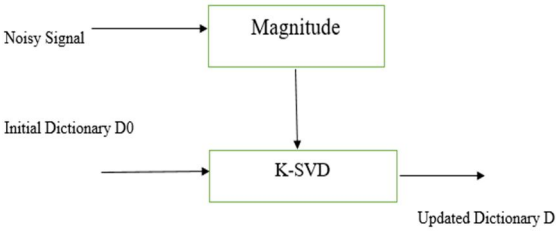


Fig 2: K-SVD using magnitude of signal

Under an overcomplete basis the decomposition of a signal is not unique, but this can some advantages. One is that there is greater exibility in capturing structure in the data. Instead of a small set of general basis functions, there is a larger set of more specialized basis functions such that relatively few are required to represent any particular signal. These can form more compact representation, because each basis function can describe can amount of structure in the data.

Unique ending the best representation in term so fan overcomplete basis is a challenging problem. It requires both an objective for decomposition and an algorithm that can achieve that objective. Decomposition can be expressed ascending a solution to x=As. where x is the signal, A is a (non-square) matrix of basis functions (vectors), and s is the vector of coefficient.

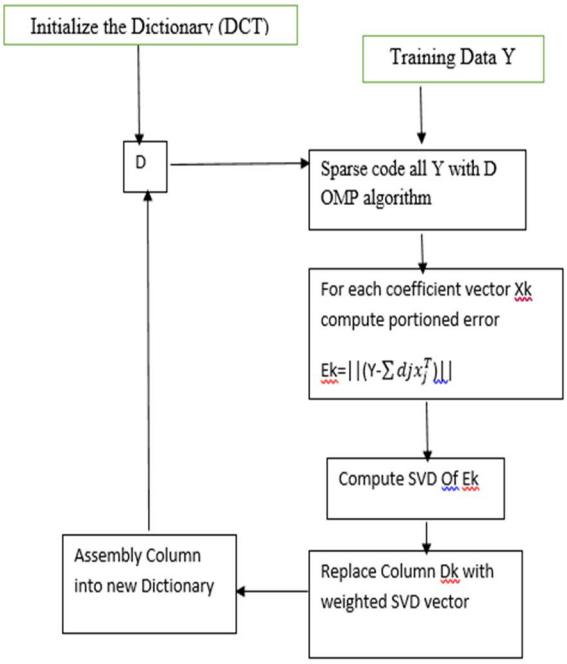


Fig 3: Block diagram of K-SVD

IV. RESULTS AND DISCUSSION

The comparison between computed dictionary and original dictionary can be done from the algorithm .Found closest column using the l^p norms which measure the distance of different dictionary.



Fig 4: Original Image

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From the figure 4.1 the value 1k which indicates that initialize the image at noisy level .After applying the K-SVD algorithm .The image move towards the fine image then only we can add the pixels and remove unwanted pixels .

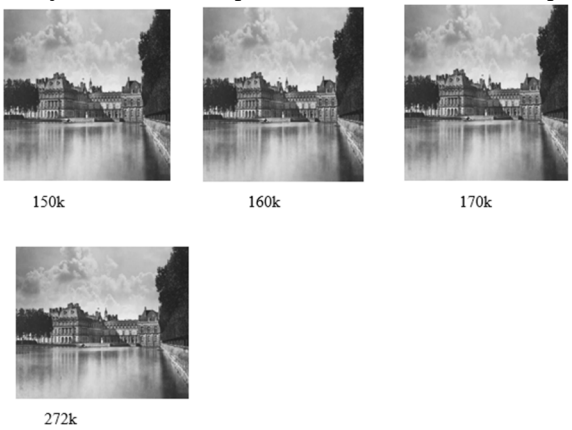


Fig 5: Images at different k values

We got the fine image at 272k values.

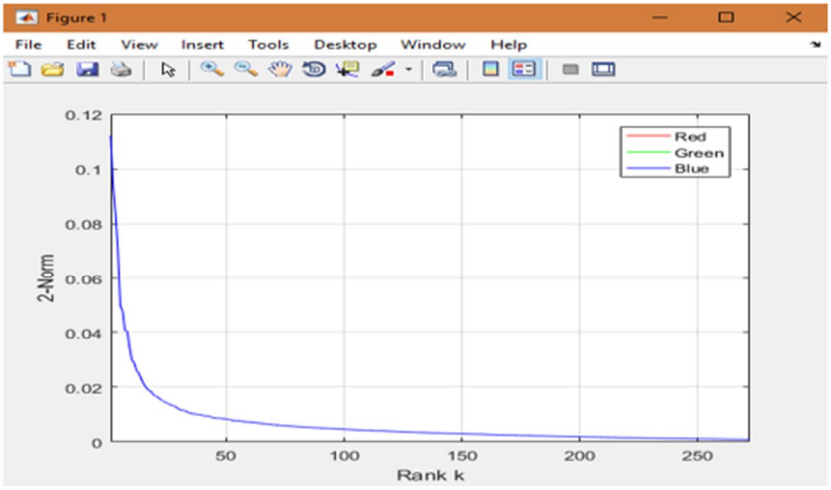


Fig 4.3 : Results graph- 1

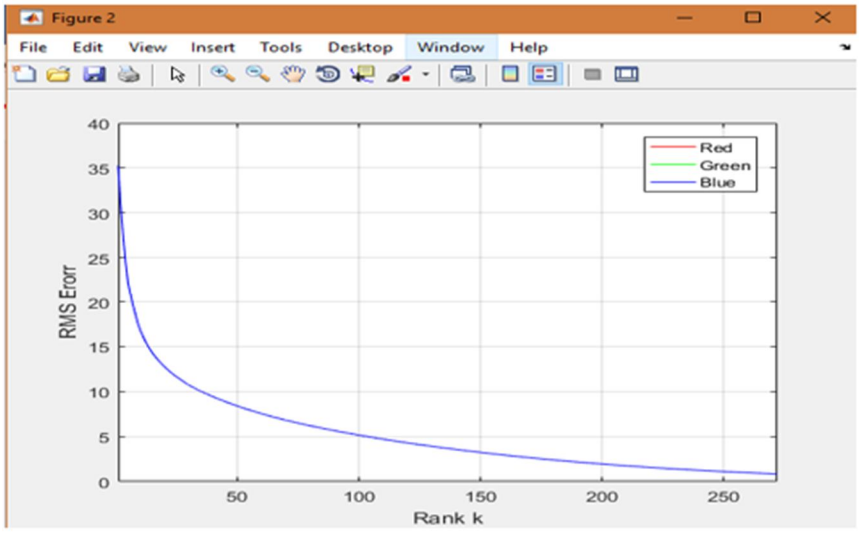


Fig 4.4: Result graph - 2

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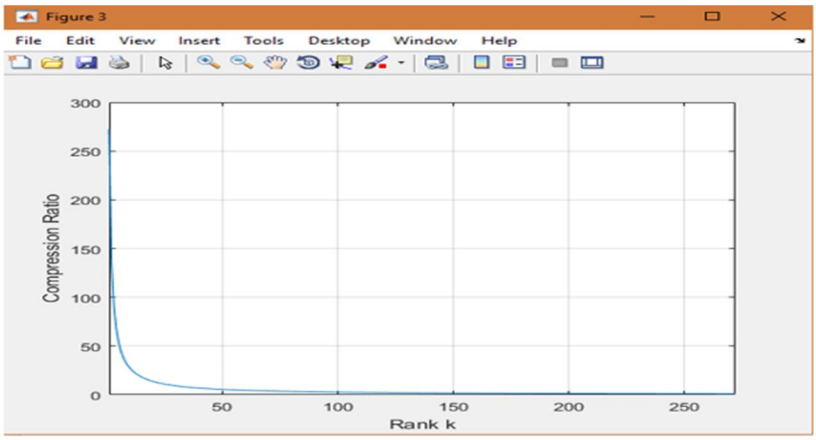


Fig 4.5: Result graph -3

By using the K-SVD algorithm compute the l^p norm signal .These the values of 2 -norms decreases with respect to K-mean values. In graph 2 distance from origin is less than the 0.01.The cycle repeat upto 50 times .The result for K-SVD algorithm at noisy level which has compression ratio value at 5.000122.In this proposed system the graph 1 indicates the pixel k values at 1.057064. Root mean square error values at 1.019946 found with respect to rank value k.

V. CONCLUSION

In over complete dictionaries K-SVD algorithm generates the problem using the given set of signal .In result we shown an algorithm of K-SVD for training the dictionaries which is suitable for the related problems. We found the different dictionaries from the K-SVD algorithm .The all the dictionaries are well suitable for image processing applications such as remove the unwanted pixels and compression .

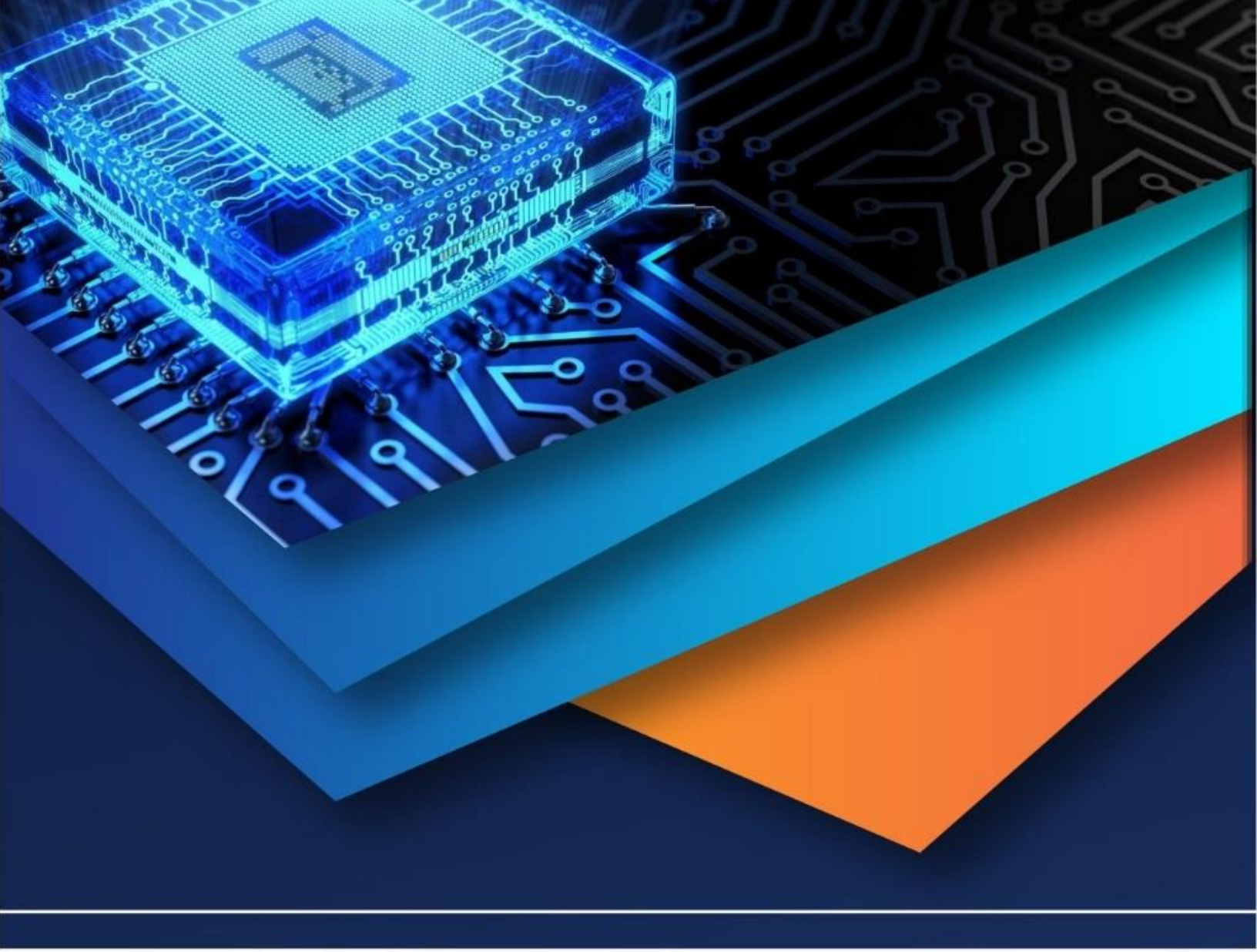
In discrete cosine transform implement the non –decimated haar and unitary DCT. By using this dictionary images are enhanced and compressed .Generally this dictionary are commonly used to need research in future work .In pursuit method connection between the calculated dictionaries .All experiment reported this system can be produced using MATLAB software which are easily available in websites .In proposed system tried to make all design part of K-SVD will become a faster .We compressed each and every image in dictionaries by using the image coding methods.

Generally this problem occurs in image processing application .Our proposed system is useful for remove the unwanted pixel and add the missing pixels into image. Further more to discover some other methods of sparse representation signal that develop algorithm efficiently also further study is needed.

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Effect of Secret Image Transformation on the Steganography Process by using LSB & DCT Techniques

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Abstract: ***Steganography is the art of hiding information in something else. It is favourable over encryption because encryption only hides the meaning of the information; whereas steganography hides the existence of the information. The existence of a hidden image decreases Peak Signal to Noise Ratio (PSNR) and increases***
Mean Square Error (MSE) values of the stego image. We propose an approach to improve PSNR and MSE values in stego images. In this method a transformation is applied to the secret image, concealed within another image, before embedding into the cover image. The effect of the transformation is tested with Least Significant Bit (LSB) insertion and Discrete Cosine Transformation (DCT) techniques. MSE and PSNR are calculated for both techniques with and without transformation. Results show a better MSE and PSNR values when a transformation is applied for LSB technique but no significant difference was shown in DCT technique. Keywords— least significant bit-LSB; discrete cosine transformation-DCT; steganography.

I. INTRODUCTION

Steganography is the technology of secret communication via a digital cover media such as image, audio or video, text files. Embedding secret image into image is known as image steganography. The ultimate goal of an image steganography is to conceal the presence of secret image embedded in the cover media. Image steganography is a powerful tool which increases security in data transferring and archiving. In image steganography, the image signal is called as cover image. The secret image data is embedded into image and form a new signal called as stego image. This image looks same as cover image. At the receiver side, the secret image is extracted from this stego image using extraction method.

It is favourable over encryption because encryption only hides the meaning of the information; whereas steganography hides the existence of the information. The existence of a hidden image decreases Peak Signal to Noise Ratio (PSNR) and increases Mean Square Error (MSE) values of the stego image. We propose an approach to improve PSNR and MSE values in stego images. In this method a transformation is applied to the secret image, concealed within another image, before embedding into the cover image. The effect of the transformation is tested with Least Significant Bit (LSB) insertion and Discrete Cosine Transformation (DCT) techniques. MSE and PSNR are calculated for both techniques with and without transformation.

There are three main issues in designing an image steganography method: undetectability, imperceptibility, and capacity.

1) Undetectability ensures that the stego, containing the secret data, is indistinguishable from the original image.
2) Imperceptibility means the hidden data insertion process makes distortion on the original image.
3) Capacity gives the relative amount of hidden data which can be inserted into the cover image.

The notion of capacity in data hiding indicates the total number of bits hidden and successfully recovered by the Stego system.

In recent years, several methods have been developed for hiding secret image into the cover image. Some method is developed in the time domain like least significant bit (LSB) substitution, phase coding steganography. LSB substitution is one of the earliest techniques used for the secret image data embedding in audio signals and other media types. The phase coding steganography methods are other time domain image steganography schemes which hide secret data in the phase of the cover image. Transform domain image steganography methods are the ones in which various transform domains such as Discrete Fourier transformation (DFT), discrete cosine transformation (DCT), and Discrete Wavelet transformation (DWT) are used to embed the secret image data in the coefficients of the cover image.

The goal of this work is to present an image steganography method which is less detectable, so more secure than existing popular methods.

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II. LITERATURE REVIEW

Mohamed Buker., et al. [1] proposed an approach to improve PSNR and MSE values in stego images. The effect of the transformation is tested with Least Significant Bit (LSB) insertion and Discrete Cosine Transformation (DCT) techniques.

Soni, A., et al. [2] illustrated the advantage of discrete fractional Fourier transform (DFrFT) as compared to other transforms for steganography in image processing. The simulation result shows same PSNR in both domain (time and frequency) but DFrFT gives an advantage of additional stego key i.e. order parameter of this transform.

Deepesh Rawat et al. [3] have proposed a steganographic technique by using improved LSB (least significant bit) replacement method for 24-bit colour image capable of producing a secret-embedded image that is totally indistinguishable from the original image by the human eye. In addition, this paper shows that how improved LSB method for 24-bit colour image is better than LSB technique for 8 bit colour image. Experimental results show that the stego-image is visually indistinguishable from the original cover-image in the case of 24 bit.

Ms.G.S.Sravanthi, et al. [4] have proposed a new method of information hiding in digital image in spatial domain. This method uses Plane Bit Substitution Method (PBSM) technique in which message bits are embedded into the pixel value(s) of an image. These experimental techniques are sufficient to discriminate analysis of stego and cover image as each pixel based PBSM and operand with LSB.

Masou d Nosrati, et al. [5] have proposed a system which is achieved by Least Significant Bit (LSB) based steganography using Genetic Algorithm (GA) along with Visual Cryptography (VC). This paper is based to design the enhanced secure algorithm which uses both steganography using Genetic Algorithm and Visual Cryptography to ensure improved security and reliability.

A. SaiKrishna et al. [6] stated, providing security for the message during transmission is a thought-provoking task. To accomplish this goal many cryptographic and steganographic algorithms are being used. Cryptographic algorithms transform the original message into a cipher text before transmission, whereas the basic idea used in Steganography is to hide the existence of the message in a media. This enables the existence of secret data to be known only to the authorized sender and the receiver. In this paper a new-fangled method based on clustering and noise addition is proposed to enhance the security of the hidden data. The proposed method consists of two steps. In the first step the pixels of the cover image are grouped into different clusters using k-means clustering algorithm which is followed by the embedding process. In the Second step a random noise is added to each pixel in all the clusters. Experimental results are compared with existing steganography techniques, which shows the proposed algorithm not only achieves same embedding capacity but also enhances the PSNR of the stego image.

Amritpal Singh et al. [7] proposed a paper in which, Least Significant Bit Steganography method for RGB image is presented. It hides RGB image into three planes of the colour image after bit lane slicing in such a way that induces minimum noise in stego image with the negligible change in the visible quality of the image which cannot be detected by naked eyes.

Lee Y. K. et al. [8] introduced an image steganographic model and have proposed a new high-capacity embedding/extracting module that is based on the Variable-size LSB insertion. In the embedding part, based on the contrast and luminance property, we used three components to maximize the capacity, minimize the embedding error and eliminate the false contours. Using the proposed method, they embedded at least four message bits in each pixel while maintaining the imperceptibility requirement.

Juneja M. et al. [9] introduced the concept of steganography and steganalysis as well as the methods for carrying these out. It also presented the authors' application which was demonstrated to be more secure than current applications against statistical attacks commonly used in steganalysis.

Thangadurai K., et al. [10] discussed the LSB method to hide the secret message in the Least Significant bit of the image. The LSB modification technique provides an easy way to embed information in images, but the data can be easily decoded LSB method is applied for various file formats. This method can use for both GIF and PNG file format. PNG does not support animation like GIF. PNG works well in online applications such as World Wide Web. LSB in GIF is a very efficient algorithm to use when embedding a reasonable amount of data in a gray scale image.

III. OVERALL DIAGRAM

The performance of the steganographic method in both spatial domain and frequency domain is evaluated. We used LSB insertion and DCT method for spatial and frequency domains, respectively.

For all experiments, we used two colour JPEG images as secret images to be embedded into four colour cover images. These cover images were chosen such that they include different textures and colour distributions. Fig. 1 & Fig. 2 shows four cover images and two secret images selected in this study. In this project, we investigate the effect of transforming the secret image before embedding it into the cover.

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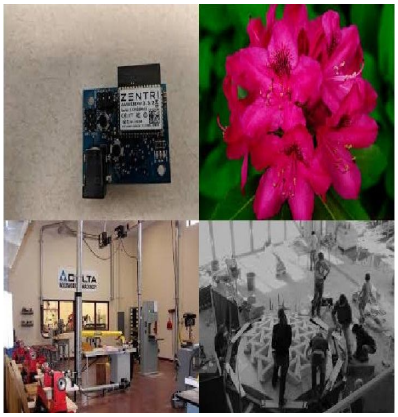


Fig. 1 Cover Image



Fig. 2 Secret Image

Our approach is based on a transformed secret image using an invertible function so that the image can be recovered. The approach is summarized in Fig. 3 & Fig. 4.

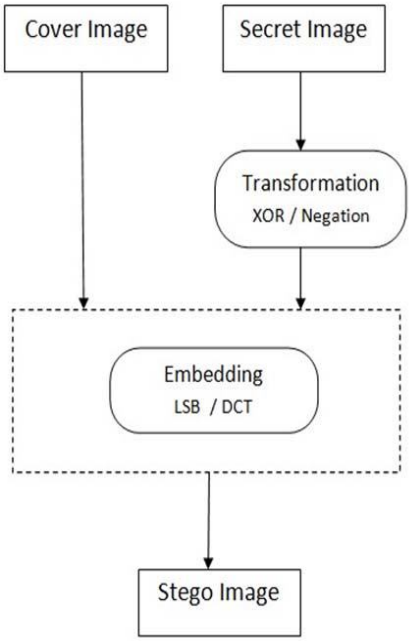


Fig. 3 Embedding Process

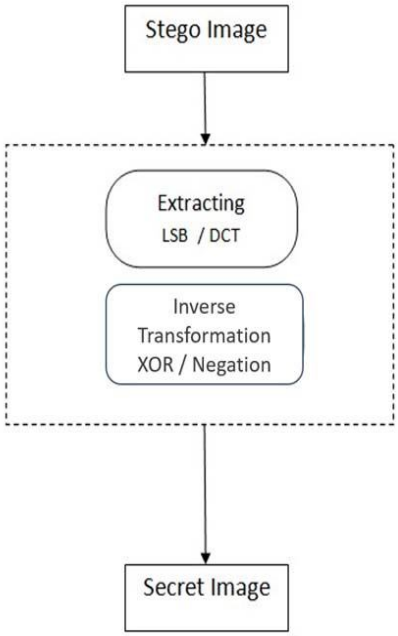


Fig. 4 Extracting Process

The reason to apply a transformation to the secret image is to reduce structural information so that the cover image is less affected. XOR is selected as a transformation function since it is reversible and it reduces the difference between smooth and non-smooth areas.

IV. EVALUATION PARAMETER

The performance of proposed algorithm is analyzed and discussed based on Mean Square Error (MSE) and Peak Signal-to-Noise Ratio (PSNR). They are employed to measure the quality of a stego-image.

A. Mean Square Error (MSE)

Lower MSE values correspond to better stego images. It is defined as follows,

$$\text{MSE} = \frac{1}{mn} \sum_{i=0}^{m-1} \sum_{j=0}^{n-1} [C(i,j) - S(i,j)]\text{^}2 \quad \text{..... (1)}$$

Where, C is cover image, S is a stego image, and m and n represent the number of rows and columns if the image matrix respectively.

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B. Peak Signal-to-Noise Ratio (PSNR)

PSNR is often expressed on logarithmic scale in decibels (dB) given in following Eq. 2. The higher the PSNR is, the better the quality of the stego-image is.

$$\text{PSNR} = 10 \log_{10}\left(\frac{C_{max}^2}{MSE}\right) \quad \text{... ……. (2)}$$

Where, Cmax is the maximum pixel value in the cover image.

V. RESULTS

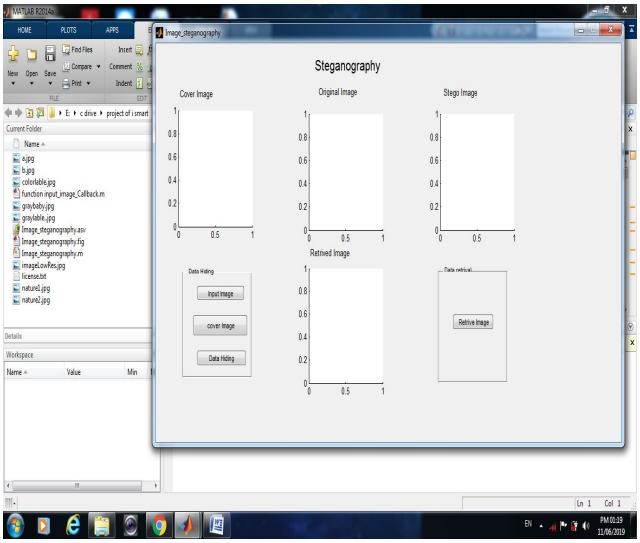


Fig 5. Result Image-1

As shown in above Fig. 5, all images will appear in single window.
It includes Input Image, Cover Image, Stego Image and finally Retrieved Image.

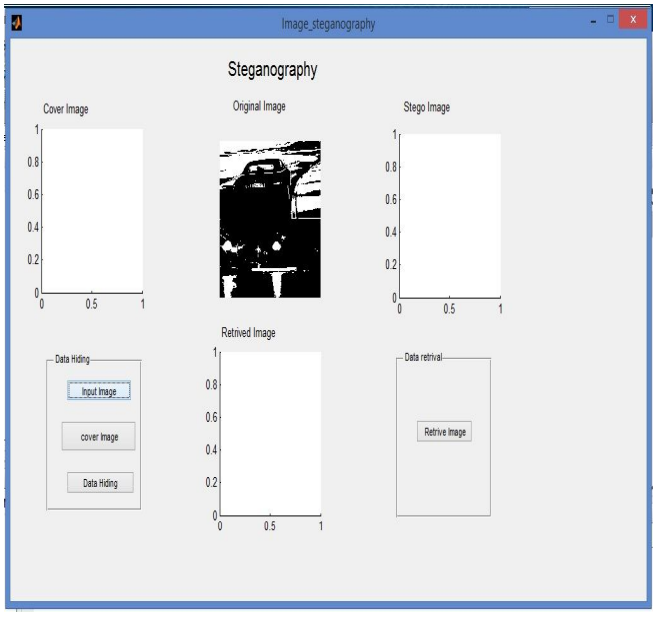


Fig. 6 Result Image-2

In above Fig 6, Input or original Image is given which is greyscale image. This image is used as secret image which is to be transformed.

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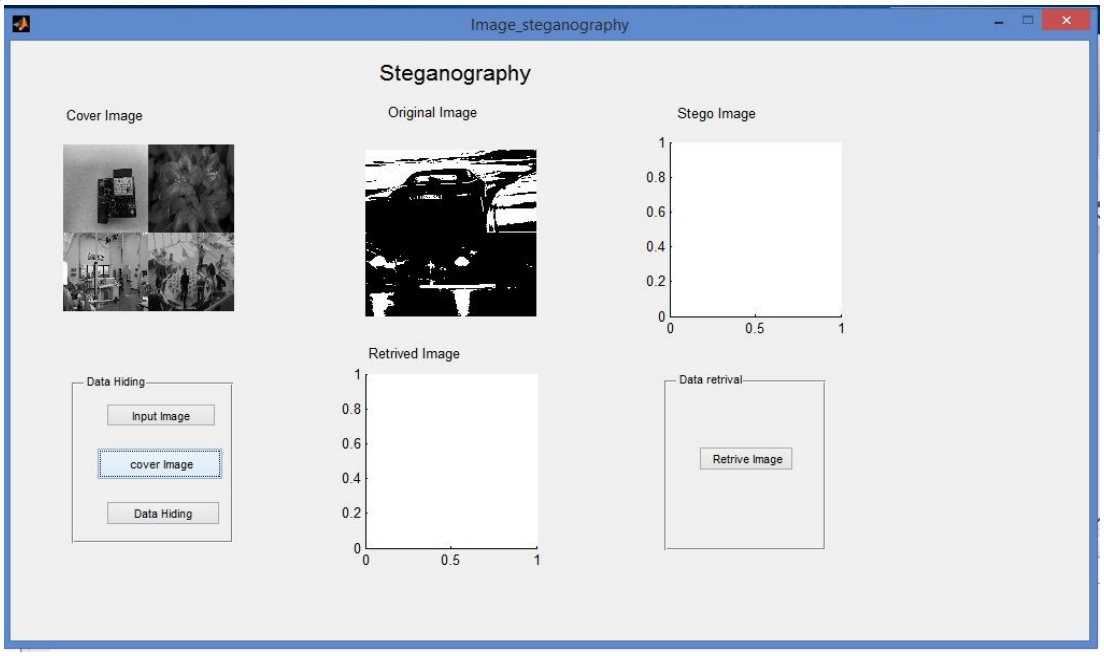


Fig. 7 Result Image-3

As shown in above Fig 7, Cover Image is given. Behind cover image, secret image i.e. input or original image is embedded.

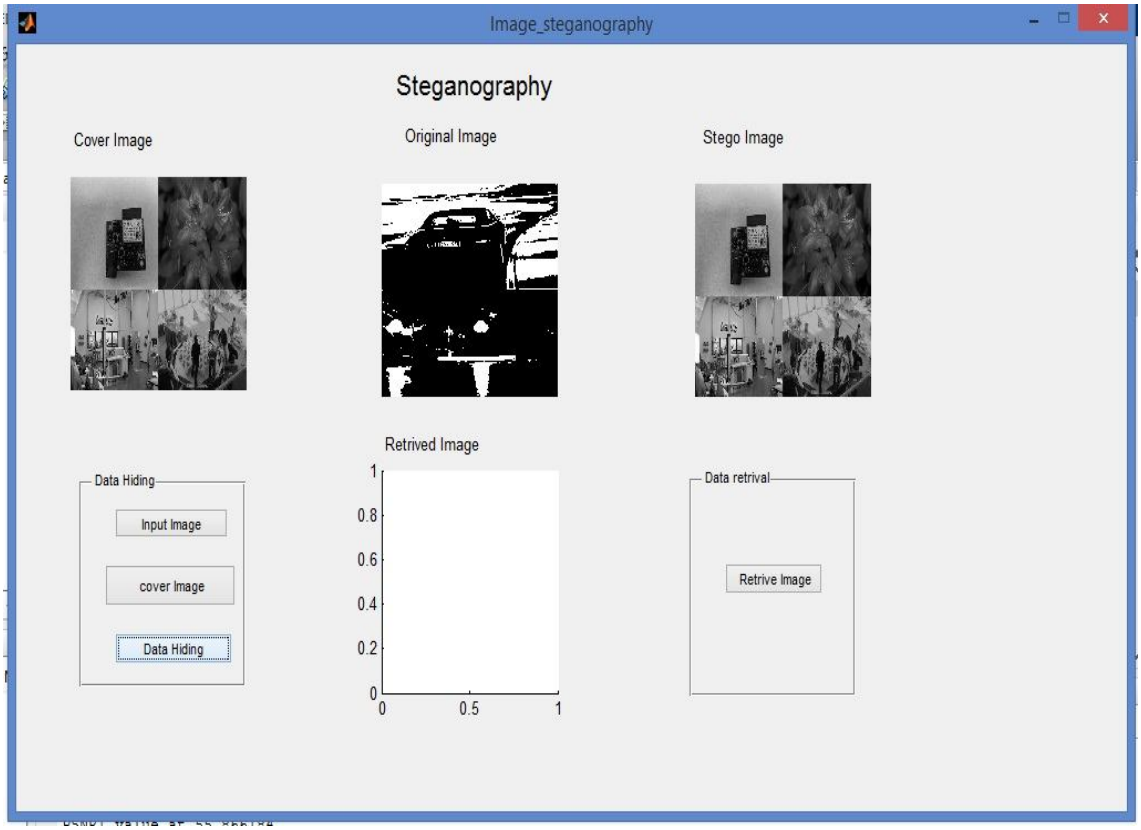


Fig. 8 Result Image-4

Fig.8 is Stego Image which is combination of cover image and secret image i.e. input or original image.

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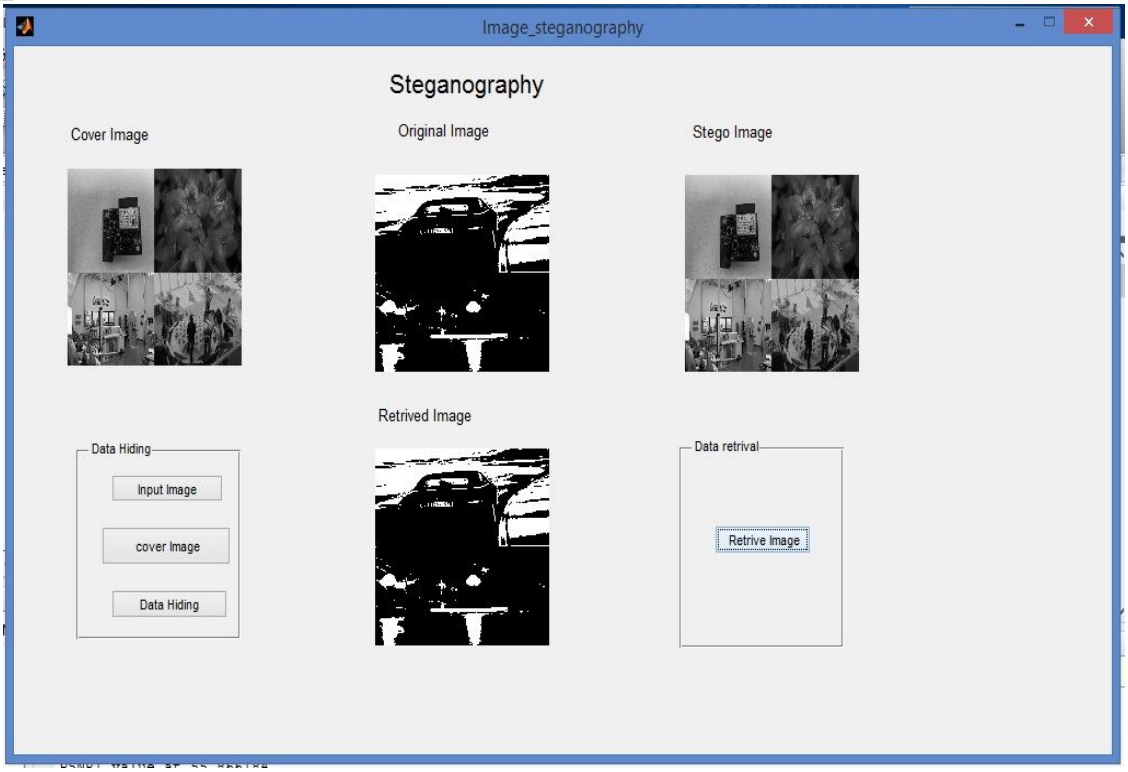


Fig. 9 Result Image-5

Above Fig 9 shows the retrieved image which is same as input image. This retrieved image is extracted from stego image and obtained same as input image.

Resulting MSE and PSNR values for the LSB with XOR Transformation of secret image and cover image are listed in Table 1 and MSE and PSNR values for the DCT technique are listed in Table 2.

Table-1 MSE and PSNR values for LSB with XOR Transformation

Secret Image	Cover Image	1-LSB		2-LSB		3-LSB	
		MSE	PSNR	MSE	PSNR	MSE	PSNR
Car	Gadget	1.0020	53.6593	1.0545	50.9859	3.0276	17.7591
	Flower	1.0056	53.4684	1.0585	50.7949	3.0605	17.5681
	Workshop	1.0092	53.2774	1.0625	50.6040	3.0941	17.3772
	People	1.0128	53.0864	1.0665	50.4130	3.1285	17.1862
Event	Gadget	1.0165	52.8955	1.0706	50.2221	3.1637	16.9953
	Flower	1.0201	52.8955	1.0746	50.0311	3.1996	16.8042
	Workshop	1.0238	52.5136	1.0788	49.8401	3.2364	16.6134
	People	1.0276	52.3226	1.0829	49.6492	3.2740	16.4224

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Table-2 MSE and PSNR values for DCT technique

Secret Image	Cover Image	1-LSB		2-LSB		4-LSB	
		MSE	PSNR	MSE	PSNR	MSE	PSNR
Car	Gadget	1.0019	56.0124	1.0233	54.8424	1.0456	53.6724
	Flower	1.0046	55.8661	1.0260	54.6962	1.0485	53.5262
	Workshop	1.0072	55.7199	1.0288	54.5499	1.0513	53.3799
	People	1.0098	55.5736	1.0316	54.4037	1.0542	53.2337
Event	Gadget	1.0125	55.4274	1.0343	54.2574	1.0571	53.0874
	Flower	1.0152	55.2811	1.0371	54.1112	1.0601	52.9412
	Workshop	1.0179	55.1349	1.0400	53.9649	1.0630	52.7950
	People	1.0206	54.9887	1.0428	53.8187	1.0660	52.6487

VI. CONCLUSION

In this paper we presented secret image transformation using steganography. Secret image transformation enters more and more into our everyday soldier and military life, thus there is an urgent need to further develop techniques into practical applications.

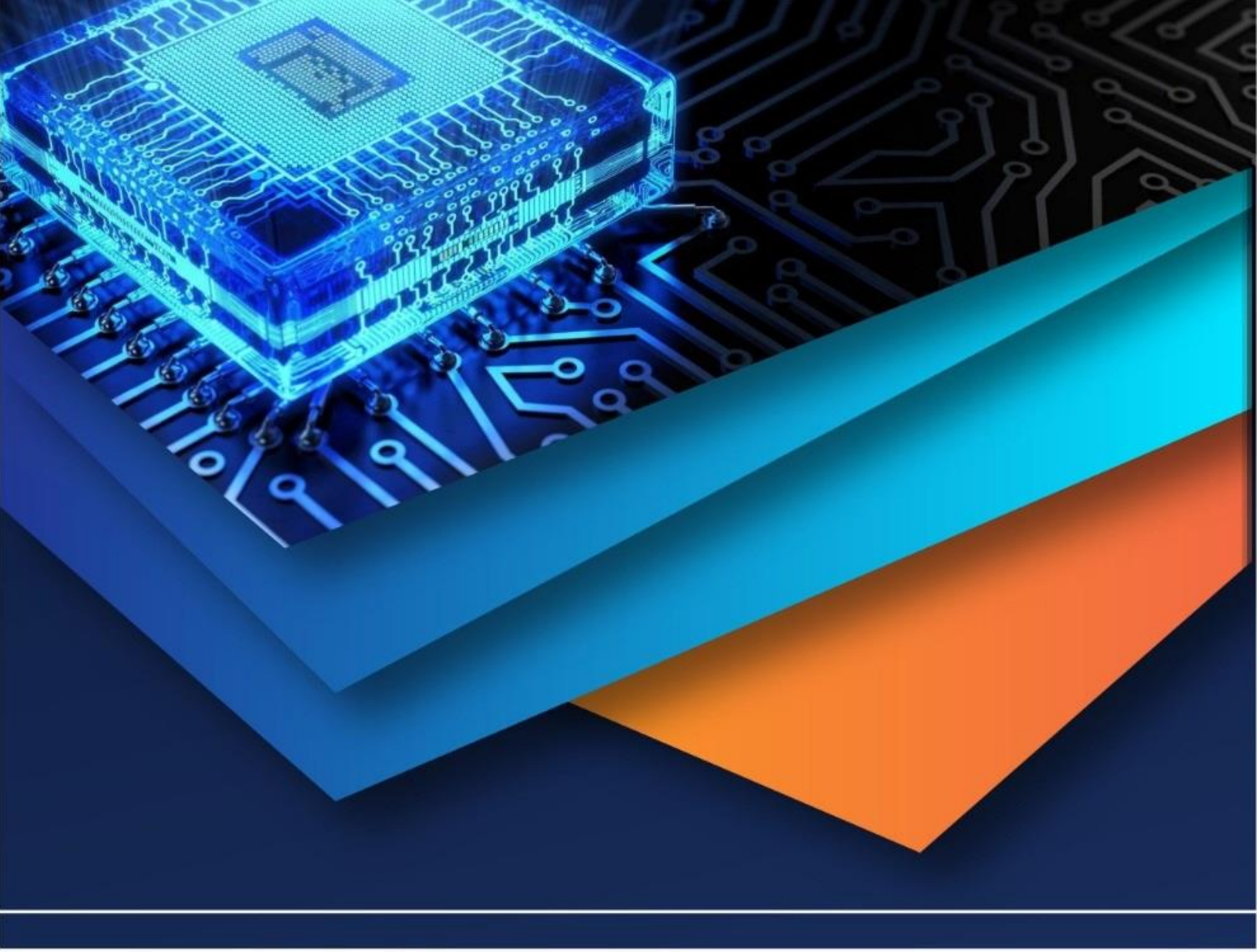
This paper is presented steganography. Steganography are ways to protect information from unwanted parties but neither technology alone is perfect and can be compromised. These troubles are usually happened in the internet communication. Hence data needs high protection on consistently. Main reason behind using steganography is secret image transformation, non disclaimer, consistency and honesty at any instant of data transfers. Steganography can be described as the skill of protection file and it makes sure that only the related people to access the content.

This paper, we examined the influence of secret image transformation, before embedding the secret image, on stego image quality. XOR is selected as a transformation function and compared to Negation transformation. Experimental results had shown that performing XOR transformation to the secret image gave better performance than Negation in the LSB method especially when embedding more than one bit. On the other hand, the same performance increase was not observed in DCT based implementation. This study was limited only to the two different transformations. However, more research is required to find another type of transformation causing a better performance.

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Security System using Raspberry Pi

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Abstract: As the technology is advancing day by day, there are various alternatives occurring for the already present or previous technologies. This article suggests the working of an wireless camera. The article gives a brief idea of various technologies or software being used for to security purpose. The main goal of our design was to develop a network that allowed for the transmitting and receiving of images from camera nodes to a base station. The

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Anti-Theft Locking For Stolen Vehicles and Canny Password Protected Access to Personalized Vehicles

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Abstract: The concern of car thieving has exaggerated staggeringly, largely at knifepoint or automotive parks. it's essential would like of the event of a vehicle thieving alert and placement identification system for vehicle homeowners to confirm thieving interference and speedy recovery tries in things wherever a vehicle is missing, taken or driven by any unauthorized person. The thieving alert feature makes use of a trending GSM application that is

Review on Automatic Cursor Moving and Clicking of PC with Eye Gaze Tracking

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Abstract— Now a days for computer we are using input devices such as keyboard, mouse and joystick. With the advancements in the field of Human Computer Interaction, eye tracking or iris tracking is the most promising field. It will fundamentally change the way we interact with computers. In the last decade, the development of eye tracking (ET) systems represented a challenge for researchers and different companies in the area of IT, medical equipment or multimedia commercial devices. An eye tracking system is based on a device to track the movement of the eyes to know exactly where the person is looking and for how long. It also involves software algorithms for pupil detection, image processing, data filtering and recording eye movement by means of fixation point, fixation duration. The main aim of this proposed work is to develop a low cost application running, to replace the traditional computer mouse with the human iris for cursor movement. The target audience majorly consists of handicapped people or people with physical impairment. The system designed aims at detecting the user's eye movements for navigating the cursor, analyzing the nature and timing of blinks, which in turn is used as an input to the computer as a mouse click. The system should consists of a good resolution webcam.

Keywords: Eye Gaze Tracking, ETM System, PCCR Method

I. INTRODUCTION

People with physical disabilities cannot fully enjoy the benefits provided by computer System .This is because the conventional mouse and keyboard were designed to be used by those who are able bodied. Due to reducing the communication barriers between man and machine human eye computer interaction is important. The main aim of this proposed system is to design and implement a human computer interaction system that tracks the direction of the human gaze. The pupil detection and tracking is an important step for developing a human-computer interaction system. To identify the gaze direction of the user's eye (right, left, up and down). Human eye uses contactless type devices. This work can develop a human computer interaction system that is based on iris tracking. The iris is widely used as the starting point for detection and tracking. It is an important eye feature that is circular in shape and that can be detected easily.

This paper presents review of hands free interface between pc and human. This technology is intended to replace conventional switching devices for the use of disabled. It is a new way to interact with the electrical or electronic devices that we use in our daily life. The paper illustrates how the movement of eye cornea and blinking can be used for controlling pc. The basic Circle Detection algorithm is used to determine the position of eye. Eye blinking is used as triggering action/clicking which produces binary output through the for computer.

Shrunkhala Satish Wankhede Ms. S. A. Chhabria Dr. R. V. Dharaskar present a paper "Controlling Mouse Cursor Using Eye Movement". This paper is aimed for designing and implementing a human computer interface system that tracks the direction of the human eye.

The particular motion as well as direction of the iris is employed to drive the interface by positioning the mouse cursor consequently. The location of the iris is completed in batch mode. This means that the frames are stored in a permanent storage device and are retrieved one by one. Each of the frames is processed for finding the location of the iris and thereby placing the mouse cursor consequently. Such a system that detects the iris position from still images provides an alternate input modality to facilitate computer users with severe disabilities. In this proposed system computer continually analyzes the video image of the eye and determines where the user is looking on the screen. Nothing is attached to the user's head or body.

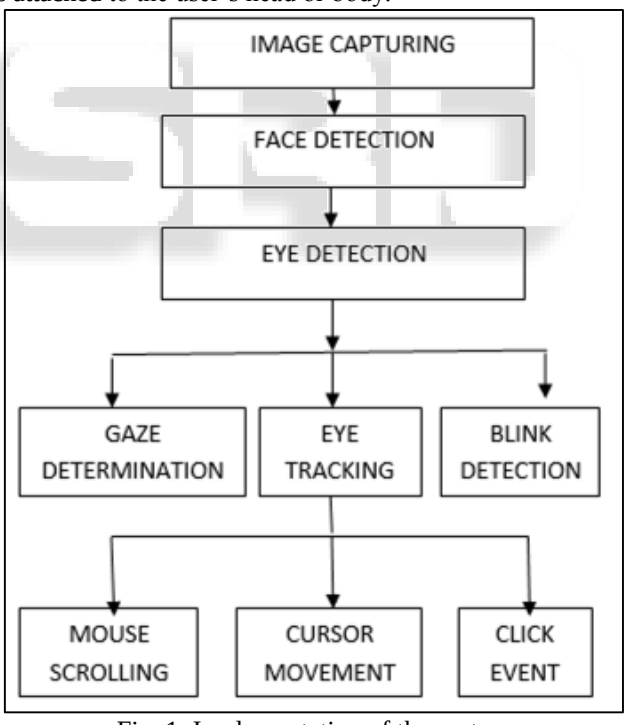


Fig. 1: Implementation of the system

To "select" any key, the user looks at the key for a specified period of time and to "press" any key, the user just blink the eye. In this system, calibration procedure is not required. For this system input is only eye. No external hardware is attached or required. Above diagram shows the implementation of the system. This paper focused on the analysis of the development of hands-free PC control - Controlling mouse cursor movements using human eyes. Thus, the comprehensive study of the gaze-based interaction processes is implemented.

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The mouse pointer is operated using eye. The most unique aspect of this system is that it does not require any wearable attachments. This makes the interaction more efficient and enjoyable. A user interface is the system by which human interact with a computer. The user interface includes hardware and software components. No external hardware is attached or required.

Junghoon Park, Taeyoung Jung and Kangbin Yim publish paper on "Implementation of an Eye Gaze Tracking System for the Disabled People". This paper proposes a modified pupil center corneal reflection(PCCR) hardware method to improve the system accuracy. The modified PCCR eye gaze tracking system, a new version of the PCCR eye gaze tracking system supplemented by the relation between IR LED position and the distance from the eye gaze tracking system to the monitor screen, improves the tracking accuracy within one degree. This paper suggests the adaptive exposure control algorithm for the proposed system which is robust against light.

This system is composed of various parts in the camera, and experiments were carried out by configuring the system to match the optimum distance through the experiment on both sides of the reflected light LED. Eye-tracking systems use the difference vector (P-CR) between the pupil position (P) and the corneal reflection (CR) to determine the gaze vector.

To bring the image of the camera which supports the USB video class UVC standard compatible interface, we use a video input library using the bright eye and dark eye depend on calculating region of interest(ROI). After two consecutive images are input, the saved two images are converted to the binary images. In the calculated images, the difference between the two images is converted to pupil. Therefore, only the difference between two images is to be extracted. If the difference between the two images is a circular shape that can be a blob candidate, depending on the situation the candidate of pupil can be extracted depending on the known information about pupil.

As shown in Fig. 2, to produce the image from the camera that supports the USB video class(UVC) standard compatible interface, we use a video input library using the bright eye and dark eye depending on region of interest (ROI) calculation. After two consecutive images are input and saved, they are converted to the binary images. In the calculated images, the difference between the two images is converted to pupil. Therefore, only the difference between two images is extracted. If the difference is a circular shape that can be a blob candidate depending on the situation, the candidate of pupil can be extracted depending on the information known about pupil. IR reflection point is extracted from the dark eye. Then, we must check whether they are bright or dark. If dark eyes are selected for finding glints, the threshold value should be chosen. The threshold value is calculated with Eq. (1) and it predicts glint brightness to extract glint. When the dark eye ROI is extracted, the maximum brightness can be expected with glint brightness. Therefore, the threshold weight (maximum brightness and pupil brightness) is set at 9:1 and slightly lower threshold than the maximum brightness is applied to make easy glint extraction. The weight of 9:1 is given because the value between glint that is the brightest and bright pupil that is next to glint brightness is used so that one value between them becomes the threshold.

$$\text{Threshold}=(\text{Max Bright}*9+\text{Pupil Bright})/10 \quad \text{(I)}$$

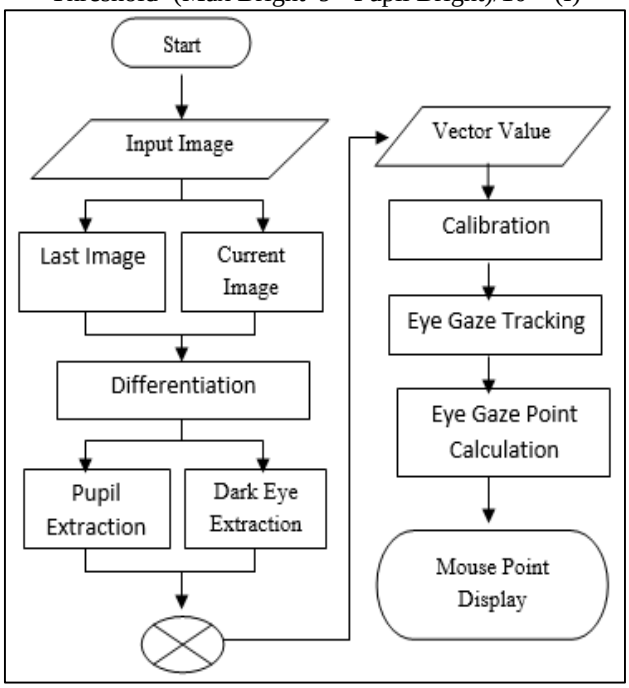


Fig. 2: The flow of the eye gaze tracking algorithm

The proposed system produces the remote eye gaze tracking system optimal to the form factor for the disabled and the eye gaze tracking system of general PCCR method using various image processing technology. Gaze accuracy that is the performance yardstick of the eye gaze tracking system is set at about one degrees and 12 point calibration is used to reflect the gazers eye error.

Robert Gabriel Lupu, Florina Ungureanu, Valentin Siriteanu publish paper "Eye Tracking Mouse for Human Computer Interaction". In this paper a reliable, mobile and low-cost system based on eye tracking mouse is presented. The eye movement is detected by a head mounted device and consequently the mouse cursor is moved on the screen. A click event denoting a pictogram selection is performed if the patient gazes a certain time the corresponding image on the screen.

In this proposed eye tracking method is oriented towards the possibility to be used by patients for email, messenger and social sites. In this paper he propose an eye tracking mouse (ETM) system using video glasses and a new robust eye tracking algorithm based on the adaptive binary segmentation threshold of the acquired images. The proposed system allows the patient to communicate his needs, to browse a graphical user interface and to select an image or a word, using only his eyes.

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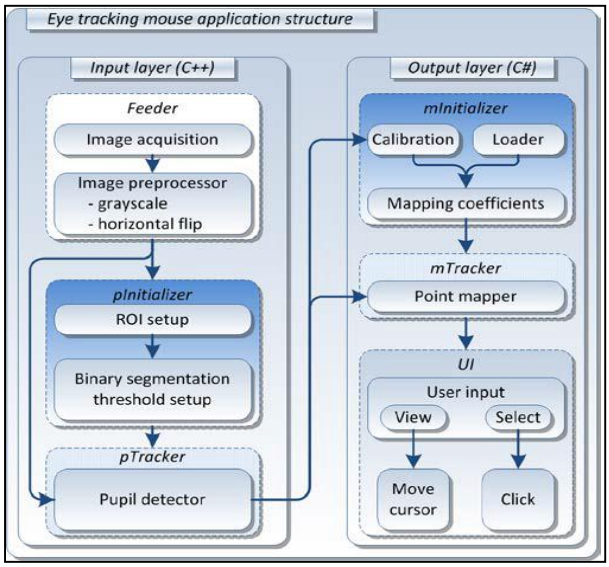


Fig. 3: Eye-tracking mouse software application

The proposed ETM system consists of two hardware devices, webcam and video glasses and the software application running the eye tracking algorithm. The webcam, mounted on a video glasses frame with the help of an aluminum bar, has a modified system lens in order to be used at a short suitable distance (less than ten centimeters) from user's eyes. It captures images only in infrared light by using an infrared filter on top of the lens. Six infrared LEDs provide constant illumination of the eye so that the natural light has an insignificant influence on pupil detection.

The video glasses display copies of the computer screen for both eyes so that the patient sees a 16:9 widescreen 1.9 m display, as seen from 3 m [4]. The software application detects the pupil and maps its webcam position on computer screen in concordance with patient's gaze direction. Therefore, the mouse cursor is moved in the point of screen coordinates. By gazing at that point for one to two seconds, the software generates left click event. In this way the patient can point and click.

Unlike the previous approach, video glasses were used instead of computer monitor so that the head position of the patient does not affect the eye tracking algorithm after calibration. The software application was written in C++ and C# using Visual Studio 2010 and OpenCV library for image processing. The software application is organized on two layers, as it is presented in Fig. 2.

The input layer is written in C++ and consists in three modules: Feeder, pInitializer and pTracker. The Feeder module provides for pInitializer continually acquired and pre-processed images until ROI (Region of Interest), binary segmentation threshold and mapping coefficients are obtained. After these values are validated, the pTracker module detects eye pupil and mTracker determines the mouse coordinates. The output layer written in C# defines how information provided by the input layer are processed. So, the Point mapper calculates the new cursor coordinates based on webcam pupil coordinates. The mapping coefficients can be loaded from a local file or can be also updated when the mTracker is not running.

The output layer written in C# defines how information provided by the input layer are processed. So, the Point mapper calculates the new cursor coordinates based on webcam pupil coordinates. The mapping coefficients can be loaded from a local file or can be also updated when the mTracker is not running. The Calibration component of mInitializer module displays nine points on screen, one at a time. The patient has to look straight to each of them for one or two seconds and the corresponding positions of the pupil are recorded. Then, using the Sheena and Borah equations, the mapping coefficients are determined.

The User Interface (UI) module moves the cursor in the position provided by Point mapper. The click event is generated if the cursor stays in a certain position for one second.

The social impact of the proposed ETM system may be significant allowing the social reinsertion of the disabled persons and increasing their self-respect. For many disabled people, such a communication system could help them to continue their intellectual and social life or to pass easier the difficult period of medical recuperation. In addition, taking into account that many people with disabilities do not afford a suitable communication system, this low-cost system could successfully replace the more expensive ones. The proposed mobile device should be also useful for people with limited hand functions or should be integrated in different virtual and augmented reality systems for recovering and rehabilitation process targeting persons suffering from neuromotor paralysis in the spirit of the new paradigm of Cyber-Physical Systems.

Riddhi Chavda,Madhura Barve, Amit Doshi publish a paper with titled "Real Time Eye-Tracking Using Web Camera". This paper describe project.

The main aim of this project is to develop a low cost application running in an open source environment and a widely used operating system Linux, to replace the traditional computer mouse with the human iris for cursor movement. The target audience majorly consists of handicapped people or people with physical impairment. The system designed aims at detecting the user's eye movements for navigating the cursor, analyzing the nature and timing of blinks, which in turn is used as an input to the computer as a mouse click. The system consists of a good resolution Logitech C270 HD webcam, as opposed to the otherwise popular infrared cameras available in the market.

The existing cameras used for tracking are highly expensive but our system is affordable and easy to use. In the project we have used the Fabian Timm image processing algorithm to achieve iris tracking.

This project implemented the Fabian Timm algorithm which locates and tracks the user's eye in consecutive frames of the video stream. The intended input is the region of interest, where the search procedure takes place, i.e. only the eye image. To navigate the mouse pointer on the screen, user will have to move our iris to the desired position and then blink for over threshold number of frames duration to establish a valid click.

They used cameras for video chat applications support high-definition (HD) images with high resolutions up to 1920x1080 pixels. They use Logitech c270HD

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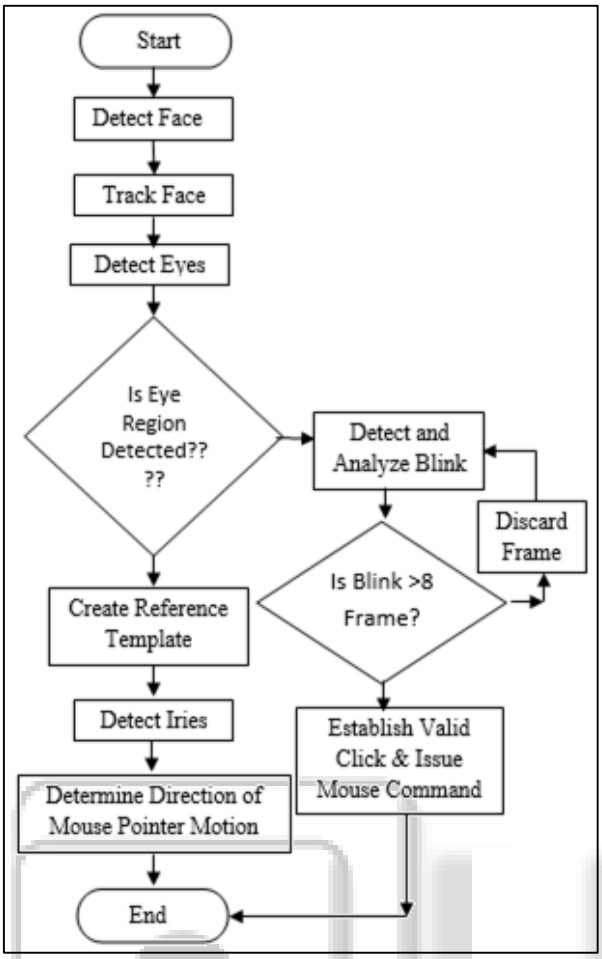


Fig. 4: Flowchart of implemented algorithm.

Older eye tracking algorithms were highly dependent upon the amount of light, resolution and contrast. Hence, the images which suffered from lower resolution and contrast gave sub-standard tracking. Thus the Fabian Timm algorithm was devised. The advantage of this algorithm is that it works in even poor lighting conditions. The algorithm first detects the face, then the eyes and then the center of the iris. It tracks the irises in real time thereby detecting where the user is currently looking. It maps the iris position as the change in cursor location on the screen.

- It works by measuring gradients of the iris.
- It uses segmentation of Image Processing.
- It will keep on measuring the gradient using the gradient function. The value of gradient will be maximum for the iris part and that will be it.
- It takes the screenshot the eyes so as to keep it as a backup making the system more robust.
- The gradient functions are implemented using OpenCV libraries.

The system shows that it has a potential to be used as generalized user interface in many applications such as determining web usability in heat maps. A heat map is a graphical representation of data where the individual values contained in a matrix are represented as colors.

II. Conclusion

In this paper we roughly describe some representative studies in the field of eye tracking, covering some aspects regarding different types of devices, algorithms for pupil detections, image processing or data filtering and also some well-known applications in assistive technology, human computer interaction, virtual reality, psychology or e-learning.

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Wireless Security Camera System

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Abstract: As the technology is advancing day by day, there are various alternatives occurring for the already present or previous technologies. This article suggests the working of an wireless CCTV camera. The article gives a brief idea of various technologies or software being used for to security purpose. The main goal of our design was to develop a network that allowed for the transmitting and receiving of images from camera nodes to a base

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Implementation of Industrial Waste Water Purification & Bottle Filling System Using PLC

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ABSTRACT: The provision of clean water is a major issue. There are multiple solutions available for water purification and supply. Different systems of water purification have different solutions. Various stages in filtrations are used in this process. TDS (Total Dissolved Salts) & pH control in impure water with the help of reverse osmosis technology and dosing of chlorine and sodium bicarbonate solutions in proper amount, method is presented in this paper. The automated process of bottle filling station using IR sensor is also mentioned in detail. The results gained in water purification are very good and purified water is potable and free from harmful chemicals and salts.

KEYWORDS: Waste water treatment, Water purification, bottle filling, PLC.

I. INTRODUCTION

The water is used for a variety of purposes like drinking, washing, recreation as well as for various industrial applications [1]. Water is the most fundamental factor needed for all organisms on this earth. The percentage of naturally available drinking water is less than 1% of the total available water on the earth [2]. Due to the ever-increasing population of world, the demand as well as consumption of water is also escalating. The water available in natural reservoirs is getting polluted because of mixing of unwanted industrial waste water without any proper treatment. As a result of this pollution, the water in these reservoirs contains various chemicals, salts and other impurities that make it unfit for drinking purpose. Therefore there is need to purify the water. Reverse Osmosis (RO), is a very popular and effective technique is used to purify water. It removes impure particles, salts and other chemicals from the water and gives only pure water. The rejected water is separated from the pure water which is indeed potable.

Here, along with Reverse Osmosis we are introducing chemical dosing of chlorine and sodium bicarbonate, to remove all the bacteria's from the water as well as to add good taste to it. Also due to the dosing of chemicals the pH and TDS of the pure water is maintained as per the required standards for potable water.

II. AUTOMATION IN WATER PURIFICATION

PLC (Programmable Logic Control) is used for the water purification to make the process automatic. It is been used for the efficient working of the system, to reduce the manual work and to maintain accuracy of the TDS. The automating filling line helps in packaging of the pure water in bottles or jars which gives total industrial solution for water purification. Process loop diagram is as shown in figure 1. There are two modes over which the water purification line can run i.e. auto mode and manual mode [6].

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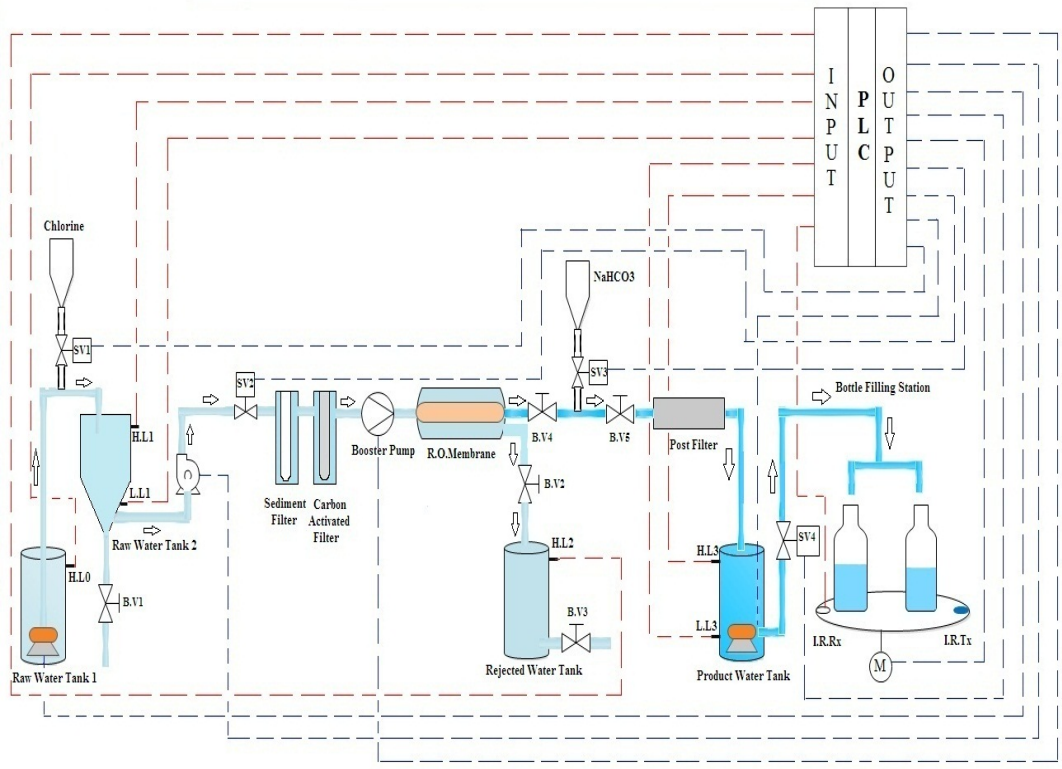


Fig. 1 Process Diagram

When process starts, the limit switches act as level indicator, which continuously gives signal to the PLC. The High Level Switches act as interlock to stop the earlier phase and further to proceed with the next phase. Thus the level transducers help to ON/OFF the respective output pumps of the particular phase. In phase II, the purification of the raw water is done with the help of pumps, filters and R.O. membrane. The chemical dosing of NaHCO3 and chlorine is in line with the process. The solenoid valve OPENS or CLOSES according to the dosing required.

As soon as the level of water in the product water tank reaches high level the bottle filling, phase III starts. In order to control the motion of the motor, I.R. sensor is used which acts as an interlock. As soon as there is obstruction in between the I.R. receiver and transmitter, it stops the motor. The bottle filling is done with the help of a timer. When the timer reaches the required time for bottle filling, the respective pump and solenoid valve gets OFF automatically. As it is a batch process, the annunciator acts as an alarm for the operator to know that the process is complete. The whole process can be stopped at any given time with the help of the STOP button.

Purification Process

Water purification include following steps as shown in figure 2:

1. Raw water: TDS range is from 150-900 depending upon the water source. It contains high amount of dissolved impurities along with salts, bacteria and Virus.

Sediment Filter: Physical impurities such as suspended solids, sand, silt, dust and rust are removed by 5 micron PP Filter.

2. Carbon Filter: Colour, odour, chlorine and organic impurities are removed by adsorption on highly activated granular carbon. Stops left-out chlorine and particles less than 5 micron. This increases life of the highly sensitive RO membrane.

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Fig. 2 Purification Process

3. Booster Pump: It creates heavy pressure in water and pushes it into the RO Membrane.
4. RO Membrane**:** It is specially designed to remove dissolved chemical impurities. This semi-permeable membrane has 0.0001 micron pore diameter. These pores being much smaller than both Virus and Bacteria don't allow them to pass through, apart from all other impurities.
5. Post Carbon Filter**:** It has been designed to prevent any possible growth of bacteria at the point of use. Also restores natural taste of water.
6. Pure Water: The water obtained at the final stage after post filter is pure having TDS in the range of 25-35 and pH of around 6.8-7.2

III. WATER PURIFICATION HARDWARE COMPONENTS

Programmable Logic Controller: PLC is a digital electronic device, which uses a programmable memory that coordinates input and output modules to control processes. A PLC has following hardware components:

Input / Output modules
Processor
Power supply
Programming devices

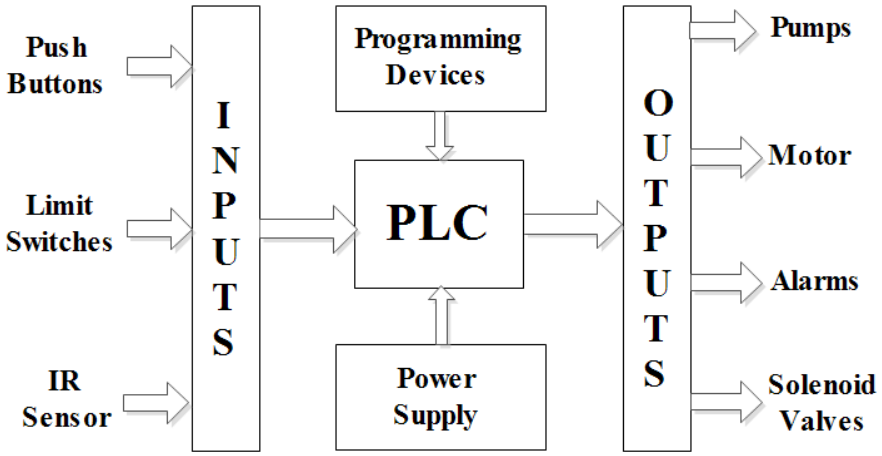


Fig. 3 Block diagram of process

The input modules are level sensors, I.R sensors and push buttons. Level sensor is required to control the water level of various tanks in the line. I.R sensors are used to detect the bottles on the plank. Push buttons are used for selecting various modes and control the overall process.

The output modules are solenoid valves, pumps, D.C motor and all the alarms. The solenoid valves are used to control the flow of liquid. There are basically four pumps. Two submersible pumps are used, out of which one is used to pour the water from raw water tank 1 to raw water tank 2 and the other is used in product water tank for bottle filling. A 12v

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D.C pump is used to force the water from raw water tank 2 to sediment filter. A R.O Booster pump is used to suck the water from the carbon filter and force it on to the R.O Membrane. A 12v D.C Motor is used to rotate the wooden plank in the bottle filling station on which the bottles are kept.

As we know that one programming device, such as a personal computer or a laptop is necessary to interface with the PLC. We need a programming device connected to the PLC. Programming devices helps us to enter the required program/commands into the PLC memory and troubleshoot the PLC ladder logic program. The program is entered in the form of relay ladder logic and is responsible to check the operation sequence.

Three types of programming devices used are:

1. Hand held terminals
2. Dedicated terminals
3. Personal computers

The PLC, which we have used, works on the supply voltage of 85V to 264V AC and supply frequency up to 63 Hz.

PLC's have two types of power supplies:
1. Internal power supply: This powers the processor module (CPU)
2. External power supply: This gives AC or DC power supply to I/O modules. The power supply provides DC power to the other I/O modules, which are inserted in the rack. The processor requires low DC power. The AC power supply of 120 or 240 volts needs to be converted into low DC power for the internal power requirements of I/O modules.[10]

Wecon HMI: Generally, the goal of human-machine interaction engineering is to produce a user interface which makes it easy, efficient and enjoyable to operate a machine in the way which produces the desired result. This generally means that the operator needs to provide minimal input to achieve the desired output, and also that the machine minimizes undesired outputs to the human. Applied input allows the users to manipulate a system output, allowing the system to indicate the effects of the users' manipulation.[11]

Touch screens displays accepts input by touch of fingers or a stylus. Used in a growing amount of mobile devices and many types of point of sale, industrial processes and machines, self-service machines etc.

The material used for the frame is 25x3 Ms (mild steel). The dimensions of the frame are 6 feet x 5 feet x 1.5 feet (*h* x *l* x *w*). We have divided the frame into 3 parts in which 1st part consists of raw water tank section in which two raw water tanks are situated one above the other separated by angles. The 2nd section consists of main water purification line consisting of various filters and pumps. The 3rd section is the bottle filling station where 4 bottles are placed on a circular conveyer operated by motor.
1. Sediment Filter: To sediment the solid suspended particles.
2. Carbon Activated Filter: To trap solid particles suspended in water.
3. RO Membrane: It is reverse osmosis element and used to reject the total dissolved salts present in water in the form of rejected water and purify the water completely
4. Carbon Post Filter: To add taste to the water
5. TDS Meter: To detect and indicate the total dissolved salts (TDS) concentration in water
6. DB9: Serial communication component
7. Relays: 24 V DC, 230V AC

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IV. ALGORITHM

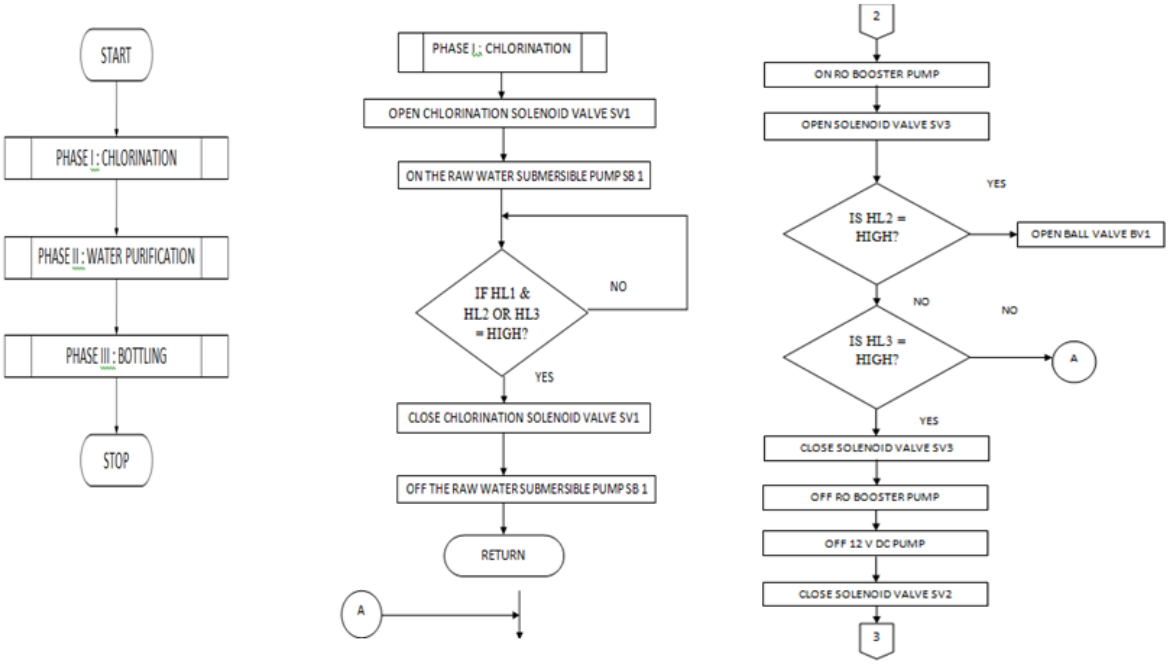


Fig. 4 Flowchart

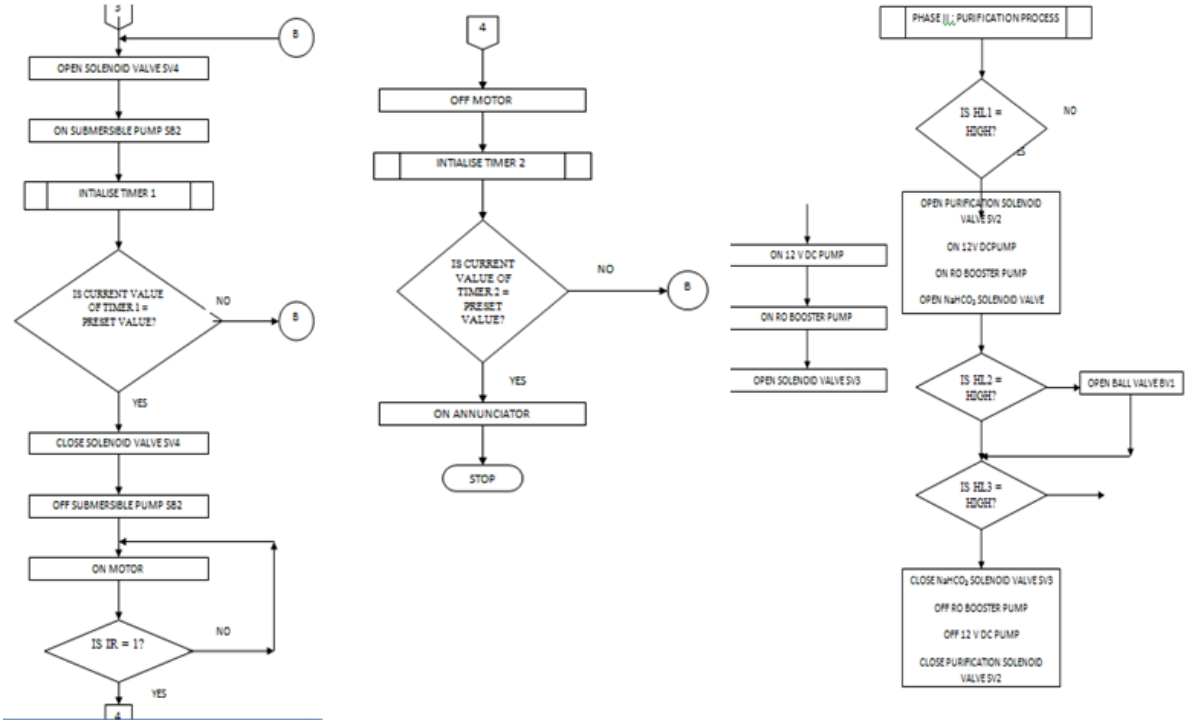


Fig. 5 Flowchart

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V. RESULT AND DISCUSSION

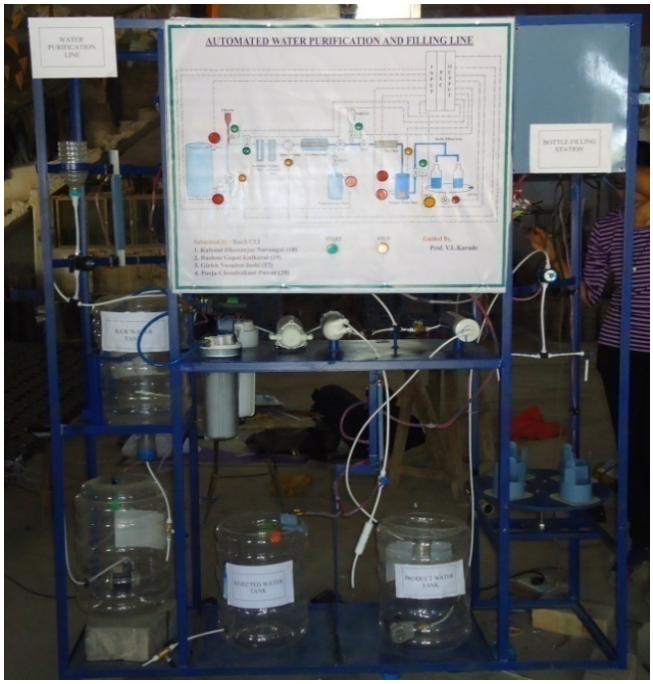


Fig. 6 Automation in Water Purification & Bottle Filling Process

Figure 6 shows the implemented system of water purification and bottle filling using PLC
1. When START button is pressed, the PHASE I i.e. Raw Water Tanks start getting filled.
2. After the PHASE I get complete PHASE II, purification of the Water from Raw Water Tank.
3. PHASE III of bottle filling is also achieved.
4. The limit switches continuously measure the level of the water in the respective tanks and sends the signal to PLC. 5.
5. The PLC controls the output side accordingly.
6. The I.R. sensor stops the motion of the motor during PHASE III.
7. After the whole batch process is completed hotter sounds.
8. When STOP button is pressed the whole process stops at any point.

VI. CONCLUSION

Reverse osmosis is one of the best solutions to purify industrial waste water. Using this technique water impurities which are in chemical form and bacteria's from the water are removed and good test is added to water. Due dosing of chemicals water TDS & pH is maintained according to standards. This results in separation of portable form of pure water from industrial waste.

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Android Based Student Feedback System for Improved Teaching Learning

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***Abstract* —** The process used to collect the student's feedback is manual and takes more time to complete its analysis and report generation. As technology is changing at fast rate, maximum numbers of android application are available for educational purpose. In recent years the android technology with web services has brought many drastic changes in the mobile application development field. In this paper we proposed a system which provides a simple interface for collection and analysis of student's feedback. It can be used by educational institutes or colleges to maintain the records of student's feedback. Valuing and asking for feedback has recognized benefits for both faculty and students. For faculty to develop and improve teaching skills. Using this application, students can fill their feedback through any android based mobile. Once they submit it, their feedback will be analyzed quickly and feedback report can be generated within very short span of time.

***Keywords* —** Students Feedback System, Adndorid, Online Feedback

I. INTRODUCTION

In today's world data handling and processing by computer aided tools is increasing day by day. In any education system *Students feedback* is considered as very important aspect for improving the teaching learning process.

The *Student feedback* approach is all about institutional practices and processes that are taken into consideration [1], the students concerns of the level of knowledge they receive. This process explains that there is a good relationship between the students learning environment and the validation of learning environment.

In the traditional/existing system, the institute provides the feedback forms developed by institute itself. These feedback forms were distributed among the students and the students are supposed to mark their feedback manually about the academics including lecturer, practical, assignments, punctuality, knowledge of problem solving capacity and many more. The submitted feedback forms are then collected by the faculty or staff and the overall grade for each point mentioned in the form, subject and each teacher is calculated probably by using the MS excel sheet. The feedback report is then handover to the Head of department. After receiving the feedback, Head of the department shall discuss it with the concern faculty and inform them regarding the necessary corrective actions to improve the academic standards and rectify the lower grades about specific point. Such existing system is more time consuming and there is also the possibility of making the mistakes by data entry operator while feeding the grades in excel sheet.

In the proposed methodology, the Head of department has to prepare questions and need to add them to the system, then he need to update these questions to the online system. Once they are uploaded by Head of the department then and then only students are able to view and give their feedback. The students are expected to enter the grades directly with their android mobile phone. As students are entering their feedback at their own, hence there is no need of data entry operator which will further reduce the possibility of wrong data feeding. As students are entering their grades, the analysis will be done automatically at the back end and the feedback report will be generated automatically. The proposed is feedback system is simpler and takes less time to collect and complete the analysis of feedback without any mistake [4].

The paper is organized into four sections. Section II explains the existing systems/tools available for taking the feedback. Proposed method is presented and demonstrated in section III. In section IV, the results and snaps of the system are demonstrated.

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II. RELATED WORK

In the existing system is feedback is taken with the help of pen and paper. Although the use of paper is considered to be a simple one, but this makes the task more tedious and time consuming. In this existing system, utmost care should be taken that the single paper should not be lost or misplaced. Generation of large number of paper photocopies for the same purpose requires a large amount of paper. The major concern about this method is that; this system is more time consuming and consumes more papers to keep the records.
Rajvee Patel et al. [1] in their work explained the Feedback management System. The 'Feedback management System' approach is all about institutional and educational practices and processes that are taken into consideration, the student's concerns of the level of the knowledge they receive. They have developed faculty feedback system to provide feedback in an easy and consistent manner to the college HOD or principal. They call it faculty feedback system which delivers via student staffs interface as online system which is acting as Service Provider. Phani Rama Prasad et al. [2] proposed the Online Student Feedback System which is an automatic feedback generation system that provides the proper feedback to the lecturers. Using their system student can give feedback in online system without wasting his time in writing. Nikhil H.M. et al. [3], developed Student Feedback System to provide feedback in an easy and quick manner to the college principal. By using their system one can take fast feedback about the faculty by students on time. Sivasankari S. et al. [4], proposed Online Student Feedback Analysis System (OSFAS). The Online Student Feedback Analysis System (OSFAS) is an automatic feedback generation system that provides the proper feedback about the teachers by using comments and categories like good, interesting, late, interactive, etc. The main aim of their system is not only to save time but also to decrease human efforts.

III. METHODOLOGY

The main intention of the proposed system is to reduce the use of paper i.e. to develop the paperless system. The proposed method is implemented on the android technology. The data collected through the feedback system will be centrally stored and can be retrieved efficiently as and when needed, hence along with proper data synchronization, proper reports generation is also possible.

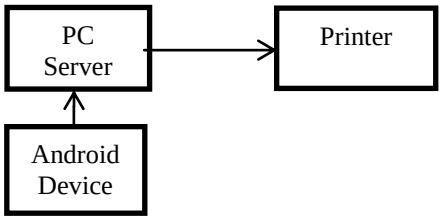


Figure 1. Top Level Block Diagram of System

A. System Description

The System will work the as follows.

- *Student Login*

The students will receive one time password (OTP) for registration at the initial step. This OTP will help us to locate the proper student and authenticate them. Once the student is logged in, he/she will be able to give the feedback for the respected entities like year, class, semester or course teachers. Once the feedback is submitted, the related data will be stored to the server (PC) that will works as the one containing data centrally.

- *Admin Module*

The admin is be responsible for generating unique ID's and one time passwords for students. He/she is able to add relative entities along with their courses and teachers/instructors or vice versa. The admin has rights to authenticate the students those are going to give the feedback.

B. Flowcharts

The functioning of the system can be well understood by the flowcharts. There are four flowcharts of the proposed system namely:

- *Flowchart for Admin module*
- *Flowchart for student module*
- *Flowchart for server*
- *Flowchart of overall system*

- *Flowchart for Admin module*

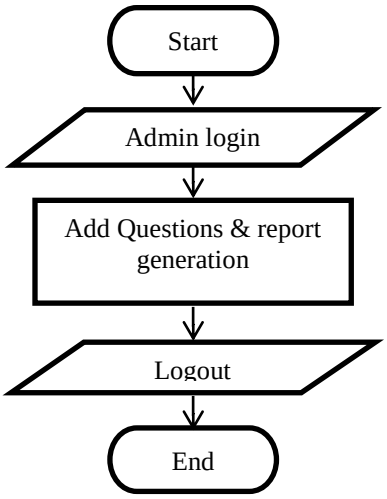


Figure 2. flowchart for admin module

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Through the Admin login (figure 2), one can create the teachers profile; add course/subject and mapping of teacher with the courses/subject. The Admin can also add the question on which the student's feedback can be gathered and analyzed. The final analysis of the received can also be done by the admin through his/her login.

- *Flowchart for student module*

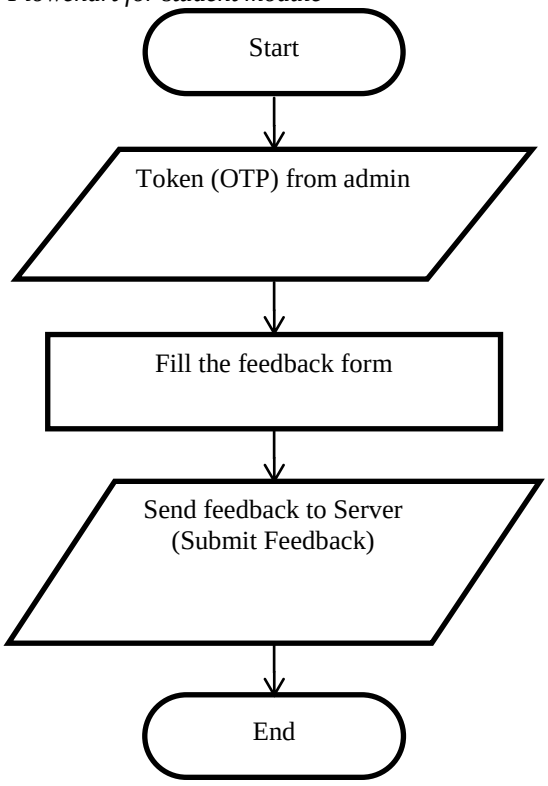


Figure 3. flowchart for student module

Through the students module (figure 3), the students can login in to the system using the token (password) received by admin. Once the student logs in the system they have to mark their feedback upon the question asked/set and the multiple options available.

- *Flowchart for server*

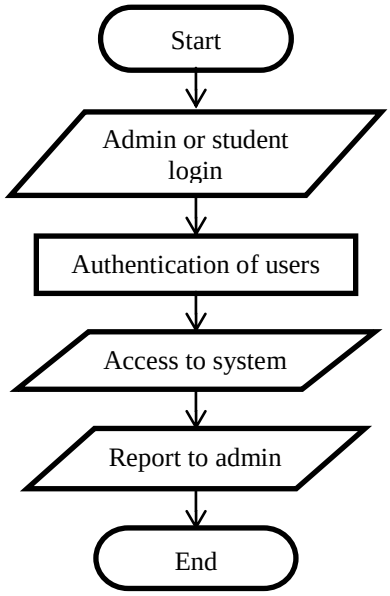


Figure 4. flowchart for server

Above flowchart (figure 4) mentions the steps that are carried out at the server for generating the feedback. Initially the when students are registering for the feedback then token is generated. Using that token students can log in into the system then server has to authenticate them. The authentic users only allowed for giving feedback.

- *Flowchart of overall system*

The overall flowchart (figure 5) of the system explains the detailed procedure and steps involved on the feedback process. As mentioned earlier, the admin has to create the questions and do the teacher and course/subject mapping. Admin also needs to create the tokens/passwords for the students. With the token provided by admin, students can log into the system. The students login has to be authenticated by admin. After login student are supposed to enter the roll number, select the department, class, subject and the mark their feedback.

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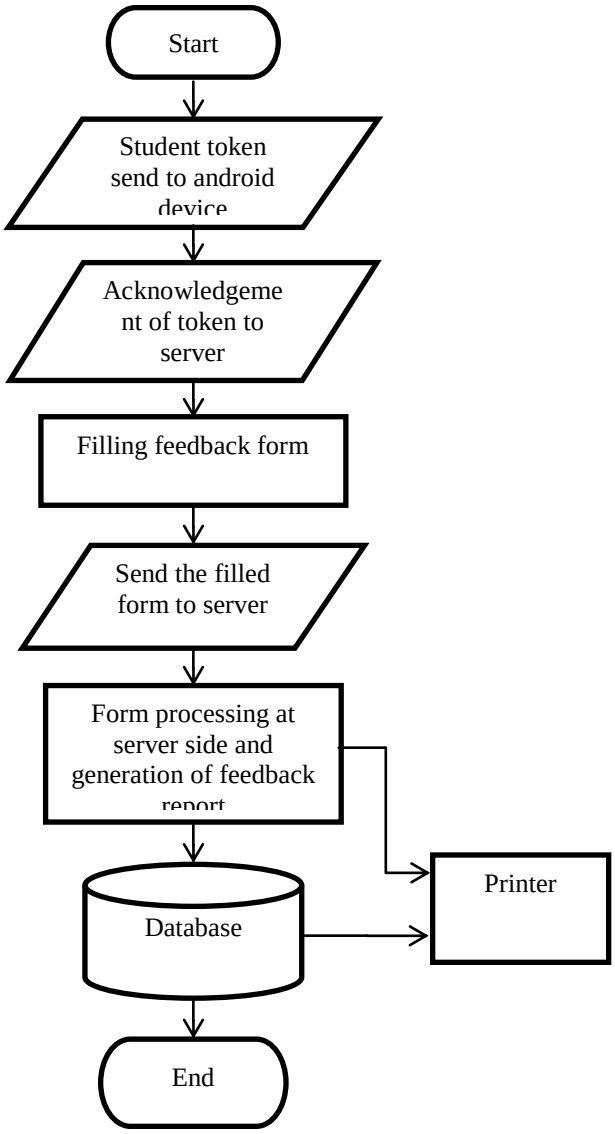


Figure 5. flowchart of overall system

IV. RESULTS AND DISCUSSION

A. *Admin side*

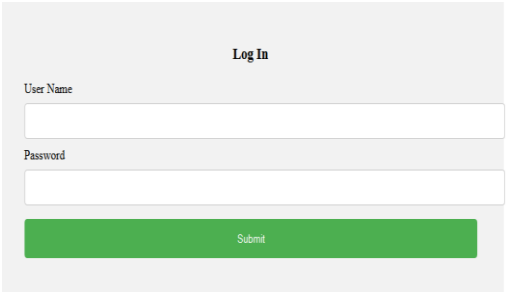


Figure 6. Admin Login

Through this window (figure 6) the admin can login into system. After logging in he can add the courses, teachers and questions of feedback.

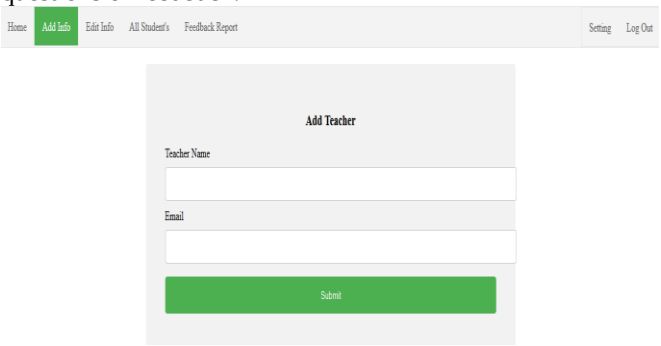


Figure 7. Add the teacher

Once the admin is logged into the system, then he has to add the teacher's information (figure 7) into the system.

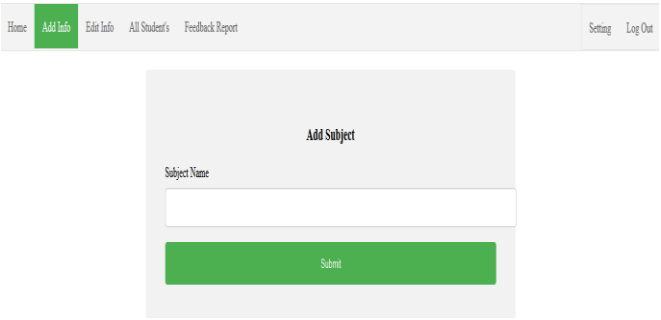


Figure 8. Add courses/subjects

After adding the teacher details, the admin need to add the names of courses (figure 8) for which the feedback is to be taken.

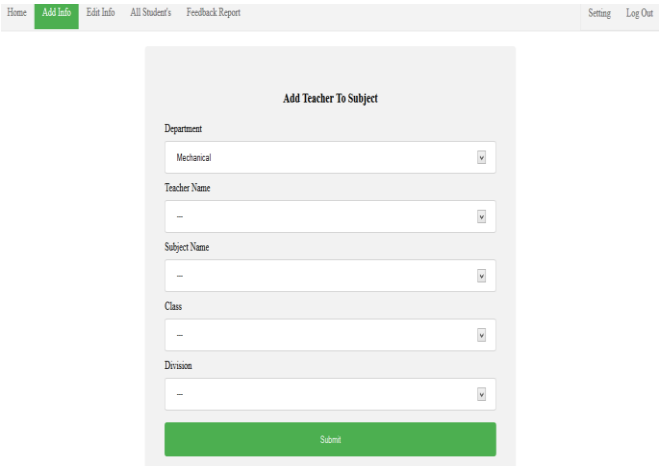


Figure 9. Mapping of teacher to course/subject

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Once the admin is entering the teacher information and all the courses, he now needs to assign the subjects/courses to the concerned faculty/teachers (figure 9).

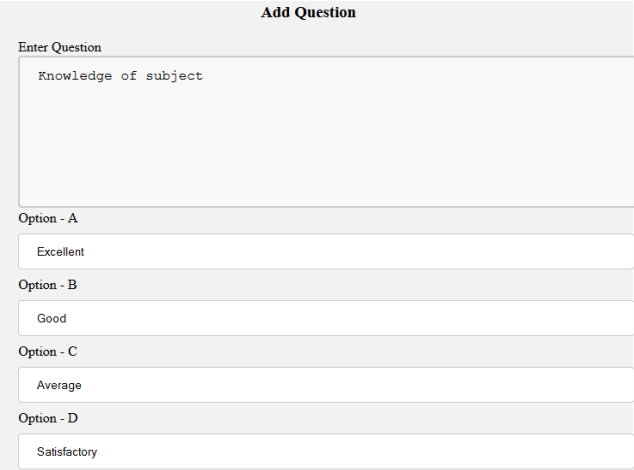


Figure 10. Add the questions

Once the admin is completing the process of adding the teacher, course name and questions of feedback and later he wants to change few points/information entered earlier e.g. teacher mail id, name of course or need to change question then the rights are given to admin to edit the earlier information.

B. Student side:

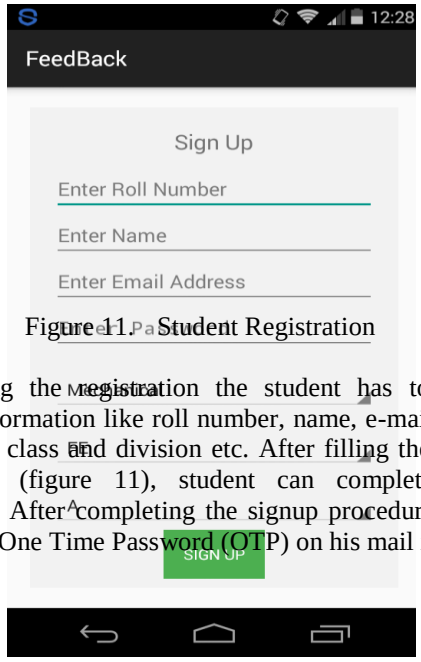


Figure 11. Student Registration

While doing the registration the student has to use his personal information like roll number, name, e-mail address, department, class and division etc. After filling the required information (figure 11), student can complete his/her registration. After completing the signup procedure, student will get the One Time Password (OTP) on his mail id.

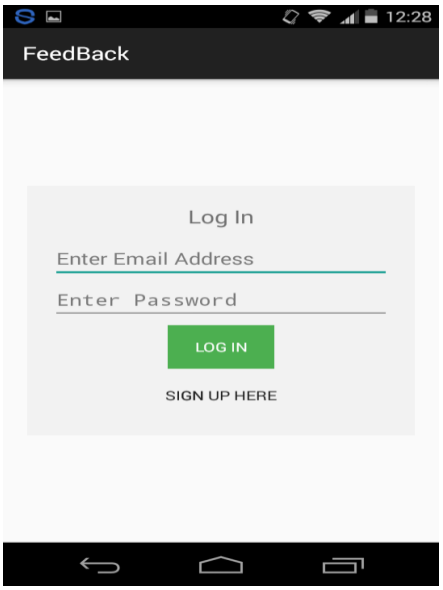


Figure 12. Student Login

With the OTP received after completion of earlier step student can now log into the system (figure 12).

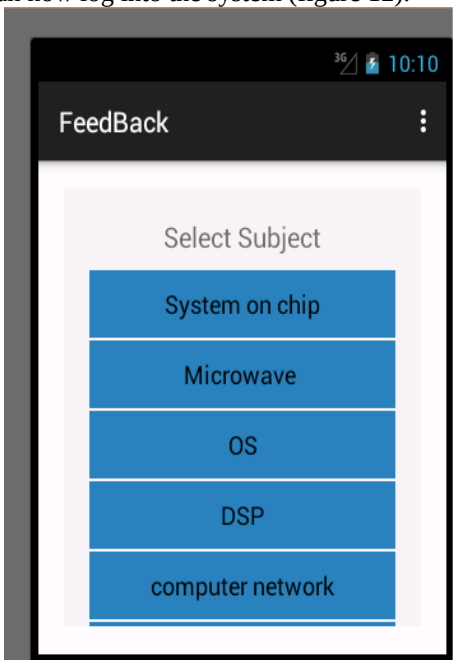


Figure 13. Select the course/subject

Student has to select their class and course/subject for which they are willing to give their feedback (figure 13).

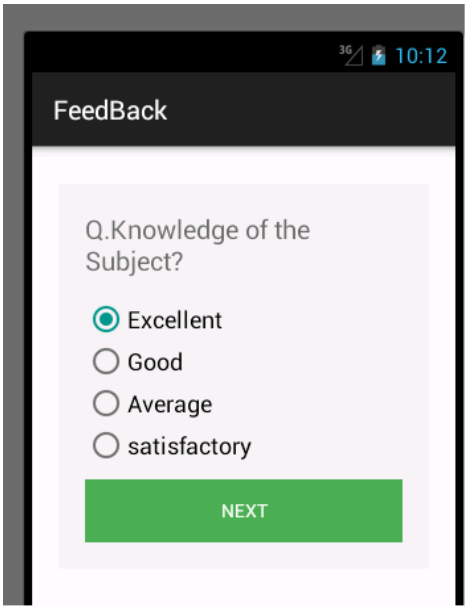


Figure 14. Feedback submission

Student should read the question and select the proper option to mark their feedback. After submitting the answer of first question they can move to next question by clicking on NEXT button.

The questions added for the feedback are:

- Knowledge of the Subject
- Ability to Explain
- Planning & Preparation towards Lecture
- Presentation & Use of Teaching Aids
- Punctuality in Academic Work
- Use of Examples to Clarify the
- Concept
- Ability to design & conduct experiments
- Ability to work on Multidisciplinary courses
- Ability to identify, formulate & solve engineering problems
- Ability to engage in life-long learning
- Knowledge of contemporary issues

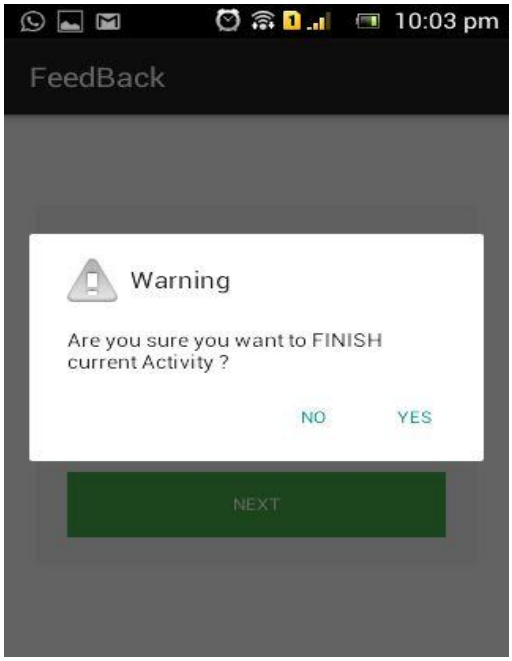


Figure 15. Confirmation regarding submission of feedback

After giving the answer to the last question of first course/subject, student has to select the new course/subject and repeat the same procedure. When student is giving the answer of last question of lat subject, he/she has to submit the feedback. During this final window, where it asks about final submission confirmation, student has to click on YES (figure 15).



Figure 16. Feedback report of course/subject

After every student finishes his/her feedback, the analysis of feedback will be done at the back end. The calculation of percentage for Best, Good, Average and Poor will be done by

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considering how many students entered their feedback and what rating they marked during feedback process. The detailed feedback report and its analysis for one course/subject is mentioned in figure 16.

V. CONCLUSION

The traditional system to collect and analyse the student feedback is more tedious and time consuming process. With the android based student feedback system we can collect the student's feedback from any android mobile i.e. feedback collection is very simple and feedback report will be made available directly after analysis of feedback data.

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Soil Analysis Technique Based on Global Positioning Enabled Mobile Image Processing

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***Abstract*:** India is primarily an agricultural country with 125 million people, among 70 % are directly or indirectly financially dependent upon the agricultural produce. Due to the large geographical area and regions, and climatic conditions it is difficult for the farmers to cultivate the proper crops. For agriculture, the soil, water, and climate are the chief parameters and soil is the major factor that determines the cropping patters in India as well as in Sangli district which is located in the Southwestern part in the state of Maharashtra. Soil's natural encloser is an inherent part of any ecosystem. So soil acts as a medium for cultivation of crops. It is primary resource for agriculture. The different types soil analysis techniques are available, but traditional methods are laborious time consuming as well as do not guarantee accuracy of information in time. So there is need to seek for easier and proper methods of analyzing soil. In the present study soils images are taken on soils samples that originate from farms located in Sangli district. The images seized via a high resolution mobile camera. The captured image is processed using image analysing techniques. The processed soil image data is compared with the readily available laboratory analysed standard data and predicted results on soil properties are displayed on the screen of the mobile phone. Using the results, the user such as a farmer can know more about the soil and is empowered to make proper decision in shortest time.

Index terms: Soil analysis, image processing, hydrometer method, mobile image processing

I INTRODUCTION

India is an agricultural country [1] in which agriculture is the primary resources for 70% population. The soil is the major factor that acts as a medium for cultivation of crops. Due to the diverse condition in the country, different types of soils are available which play important role in the water holding capability. Soil quality is an imperative soil feature that affects strong water penetration rates. The texture of a soil is structured by the proportion of sand, silt and clay. Textural classes of soil are: - (1) sands; (2) silts; (3) loams; and (4) clays. A clay soil is specified as a fine-surfaced soil and a sandy soil is a granular textured soil. Soil texture comprises various assets as follows: drainage, water catching capacity of soil, ventilation, predisposition to erosion, organic matter (OM) content, cation exchange capacity (CEC), pH protecting capacity of soil. The proportion at which water sinks through a doused soil can be controlled by soil texture.

On behalf of this study we have considered the soil for analysis from the Sangli district [10-12]. The different soil types of Sangli district are obtained from the Deccan trap. These are classified as follows:

1. Coarse Shallow soil- Large area of eastern part of Miraj tehsil, southern part of Kavthe-Mahankal tehsil and part of Jat tehsil, 25% soil is coarse shallow type. These are light brown in colour and loamy to sandy in texture having low depth, deficiency of nitrogen (N), organic carbon (SOC) and phosphorous (P) found in these soils. Productivity is less and mostly groundnuts, jowar, bajara, grapes, wheat, potato, tomato are grown in this soil belt.

2. Medium black soil –Percentage of medium black soil is 53% in Sangli district. South west parts of Khanapur, Atpadi, Tasgaon and Kavthe-Mahankal tehsils of the regions are located in this type. In texture these soils are loamy to clayee. Sugarcane, cotton, wheat, jowar, maize, soyabean, and vegetables are grown in these soils.

3. Deep Black Soil- deep black soils are 20% in the Sangli district. The major area of this ample soil is established in the Yerala river valley. The soil is very high in calcium (Ca) and magnesium (Mg) but lacking in N and P. These soils are black in colour due to the existence of titan ferrous magnetite, iron (Fe) and humus content. The major advantage of the soil is it's owning a high water holding capacity but low in drainage and excessive water makes in water logged. That's why water management is very vital in the river area.

4. Sandy soil- having ability of moving water freely through it than clayey soils. Soil quality correspondingly impacts how much water is accessible to the plant, clay soils have a larger water seizing ability than sandy soils. Completely drained soils normally have good soil ventilation which means that the soil comprises atmospheric air. That atmospheric air is contributing to nutritious root growth and consequently a nutritious harvest. Texture of soils also be different in their sensibility to corrosion; under the same conditions, an extreme proportion of silt and soil granules has a superior credibility than a sandy soil. Variances in soil texture also impacts OM levels in sandy soils OM breaks down faster than in fine-surfaced soils, known related ecological circumstances, cultivation and fruitfulness management, since a greater amount of oxygen (O_2) accessible for decomposition in the light-surfaced sandy soils.

II SOIL ANALYSIS BY CONVENTIONAL TECHNIQUES

Traditionally soil analysis is performed by taking sample of soil and into a laboratory for performing various procedures in a sequence beginning with sieving and crushing, followed by measuring sedimentation using the hydrometer or pipette method [3]. John Ashworth and Doug Keys [4] narrated in standard procedure in the Hydrometer method for particle size analysis to avert errors intrinsic in various procedures [3], which can elicit predictable standards. Hydrometer method is generally used in support of particle size study of soils, it determines the weight percentage of sand, silt and clay are evaluated from the density of an aqueous soil deferment, the value of the deferment, in the correcting method of raw reading.

The practice provides reliable–size dispersal data to test center clients. Pipette, Hydrometer, SediGraph, and Hydrophotometer these four methods investigated [5] to analyzing particle sizes finer than 63 μm are analyzed. A high plasticity mud, a p-layer loess, a highly micaceous silt, and a synthetic pure quartz mud was analyzed. Results of pipette and hydrometer investigations are close throughout the entire size range. SediGraph results compare closely with pipette results at sizes finer than 16 μm but indicate a distinctly coarser distribution at larger diameters. The Hydrophotometer gives anomalously coarse results throughout the size range. Pipette and hydrometer have excellent reproducibility, good for Hydrophotometer, and moderate for SediGraph. Instrument exactness of the SediGraph and Hydrophotometer is exceptional; inaccuracy arises mostly during the subsampling method. Procedure for determining the presence of sand, slit and clay in soil has been carried by Sheryl Gill et.al [6].

1) Soil sample preparation,
2) HMP solution preparation
3) Soil dispersion
4) Calibration of a blank
5) Hydrometer measurement

Initially take 150 grams soil sample and put it in oven 105 degree Celsius temperature for 24 hours. After cooling down the sample grind and sieved the particle of soil. Take 2 mm sieve and extract all the rocks from soil sample .Again the rocks were grinded and all particle are sieve in 2 mm sieve. For texture analysis take 50 gm to 100 gm soil depends on sand and clay content. Then prepare Na hexametaphosphate solution by adding sodium (Na) hexametaphosphate powder in moving water and leave it for several hours. For dispersion take 100 ml of above solution and added to sample and also add 250 ml distilled water and mixed it well in a jar. Then take it away for overnight to settle down. This liquid is then poured in two jars and mix it with mixer for 5 minutes. The process of Calibration with blank is done.The amount of each particle like sand, clay and silt are determined with the help of hydrometer.

Ref [7] by using computerized process of digitized soil images uncovers elements of soil composition and illustrates primary approximations of environmental significance, as fertility and transformations in global bionetworks. According to survey, high level integration of recent techniques from computer vision for image attribute extraction, separation into standardized region and texture investigation. Independently utilizing divergence and texture material, across multiscale image smoothing they recommend a joint image segmentation method for further clarification of soil images and attribute

III DIGITAL CAMERA IMAGE PROCESSING BY COMPUTER VISION

Real life objects as images are captured with a digital camera, images are two dimensional matrices. Digital signals are directed to a frame grabber which is connected to a computer and it stores as a digital matrix .Then the digital image is processed as per requirement. According to researcher Haralick and Shapiro [3], the definition of image processing is the science of creating, defining and testing an algorithm that is capable of automatically extracting and analyzing useful data from the image database.

Following are the basic steps of image processing –

1. Image acquisition and storage.
2. Image pre-processing.
3. Image segmentation.
4. Extraction of features of interest.
5. Mathematical manipulation of interested data.

A digitalimage of large and particulate matters can be explored the parameters by using computational process.

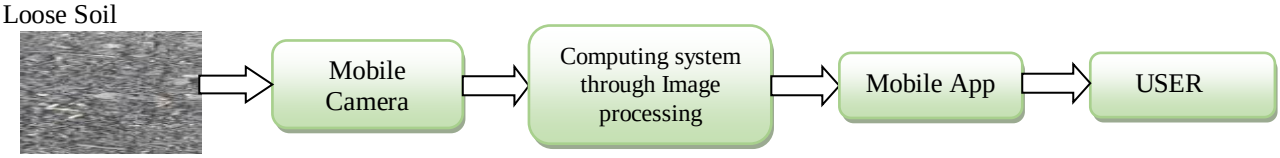


Fig. 1 Proposed system for soil analysis using mobile

Digital image processing (DIP) has been used extensively in the fields of defence and target acquisition. With the appropriate processor, it is possible to acquire and extract relevant information in real time. DIP is also used for pattern recognition analysis in fingerprint matching.

IV PROPOSED SYSTEM

The proposed system for soil analysis is displayed in the Fig. 1. The system consists of mobile based high resolution camera, computing system and user. Using the system, the user collects images on soil sample collected in agricultural farms located in different regions of Sangli district. The samples are collected using GPS and the coordinates are recorded. The samples are processed before collecting images. Some of the processes include, air drying to remove the moisture effect. Followed by breaking the aggregates and then grinding it using a mortor. Later the ground samples are passed through sieves of different sizes and shapes to remove any unwanted content. The processed soil sample is taken in a tray and a raw image is collected with the help of mobile camera and is sent for further processing by a specialized application software. The specialized application is installed on an individual computer system who will read the scanned image data and processes it to calculate the SOM contents and the soil water content and displays the results accordingly.

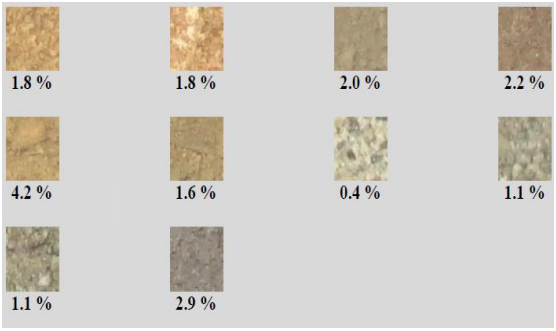


Fig 2: Extracted Color analysis of soil images taken on soil image pixels with known percentage [16]

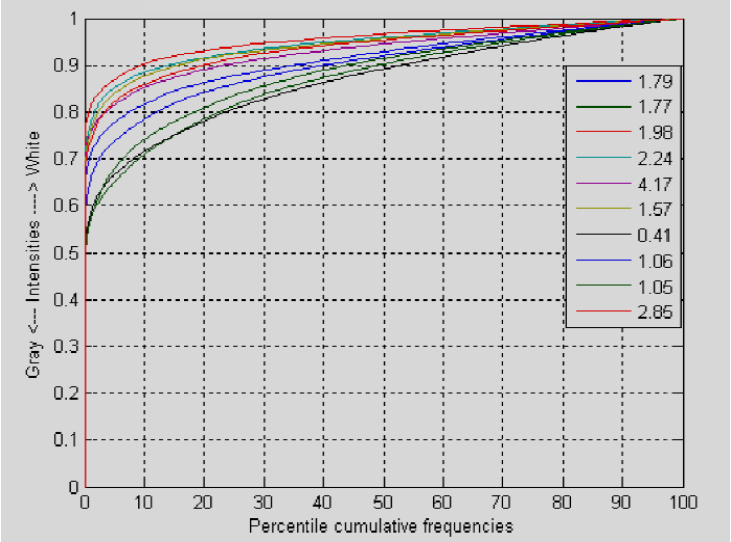


Fig 3 Color analysis of soil images taken on ten indoor soil sample taken at AAFC [16]

Fig 2 and 3 illustrates [16] a primary study which was investigated and implemented to estimate the near surface soil organic matter (NSSOM) on Agriculture fields originated from Canada. Surface percentage SOM was measured using a digital camera with 1/12”CMOS camera. Ten soil images where accumulated fromAgriculture and Agri-Food Canada (AAFC) site. The images were converted into gray scale, and gray color analysis was performed on ten samples of soil images. A new correlation between gray color intensities versus their cumulative frequencies were determined and a new relationship is established with percentage of SOM content. In present study we are trying to implement the similar method of analyzing soil samples that originates from farms located in Sangli district of Maharashtra state in India, where, a simple global positioning (GPS) enabled digital camera could be another inexpensive and possible technique used for sampling and lab analysing techniques for sampled soils and for NSSOM.

The flow chart is shown in Fig 4. This diagram represents the flow of different processes that take place between data collection and displaying of the result on the quantity of soil properties of interest. After a soil image is collected, it gets uploaded to the remote computing system using online services. The computing system takes place of other processes such as conversion and comparison and calculation of the result. The specialized image processing application is developed using MATLAB. The image acquisition rate is controlled according to the time taken to compare the data with standards and to transfer the results back on to the mobile application to user.

FLOW CHART

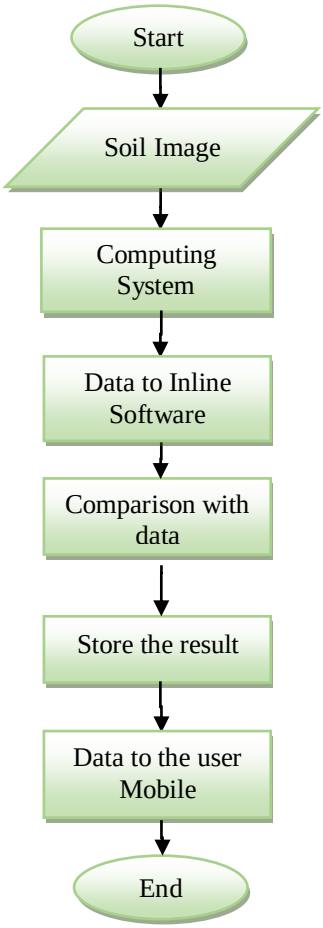


Fig. 4 Flowchart of the present image processing and analysis system

V. CONCLUSION

This paper deals with the review on design and the development of Global Positioning System enabled Mobile Image Acquisition, Processing and Computing tool useful to predict the quantities of various soil properties such as near surface soil organic matter, soil moisture, and percentages of sand, silt and clay in farms located in Sangli District, Maharashtra, India. The results obtained can be used to take optimal management decision on the seasonal cropping patterns. This is a type of online field testing method. It is inexpensive and easier in terms of its usage. The results are provided instantly and can help to decide the seasonal cropping patterns simply by taking images of surface soils using Global Positioning System enabled high definition mobile cameras. The mobile application, once developed will be easily available for farmers to get instant result about their soil health conditions in the field.

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Experimental Design of Collection and Separation of Cashew Fruit Machine

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ABSTRACT:Cashew is often regarded as poor man's crop and rich man's food that is an important cash crop and highly valued nut in the global market. The area under Cashew cultivation is the highest in India. However it is not so in the case of productivity, processing and quality. So to increase productivity modern agricultural technology is necessary to use. This paper attempts to partially replace human by semi-automated machine for collection and separation operations. These processes involves collection of Cashews from ground by roller type collector and after collecting it transfer to separator. So that separation of Cashew Apple from Cashew is done so an efforts of collection and separation are reduced. This machine is simple to operate for single person by electrical power.

KEYWORDS:Machine design, Collector, Separator, Semi-automatic machine.

I. INTRODUCTION

The Cashew nut tree is first grower and ever green tropical tree. It grows to height of 12 m blossoming takes place between November and January. The fruit ripens with two months.

The nut is attached to the lower portion of cashew apple which is conically shaped. The nut (seed) hangs at the bottom of the apple. And is C shaped. The cashew seed has within the shell the edible kernel or nut. Cashews outside shell is tough enough to protect inside nut. It is hard to break by hand and the apple attached to it is juicy and soft.

In actual process of cashew is collected and separated from its apple. This process of collection and separation is done now days manually. It requires lot of manpower for collection of cashews and separation from apple by twisting it. Cultivation area of cashew tree is minimum of 2m to 3m so it's difficult for single or two persons to collect it and it's time consuming. It's possible to done this collection and separation process with small cultivation area by manually but it's also time consuming. As cultivation area increase manpower required for this process is more and sometimes farmers do not have that much manpower to done this process. So finally it can be conclude that this process of collection-separation is time consuming and requires more efforts.

To solve this agricultural problem there is need of technical solution. This paper introduce about the machine that will do this process with very less effort and within less time. This machine is simple to use and single person can operate.

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II. LITERATURE REVIEW

The literature survey is carried out in order to seek information about the above said subject. However, there is no literature available which illustrates the collecting and separating of Cashew nuts. So, it also concludes that no work has been carried on the above said subject. However, there is a little work carried on the collection of other fruits and vegetables.

Johan Baeten et. al. [1] invented an Apple picking machine in Belgium. The key motive of this machine was to harvest Apples. The machine consisted of the art industrial components with newly designed flexible gripper. The gripper consist of a Silicone funnel with a camera mounted inside.

Pitzer [2] invented the fruit berries picking machine near Duette. The construction as big as a bus, long enough to straddle a dozen rows of strawberries at once. It consisted of a computer mounted at the top which is controlled with software and super accurate GPS. They also used robots to pick more than 50% of ripe berries. However, he concluded that this machine is slower than human hands and needs for further improvement.

K. Ashwini [3] in her paper, designed a movable strawberry harvesting robot which was molded on a travelling platform and they were developed and operated in green house. Combining the harvesting robot and travelling platform. It demonstrated the potential for autonomous harvesting in 2D area in a greenhouse.

Nadine Sangster et al.[4] studied harvesting for particular fruit crops in lower production level, his design a mechanical fruit picking device which could assist in the reaping process. He gave more impetus on picking the fruits without damages in a specified period of time.

Hayashi et al. [5] A strawberry harvesting robot, which performs autonomous harvesting by moving back and forth along a set of rails, was developed and tested in field. Strawberry harvesting robots is cylindrical type and mounted on travelling platform, were developed and operated practically in a greenhouse. The harvesting robot is based on the second prototype; however, it can be separated from travelling unit. Both the robot and the travelling platform are modular system units that can be developed and tuned individually before it installed on the platform. Intercommunication takes place via digital I/O signals.

Andrew Meikle [6] was invented first threshing machine in 1786 by Scottish engineer. A threshing machine or thresher is a piece of farm equipment that threshes grain that is it removes the seeds from the stalks and husks. The subsequent adoption of such machine was one of the earlier examples of the mechanization of agriculture.

Denison [7] was issued a patent on August 12, 1839, for a freestanding, hand –operated machine that removed individual kernels of corn by pulling the cob through a series of metal-toothed cylinders which stripped the kernels off the cob. Soon after, other patents were granted for similar machines, sometimes having improvement over his original design. Corn Sheller can be powered by a hand crank, a tractor, a stationary engine, or by an electric motor. Whole corn cobs are fed in. They are pulled between two toothed wheels, usually made of metal. Each wheel spins the opposite direction of the other. The teeth pull the kernels off the cob until there are no kernels left. The kernel fall out through a screen into a container placed underneath the machine.

Sarig. Y. et al., [8] studied the development of novel technologies for extracting pomegranate seeds, to be utilized as both, fresh and processed products. Proceedings of the 6th international symposium on fruit, nut, and vegetable production engineering, Potsdam, Germany.

Okokon, et al., [9] done the Analysis of the Impact Forces on Melon Seeds during Shelling. Agricultural Engineering International.

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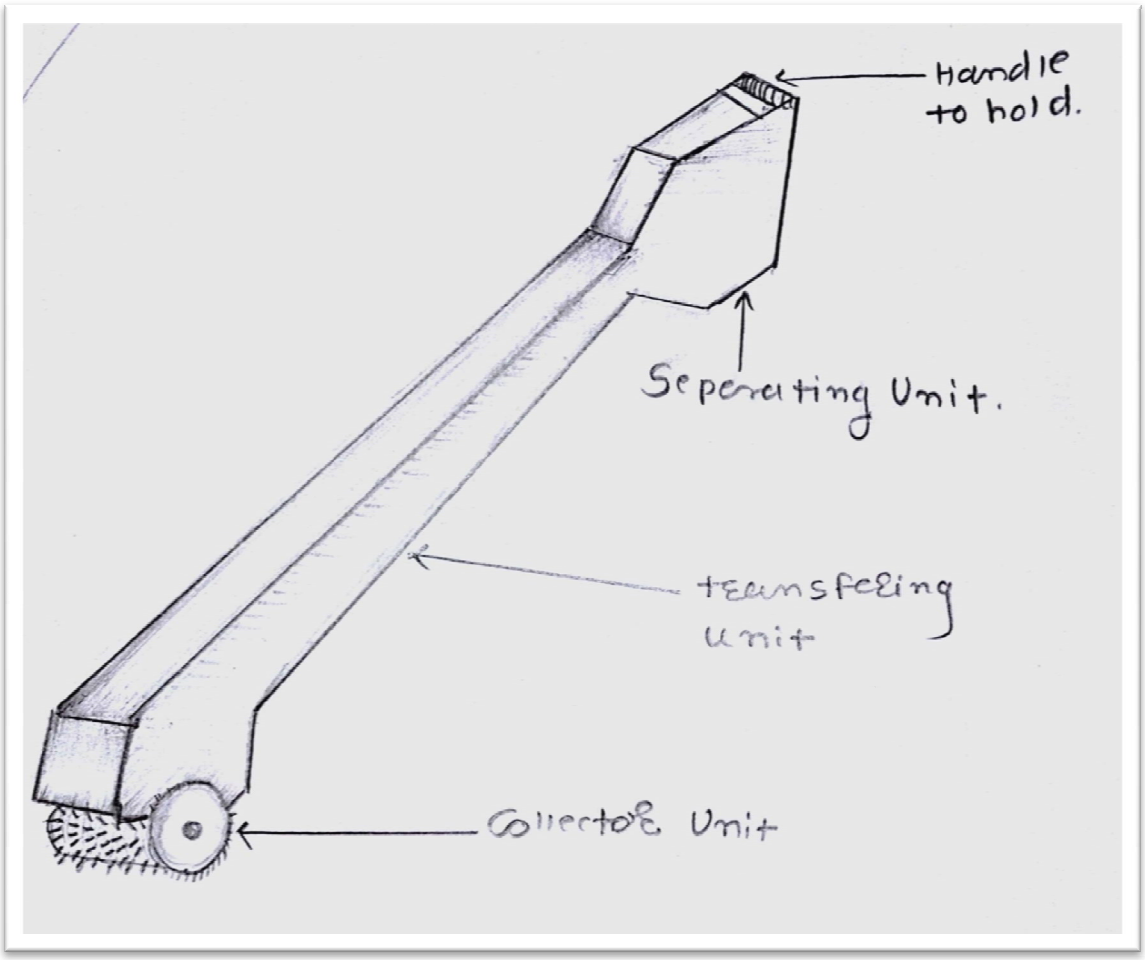
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From literature survey, it is found that very few research work done on this topic. Concept of this collection-separation machine is not exist yet. Hence, it is decided to carry out an experimental work to find performance and efficiency of this machine.

III.EXPERIMENTAL WORK

Collection and separation process will be done in separate sections within machine. Collection of cashew from land will made of roller like structure. It will roll over the land and collect cashew. Another process will to separate cashew apple from cashew and it will achieve by cutting cashew apple and separating it from cashew.
Collector will have roller like structure. It collects cashews, and these cashews passing through conveyer towards separator where cashew apple and cashew will separate from each other. Approximate machine structure we have included in this synopsis.
In actual process, roller will roll on ground, by which it will collect cashews. After that, the separator which will connected after the conveyer output will done separation process.



DIAGRAMMATIC REPRESENTATION

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IV. CONCLUSION

This paper deals with the solution for time consuming and effort taking process of Cashew Farming. Now day's process of Cashew collection and separation from fruit is manual process. And we know this large amount of Cashews collection and separation from fruit by human hands it is not better option. Also it takes lot of time and effort. So that this paper work inform that there is a best technical solution for this. Machine that is mentioned in this paper will be operate by single person and it will easy to handle. Power require for this machine will be less than human efforts. So we can conclude that this machine is the technical solution to solve this cashew farming problem.

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Behavior of Concrete under Partial Replacement of Hypo-Sludge & Foundry-Sand

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Abstract

Concrete is exclusive construction material which extensively used world widely. It is a mixture of cement, sand, aggregate, admixtures and water. The manufacturing of Portland cement which is the main ingredient of concrete releases a large amount of greenhouse gases especially CO2. On the other side, dumping of wastes produced from various industries, corporations and municipalities causes major environmental pollution issues. To minimize these effects, researchers are trying to use waste materials from industries as replacement material for cement or coarse aggregate or fine aggregates. During this research work an attempt has been made for simultaneous replacement of cement with hypo-sludge and fine aggregate with foundry sand. The present dissertation work is directed towards developing low cost concrete from paper industry waste, and foundry industry waste. The work is carried out with M30 grade concrete. The hypo sludge& foundry sand was replaced within the range of 10-30% by weight of cement& fine aggregate respectively. Cubes of 150mm x 150mm x 150mm in size, Cylinders of 150 mm diameter and 300 mm height, beams of 150mm x 150mm x 700mm were casted. In the present study, four different mixes are tested for parameters like: compressive strength, flexural strength and split tensile strength.

Keywords: Concrete, Fine Aggregates, Foundry-Sand, Hypo-Sludge, Strength, Water-Cement Ratio

I. INTRODUCTION

Concrete is exclusive construction material which extensively used world widely. It is a mixture of cement, sand, aggregate, admixtures and water. The manufacturing of Portland cement which is the main ingredient of concrete releases a large amount of greenhouse gases especially CO2. On the other side, dumping of wastes produced from various industries, corporations and municipalities causes major environmental pollution issues. To minimize these effects, researchers are trying to use waste materials from industries as replacement material for cement or coarse aggregate or fine aggregates. During this research work an attempt has been made for simultaneous replacement of cement with hypo-sludge and fine aggregate with foundry sand. The hypo sludge or paper mill sludge is a major waste and environmental pollutant from the paper and board industry. The material is a by-product of the deinking and re-pulping of paper. Investigations were undertaken to produce low cast concrete by blending various ratios of cement with hypo sludge. Metal foundries use large amounts of sand as part of the metal casting process sand consists primarily of silica sand, coated with a thin film of burnt carbon, residual binder (betonies, sea coal, resins) and dust. Foundry sand can be used in concrete to improve its strength and other durability factors. Foundry Sand can be used as a partial replacement of fine aggregates or total replacement of fine aggregate and as supplementary addition to achieve different properties of concrete.

II. METHODOLOGY

A. Introduction

Physical properties of hypo sludge and other materials were determined by performing tests & results. Various partial replacement proportions of hypo sludge & foundry sand were fixed. Based on the result a mix design of M30 grade was formulated according to the standards of IS 10262- 2009. About 4 different concrete samples of M30 grade were casted & cured for about 7 & 28 days including cubes, cylinders & beams. These specimens were used to find the important properties like compressive strength, flexural strength and split tensile strength.

B. Details of Project

Chemical composition of hypo sludge & specific gravities of coarse aggregate, fine aggregate, hypo sludge & foundry sand were determined.

1) Chemical Properties of Hypo-Sludge

The chemical properties & their percentage amount of the constituents of hypo sludge were tested in a lab. These chemical properties of PPC & Hypo sludge were compared.

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Table – 1
Comparison of Chemical Properties of Cement & Hypo Sludge

Chemical Properties	*Cement*	*Hypo Sludge*
Calcium (CaO)	*60*	*12.01*
Magnesium (MgO)	*0.1*	*07.56*
Silica (SiO2)	*17*	*07.28*
Sulphur (SO3)	*1.3*	*07.74*
Alumina (Al2O3)	*3*	*03.06*
Iron Oxide (Fe2O3)	*0.5*	*01.18*
Sodium (Na2O	*0.4*	*03.50*
Potassium (K2O)	*0.4*	*00.38*
Loss on Ignition	*2*	*43.32*

2) *Specific Gravity*

Specific gravity can be defined as the ratio of the weight of a given volume of material to the weight of an equal volume of water. Specific gravities of coarse aggregate, fine aggregate, hypo sludge& foundry sand were determined which were further used in mix design calculations. The experiment was carried out with help of the pycnometer.

Specific gravity of various materials was calculated with help of pycnometer & by using expression,

$$G = \frac{M2-M1}{(M2-M1)-(M3-M4)}$$

Where,

M1 = mass of empty Pycnometer,

M2 = mass of the Pcynometer with material,

M3 = mass of the Pcynometer and material and water,

M4 = mass of pyconmeter filled with water only.

Table – 2
Comparison of Chemical Properties of Cement an&d Hypo Sludge

Material	*Specific gravity*
Coarse aggregate	*3.03*
Fine aggregate	*2.57*
Hypo-sludge	*1.64*
Foundry sand	*2.36*

III. CONCRETE MIX DESIGN

Concrete mix design for M30 concrete,

1) Stipulations for Proportioning
- Grade Designation: M30
- Type of cement: PPC 53 grade
- Maximum nominal size of aggregate: 20mm
- Minimum cement content: 220 Kg/m3
- Workability: 70 mm (slump)
- Exposure Condition: Mild
- Degree of supervision: Good
- Type of aggregate: Crushed Angular

2) Test Data for Materials
- Specific gravity of cement = 3.15
- Specific gravity of coarse aggregate = 3.03
- Specific gravity of fine aggregate = 2.57
- Specific gravity of hypo-sludge = 1.64
- Specific gravity of foundry sand = 2.36

3) Target Strength for Mix Proportioning

$$f_{ck= f_{ck+k\sigma}}$$

$$= 30 + (1.65 * 5) = 38.25 \ {}^{N}/_{mm^2}$$

4) Selection of Water-Cement Ratio

From Table 5 of IS 456, maximum water-cement ratio = 0.60

Hence we adopt water-cement ratio as 0.45.

5) Selection of Water Content

From Table 2, of IS 10262-2009 maximum water content for 20 mm aggregate = 186 lit (for 25 to 50 mm slump range)

Estimated water content for 70 mm slump = 186 + 186 * 0.03 = 191.58 lit.

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6) Selection of Cement Content

Water Cement Ratio = 0.45

Cement content = $\frac{191.58}{0.45}$

= 425.73 Kg/m3

From Table 5 of IS 456, minimum cement content for 'mild' exposure condition = 220 Kg/m^3

425.73 kg/ m^3 > 220 kg/m^3, Hence, O.K.

7) Proportion of Volume of Coarse and Fine Aggregates Content

From Table 3, of IS 10262-2009 volume of coarse aggregate corresponding to 20 mm size aggregate and fine aggregate (Zone I) for water-cement ratio of 0.50 =0.60.

In the present case water-cement ratio is 0.45. Therefore volume of coarse aggregate is required to be increased to decrease the fine aggregate content. As the water-cement ratio is lower by 0.05 the proportion of volume of coarse aggregate is increased by 0.01

= 0.60 + ($\frac{0.01}{0.05}$ * 0.05)

= 0.61

Therefore, volume of coarse aggregate = 0.61.

Volume of fine aggregate content =1 - 0.61 = 0.39.

8) Mix Calculations

The mix calculations per unit volume of concrete shall be as follows:

a) Volume of concrete = 1 m^3

b) Volume of cement = $\frac{\text{mass of cement}}{\text{specific gravity of cement}} * \frac{1}{1000}$

= $\frac{425.73}{3.15} * \frac{1}{1000}$ = 0.134 m^3

c) Volume of water = $\frac{\text{mass of water}}{\text{specific gravity of water}} * \frac{1}{1000}$

= $\frac{191.58}{3.15} * \frac{1}{1000}$ = 0.191 m^3

d) Volume of all in aggregates = [a-(b+c)] = [1-(0.134-0.194)] = 0.675 m^3

e) Mass of coarse aggregate = (d x volume of coarse aggregate x specific gravity of coarse aggregate x 1000)

= 0.675 * 0.6* 3.03 * 1000

= 1247.60 kg

f) Mass of fine aggregate = (d x volume of fine aggregate x specific gravity of fine aggregate x 1000)

= 0.675 x 0.39 x 2.57 x 1000

= 676.55 kg

9) Mix Proportions

Table – 3
Mix Design for Various Proportions

Mix design type	*Cement (kg/m^3)*	*Water (kg/ m^3)*	*C.A. (kg/ m^3)*	*F.A (kg/ m^3)*
Conventional	*425.73*	*191.56*	*676.55*	*1247.60*
	1	-	*1.58*	*2.93*
10% replacement	*393.71*	*196.48*	*654.50*	*1206.93*
	1	-	*1.66*	*3.06*
20% replacement	*351.17*	*197.53*	*641.47*	*1182.91*
	1	-	*1.82*	*3.36*
30% replacement	*311.88*	*200.05*	*621.42*	*1145.94*
	1	-	*1.99*	*3.67*

IV. RESULTS & DISCUSSION

A. Compressive Strength

Compressive strength test was carried out on cube specimens of size 150mm x 150mm x 150mm which were casted & cured for 7 & 28 days. The cubes were casted by using M30 grade concrete & respective mix proportions from the mix design. The partial replacement of hypo sludge & foundry sand was 10%, 20%, 30% respectively. There was also a set of conventional concrete blocks for the comparison of the results thus obtained. The test was carried out as per guidelines of IS 516 1959.

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Table – 4
Average Compressive Strength of Cube Specimens

Types of concrete sample	*Average Compressive Strength (N/mm²)*	
	7 Days	*28 Days*
Conventional Concrete	*19.65*	*34.83*
10% Replacement	*19.71*	*35.24*
20% Replacement	*17.22*	*33.66*
30% Replacement	*12.55*	*23.75*

B. Flexure Strength

The flexure strength on a concrete slab is called upon to resist tensile stresses from two principal sources wheel loads & volume change in the concrete. The flexure strength test was carried out on the beam specimens of size 150mm x 150mm x 700 mm. This test was carried out by Centre-point loading method on UTM. This test was also carried on conventional & partial replaced specimens of M30 grade & respective proportions from mix design. The beam specimens were casted & cured for 7 & 28 days. The test procedure was carried out as per the guidelines of IS 516 1959.

Table – 5
Average Flexure Strength of Cube Specimens

Types of concrete sample	*Average Flexure Strength (N/mm²)*	
	7 Days	*28 Days*
Conventional Concrete	*3.15*	*4.51*
10% Replacement	*2.86*	*4.09*
20% Replacement	*2.78*	*3.98*
30% Replacement	*2.58*	*3.69*

C. Split Tensile Strength

The determination of split tensile strength of concrete is necessary to determine the load at which the concrete may crack due to tension. These tests were carried out on the cylindrical specimens of size 300 mm depth & 150 mm diameter casted & cured for 7 & 28 days for conventional & different partial replacements concrete samples.

Table – 6
Average Split Tensile Strength of Cube Specimens

Types of concrete sample	*Average Flexure Strength (N/mm²)*	
	7 Days	*28 Days*
Conventional Concrete	*1.60*	*2.29*
10% Replacement	*1.41*	*2.01*
20% Replacement	*1.35*	*1.93*
30% Replacement	*0.93*	*1.33*

V. CONCLUSION

Based on the limited experimental investigation concerning the compressive, flexural, split tensile strength, following conclusions are drawn:

- Hypo sludge possesses cementitious properties therefore it is feasible construction material, for partial replacement of cement.
- Foundry Sand, a byproduct of metal industry, contains silica sand which aids in increasing strength and durability of concrete, and therefore is feasible for use as construction material, for partial replacement of fine aggregate.
- After a 10% of partial replacement of hypo sludge exceeds, as the percent partial replacement of hypo sludge and foundry sand is increased, there is reduction in strength of concrete.

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Flexural Behaviour of RC Beam with Partial Replacement of Coarse Aggregate by Coconut Shell

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Abstract - *The rapid development in construction industry increasing demand for new innovative material as a part of construction industry. Coconut is grown in more than 93 countries. India is the third largest, having cultivation on an area of about 1.78 million hectors. The properties of coconut shell aggregate concrete are examined and the use of coconut shell aggregate in construction is tested. Experimental studies are conducted on the effect of coconut shell used in proportions of 5%,10%,15%,20% and 25% to replace coarse aggregate in conventional concrete (M20 grade and M30 grade).*

As a present scenario research carried out on RC beams by using coconut shell as coarse aggregate yet not found. This study will therefore focus on reinforced concrete beams with partial replacement of coarse aggregate by coconut shell for M20 and M30 grade concrete are carried out. Twelve specimen of beam having a size 700 X 150 X 150 mm were casted. After 28 days they were tested by using UTM of 1000KN under two point loading with shear span of 210mm.Possibility & feasibility of compressive and flexural strength of coconut shell concrete for cube and beam specimens are determined respectively. The obtained results are compared with that of conventional mix.. From study, we find out the optimum percentage for replacement of coarse aggregate by coconut shell and we can encourage the use of these 'seemingly' waste products as construction material in Civil engineering.

Key Words: Coarse aggregate, coconut shell, compressive strength, flexural strength, conventional concrete.

1. INTRODUCTION

Concrete is the vital civil engineering material. Its manufacturing involves utilization of ingredients like cement, sand, aggregate, water and required admixtures. The coarse aggregate is the main constituent of concrete mix. Demand of construction material is increased due to infrastructural development across the world. That high demand for concrete in the construction using normal weight aggregate such as gravel and granite drastically reduces the natural stone deposits and this has damaged the environment there by causing ecological imbalance, there is a need to explore and to find out suitable replacement material to substitute the natural stone. Therefore it is necessary to encourage or research on sustainable material which will help to use such waste material as construction material with less cost and safety of structure. The coconut shell is the agricultural waste product and simultaneously its use in construction material will reduces the environmental problem of solid.

1.1 Properties of Coconut Shell

Coconut shell has high strength and modulus properties. It has added advantage of high lignin content. High lignin content makes the composites more weather resistance. It has low cellulose content due to which it absorbs less moisture as compare to other agriculture waste. Coconuts being naturally available in nature and since its shell are non- biodegradable; they can be used readily used in concrete which may fulfil almost all the qualities of the original form of concrete. [3]

1.2 Coconut Shell Aggregate

Here coconut shells which were collected already broken into two pieces were collected from local temple or restaurants, hotels etc.then they are get air dried for five days approximately at the temperature of 25 to 30^{0}C, removed fibre and husk on dried shells; further broken the shell into small chips manually using hammer and sieved through the set of sieve which is shown in fig 1.1.The material passed through 20 mm sieve and retained on 12.5 mm sieve was used to replace coarse aggregate with CS. The material passing through 12.5mm sieve was discarded. Water absorption of the CS was 20 % and specific gravity at saturated surface dry condition of the material was found as 1.29.

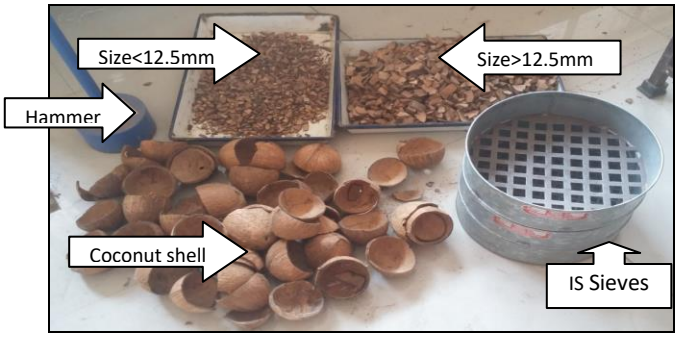


Fig.1.1: Preparation of Coconut Shell Aggregate

2. LITERATURE REVIEW

Teo DCL, Mannan MA, Kurian VJ (2006), have constructed the structure to show the potential use of oil palm shell (OPS) concrete. In actual project, a small footbridge of 2 m in span and a low cost house with a floor area of 59 m^2, both using OPS concrete were constructed on the campus of University Malaysia Sabah (UMS).These structures are located near the coastal area, which has an annual rainfall of about 2500 mm, air temperature in the range of 23–32°C and relative humidity of 72–91%. [8]

Dewanshu Ahlawat, L.G.Kalurkar (2010), have conducted the experimental study on M 20 grade of concrete with partial replacement granite by coconut shell. Forty five cubes were casted and their compressive strength and workability were evaluated at 7, 14 and 28 days. The compressive strength of concrete reduced as the percentage replacement increased. Concrete produced by 2.5%, 5%, 7.5%, 10% replacement attained 28 days compressive strength of 19.71,19.53,19.08,18.91 respectively. These results showed that Coconut shell concrete can be used in reinforced concrete construction. Its utilization is cost effective and eco-friendly. [5]

Gunasekaram K, Kumar PS, Lakshmipathy M (2011), have concluded that CS (coconut shell) concrete has better workability because of the smooth surface on one side of the shells. The air-dry densities of CS concrete of the typical mixes are within the range of structural LWC (Light Weight Concrete). The flexural strength of CS concrete is approximately 17.53% of its compressive strength. The splitting tensile strength of CS concrete is approximately 10.11% compressive strength. The impact resistance of CS concrete is high when compared with conventional concrete. [6]

Payam Shafigh, Mohd Zamin Jumaat, Hilmi Bin Mahmud, Norjidah Anjang Abd Hamid (2012), have carried out the experiment by replacing normal weight aggregate by Oil palm shell (OPS) which is a waste lightweight aggregate originating from the palm oil industry, which is approximately 50% lighter than conventional aggregate. In this study, crushed old OPS was used as coarse aggregate. Compressive strength under different curing conditions and the splitting tensile and flexural strengths were compared with those of the normal weight granite concrete. The test results showed that OPS concrete with a compressive strength in the range of 34–53 MPa has a splitting tensile strength rang of 2.8–3.5 MPa and flexural strength range of 4.4–7.0 MPa. The sensitivity of compressive strength of OPS concrete in this study is significantly lower than uncrushed OPS concrete reported in the literature. The sensitivity of OPS concrete, under poor curing regime, can be reduced by decreasing the water/cement ratio, increasing the OPS content or reducing the cement content. It was found that there was no substantial difference in 28-day compressive strength for OPS concretes cured initially for 3, 5 and 7 days. The28-day compressive, splitting tensile and flexural strengths of OPS concrete was found to be 38%, 28% and 17%, lower than that of granite concrete, respectively. [7]

Amarnath Yerramala, Ramachandrudu C (2012), have carried out the experimental investigation on properties of concrete with coconut shells (CS) as aggregate replacement. Control concrete with normal aggregate and CS concrete with 10 - 20% coarse aggregate replacement with CS were made. Two mixes with CS and fly ash were also made to investigate fly ash effect on CS replaced concretes. Constant water to cement ratio of 0.6 was maintained for all the concretes. Properties like compressive strength, split tensile strength, water absorption and moisture migration were investigated in the laboratory. The results showed that, density of the concretes decreases with increase in CS percent. Workability decreased with increase in CS replacement. Compressive and split tensile strengths of CS concretes were lower than control concrete. Permeable voids, absorption and sorption were higher for CS replaced concretes than control concrete. Coarse aggregate replacement with equivalent weight of fly ash had no influence when compared with properties of corresponding CS replaced concrete. [2]

Tomas U. Ganiron Jr (2013), have studied on generating product using agricultural waste as well develop an alternative construction material that will lessen the social and environmental issues. It also paved the way to the recognition of using coconut shells and fiber as substitute for aggregates in developing concrete hollow blocks. This paper presents the result on the workability and compressive strength of concrete containing various percentage of coconut shell content as partial aggregate replacement. Workability test and compressive strength test were conducted in accordance to ASTM C136 and ASTM C137 respectively. Results show that replacement of appropriate coconut shell content able to produce workable concrete with satisfactory strength. Integration of coconut shell enhanced the strength of concrete making it to be the highest as compared to conventional concrete mixture. [11]

B.Damodhara Reddy, S.Aruna Jyothy, Fawaz Shaik (2014), have conducted the experimental investigation on concrete with different coarse aggregate.The properties of coconut shell and coconut shell aggregate concrete is examined and the use of coconut shell aggregate in construction is tested. The project paper aims at analyzing flexural and compressive strength characteristics of with partial replacement using M30 grade concrete. The project also aims to show that Coconut shell aggregate is a potential construction material and simultaneously reduces the environment problem of solid. Beams are casted, tested and their physical and mechanical properties are determined. The main objective is to encourage the use of these "seemingly" waste products as construction materials in low-cost housing. [4]

T.R.M.Nandhini, P.Balamurugan (2016), have concluded that the project will encourage the use of these harm free

waste products as construction materials in low-cost housing. In conventional constructions, the cost of the materials are high and this has necessitated the use of waste material i.e., coconut shell (cocos nusifera) which is also the light weight material. Hence in this current scenario this experimental study of partial replacement of coarse aggregate finds an effective solution in the reduction of land fill cost and also reduces the environment pollution. In this experimental study the partial replacement of coarse aggregate with 0% to 50% of coconut shell waste collected from the agricultural farms and houses were used along with the admixture. They are mixed at M30 graded concrete and the specimens are casted, cured and tested for its compressive strength & with its result the beams are casted and tested for flexural strength. The parameters will be tested for 28 days curing. [9]

T.Subramani, A.Anbuvel (2016), have carried out the experimental investigation on behavior of reinforced concrete beam with coconut shells (CS) as coarse aggregate. Control concrete with normal aggregate and CS concrete with 0 - 20% coarse aggregate replacement with CS were made. Two mixes with CS and fly ash were also made to investigate fly ash effect on CS replaced concretes. Constant water to cement ratio of 0.6 was maintained for all the concretes. Properties like compressive strength, split tensile strength, water absorption and moisture migration were investigated in the laboratory. The properties of coconut shell and coconut shell aggregate concrete is examined and the use of coconut shell aggregate in construction is tested. The project paper aims at analyzing flexural and compressive strength characteristics of with partial replacement using M25 grade concrete. [10]

Ajay Tharwani, Ashish Sablani, Gaurav Batra, Sakshi Tiwari, Divya Reel, Manish N. Gandhi (2017), have studied the effect of coconut shell on the strength of concrete when used in replacement of aggregate. The tests were conducted on concrete with varying percentage of coconut shell (5%, 10% and 15%). Data presented include strength and slump value of concrete. The use of coconut shells can also help the prevention of the environment and also help economically. Sun drying shell should be used to make sure biodegradable materials decay before its mixing with concrete. It also contributes to sustainable construction. The aim of this paper is to spread awareness about the utilization of coconut shell as a construction material in civil engineering. [1]

3. OBJECTIVES

- To study the flexural behavior of RC beam with partial replacement of coarse aggregate by coconut shell.
- To prepare mix design for M20 grade and M30 grade concrete.
- Experimental investigation of the concrete cube and beam specimen that are cast with different Coconut shell content for replacement of coarse aggregate.
- To study the behavior of compressive and flexural strength of coconut shell concrete.
- To find out the optimum percentage for replacement of coarse aggregate by coconut shell.
- To study the cost comparison for production of conventional concrete and Coconut shell concrete.

4. METHODOLOGY

In order to accomplish the objectives, the project work has been divided into seven major parts. They are:

- The Coconut shell samples are to be collected from nearby sources located in area.
- Mix design will be prepared for M20 grade and M30 grade concrete according to IS: 10262-2009.
- Test samples will be prepare containing different proportions (i.e. 10%,15%,20% and 25%) of Coconut shell and tested to get optimum strength with partial replacement of normal weight aggregate by coconut shell.
- The various tests like Compressive Strength and Flexural Strength are perform on casted cube and beam specimen respectively, as per the specified procedure of IS Codes.
- The obtained results are compared with that of conventional mix.
- Comparison to be made between these analysis, to know possibility and feasibility.
- Conclusions will be drawn from the results of analysis.

5. MATERIALS AND EXPERIMENTAL PROCEDURE

The constituent materials used in this project were obtained from local sources and these were Pozzolana Portland Cement (P.P.C), sand as fine aggregate, crushed granite and coconut shell both as coarse aggregate. Potable water was used for mixing and curing.

5.1 Concrete

The concrete used for casting was prepared in the testing laboratory using a hand mix method of concrete. The concrete was (M20 and M30 Grade) with mix proportion adopted was (1: 1.432: 3.112) and (1: 1.228: 2.671) with water to cement ratio of 0.50 and 0.44 respectively. The material proportions per cubic meter of concrete:

A) For M20 grade concrete:

1) 1193.368 kg/m³ of coarse aggregate (maximum size 20mm)

2) 548.775 kg/m³ of natural river sand (sp.gr =2.608)

3) 383.16 kg/m³ of Pozzolana Portland Cement (P.P.C.)

4) 191.58 liters of water

B) For M30 grade concrete:

1) 1162.998 kg/m³ of coarse aggregate (maximum size 20mm)

2) 543.809 kg/m³ of natural river sand (sp.gr =2.608)

3) 435.409 kg/m³ of Pozzolana Portland Cement (P.P.C.)

4) 191.58 liters of water

5.2 Compressive Strength Test

A) Preparation of Specimens:

M-20 & M-30grade of concrete was designed by I.S 10262-1982. Batching was done as per the mix proportions with the help of electronic weigh balance. Placing and Compaction was done. The moulds were greased from inside for easy demoulding. Place the fresh concrete in cubes in 3 layers, tamping each layer 25 times. The entrapped air in concrete is removed by table vibrator shown in fig.5.1. Concrete cubes are now kept in curing tank for 3, 7 and 28 days. After 28 days, concrete cubes were removed from curing tank to conduct tests on hardened concrete by using CTM as shown in fig.5.1.



Surface Vibrator **Compression Testing Machine (CTM)**

Fig. 5.1: Equipments used for compression testing of cube specimen

B) Results and Discussion:

Compressive Strength: Cubes were placed in Compression Testing Machine (C.T.M), and load was applied. The readings on display of machine were recorded and compressive strength was calculated. The results of Compressive strength are shown in Table 5.1 and 5.2.

Table 5.1: Compressive Strength of Coconut Shell Concrete (N/mm2)

M20 grade concrete

Curing Days	0% CS	5% CS	10% CS	15% CS	20% CS	25% CS
3	14.30	12.25	11.85	11.50	9.85	9.25
7	18.867	16.73	13.60	115.73	13.20	12.33
28	27.80	22.70	20.50	22.83	20.30	19.23

Table 5.2: Compressive Strength of Coconut Shell Concrete (N/mm2)

M30 grade concrete

Curing Days	0% CS	5% CS	10% CS	15% CS	20% CS	25% CS
3	14.90	11.80	11.20	11.65	9.60	9.35
7	18.86	17.46	15.43	16.13	13.76	13.20
28	29.83	24.46	23.06	24.73	20.16	19.40

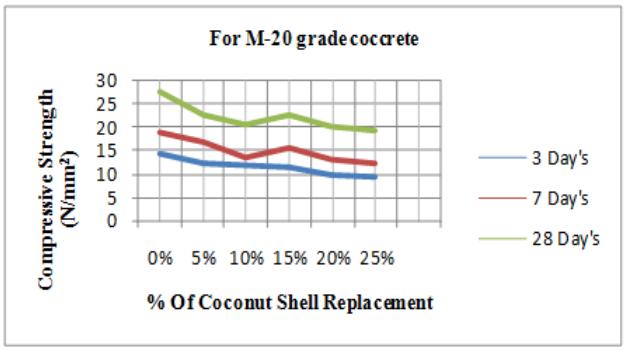


Fig.5.2: Graph Shows Variation in compressive strength (28 days) with age for M20 grade concrete

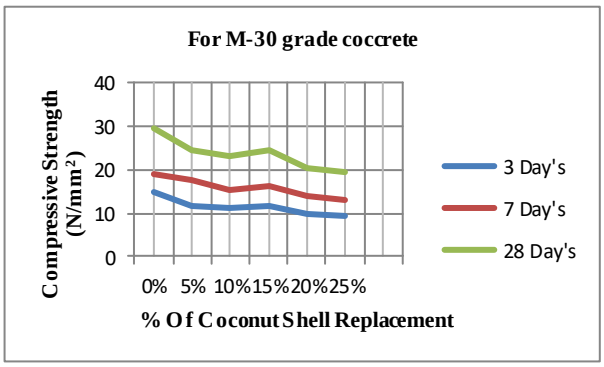


Fig.5.3: Graph Shows Variation in compressive strength (28 days) with age for M30 grade concrete

From above fig.5.2 and 5.3 it is clear that the compressive strength holds well up to 15% replacement of coarse aggregate by coconut shell. The percentage increased above 15% the compressive strength decreases significantly.

5.3 Flexural Strength Test

A) Details of the R.C. Beam:

While reviewing literature of beam come to knew that the beam size is 700X150X150 mm. As accorded to the IS (10086-1982) & IS (516-1959) minimum size of specimen for beam mould is 700X150X150mm.

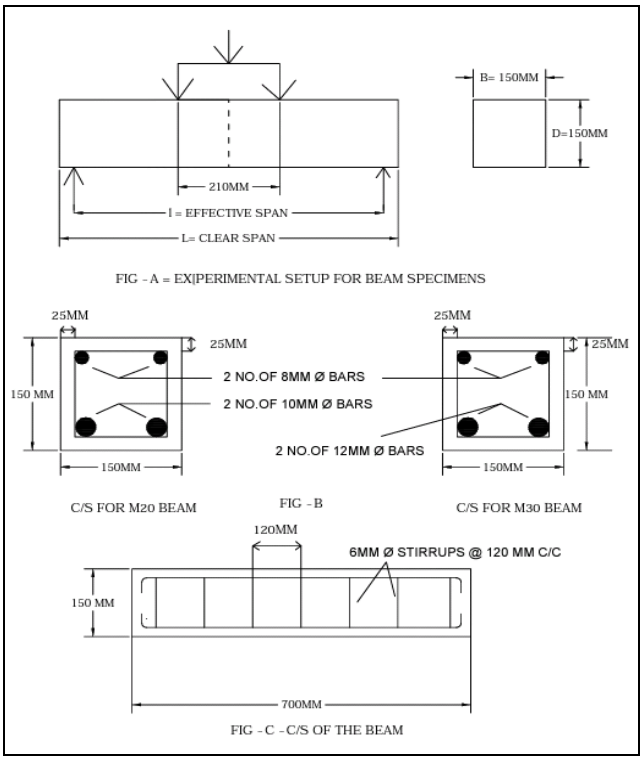


Fig.5.4: Details of R.C. Beam

B) Casting and curing of specimens:

The wooden beam mould was used for casting the beam specimens. Before mixing the concrete, the moulds were kept ready by placing it on horizontal surface. The sides and bottom of all the moulds were properly greased for easy demoulding. The concrete was placed in the mould and proper care was taken for uniform compaction using tamping rod and surface finish throughout the beam. After 24 hours the specimen is demoulded and is cured for 28 days. Then the beam is dried in air for 12 hours after curing before the testing.



Fig.5.5: Preparation of Mix and Casting of beam specimens

C) Testing of specimens:

The beams were cured for 28 days to achieve the approximate flexural strength and they are tested using the Universal Testing Machine (UTM) of 1000KN capacity. The beams are tested as simply supported beam with two point loads until failure. The load positions were spaced at 210 mm c/c which is one-third of the span. Fig.5.6 shows Flexural Strength Test on Beam using Universal Testing Machine (UTM).



Fig. 5.6: Flexural Strength Test on Beam using Universal Testing Machine (UTM)

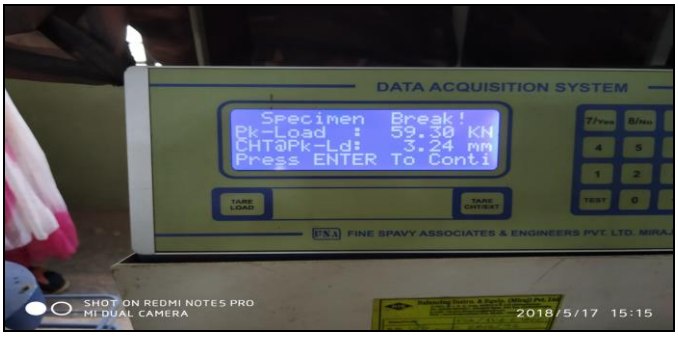


Fig. 5.7: Data acquisition on UTM for beam

The flexural strength was recorded in table 5.3 .The flexural strength is very much dependent on the physical compressive strength of coarse aggregate. Flexural strength is equal to $0.7\sqrt{fck}$ where fck is characteristics compressive strength of conventional concrete. Therefore similar to compressive strength, flexural strength also decreases with increase in CS replacement.

Table 5.3: Flexural strength of M20 and M30 grade R.C. beam

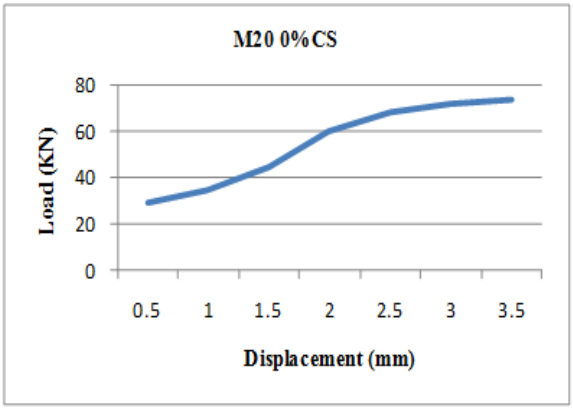
Grade of concrete	28 days flexural strength (N/mm²)	
	0% CS	15% CS
M20	3.212	2.477
M30	3.397	2.678

6. RESULTS

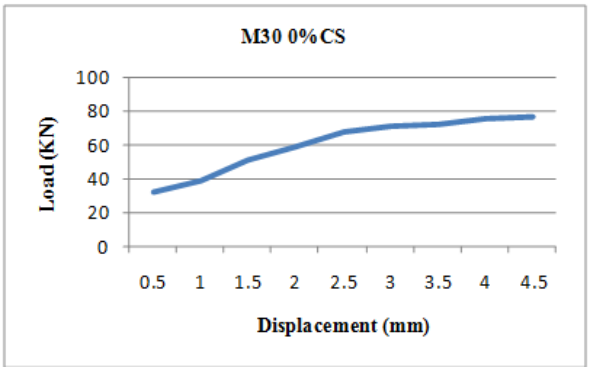
All the 12 number of beams were tested at UTM machine with capacity of 1000KN and following data were obtained.

Grade of concrete	Designation of sample	Load Carried (KN)	Deflection (mm)	Avg. load (KN)
M20 0% CS	B1	71.7	3.38	72.283
	B2	70.85	3.01	
	B3	74.30	3.52	
M20 15% CS	B4	53.07	2.72	55.74
	B5	56.40	2.94	
	B6	57.75	2.96	
M30 0% CS	B7	77.60	4.54	76.45
	B8	72.90	4.32	
	B9	78.85	4.63	
M30 15% CS	B10	59.30	3.24	60.256
	B11	58.55	3.02	
	B12	62.92	3.38	

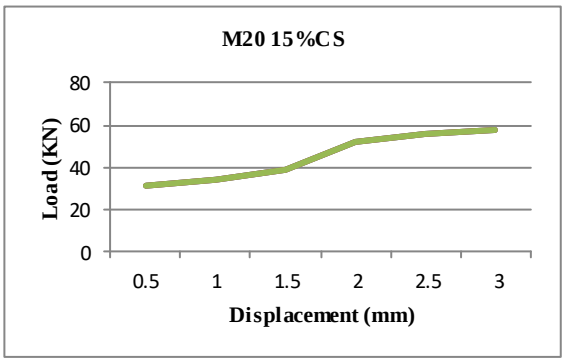
6.1 General Result



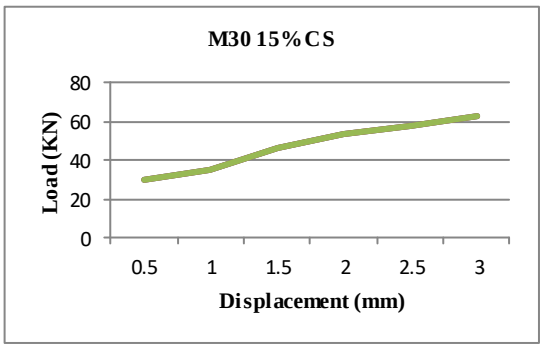
Graph 6.1: Load Vs Displacement curve for beam B3 M20 grade concrete with 0% CS replacement



Graph 6.2: Load Vs Displacement curve for beam B6 M20 grade concrete with 15% CS replacement



Graph 6.3: Load Vs Displacement curve for beam B9 M30 grade concrete with 0% CS replacement



Graph 6.4: Load Vs Displacement curve for beam B12 M30 grade concrete with 15% CS replacement

6. CONCLUSIONS

From the data received after all the secession of test carried out on beam specimens with different replacement level of coconut shell, the following conclusions are drawn.

- Increase in percentage Replacement of coconut shell (CS) reduces compressive and Flexural Strength of concrete.
- Coconut shell can be grouped under lightweight aggregate as the 28 days air-dry densities of coconut shell aggregate concrete are less than 2000

kg/m3.Increase in percentage of coconut shell, decreases densities of concrete.

- Coconut shell concrete (CSC) has better workability because of the smooth surface on one side of the shells and the smaller size of coconut shell. So we could possibly use CSC in concretes where high workability is desirable.
- Lightweight concrete can be prepared by using coconut shell as coarse aggregate.
- It was concluded that the CSs were more suitable as low strength giving lightweight aggregate when used to replace common aggregate in concrete production especially for M20 and M30 grade concrete.
- The optimum replacement of coarse aggregate by coconut shell is obtained as 15%.So that up to 15% environmental pollution gets reduced.
- Solves problem of disposal of CS that's why it leads to sustainable development.

7. FUTURE SCOPE OF PRESENT STUDY

Based on the scope and the results of this research the following are the recommendation for further investigation.

i. A study of the shrinkage characteristics of Coconut shell

Concrete is recommended.

ii. A long term durability study of Coconut shell concrete should be investigated.

iii. The study of the development of the micro structure of the coconut shell concrete is important in predicting the long term behavior.

iv. The use of coconut shell aggregate as a replacement in convectional concrete should be encourage in the locality where it is in abundance to enhance environmental cleanliness.

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Design of high damping rubber Isolator for RC Multistoried Structures and its Comparative Seismic Analysis

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Abstract –*Seismic base isolation is a suitable technology for earthquake resistant design of variety of buildings. The concept of protecting a building from the damaging effects of an earthquake by introducing some type of support that isolates it from the shaking ground is an attractive one and many mechanisms to achieve these results have been developed. The technique of base isolation involves the introduction of devices at the foundation of a building to increase the flexibility in the horizontal plane. The aim of the present study deals with the selection of suitable type of isolators. This study investigates structural behavior of multi storey building with or without base isolation subjected to earthquake ground motion. The performance of isolator is assessed from variation of base shear, , displacement, storey drift etc for the G+8 and G+10 building by installing high damping rubber bearing (HDRB)at the foundation level then compare the performance between the fixed base condition and base isolated condition by using SAP software.*

Key Words**:** *Fixed base, base isolation, high damping rubber bearing, Static pushover analysis, Nonlinear Time history analysis***,** *Software (SAP2000)*

SCOPE OF STUDY

The scope of this study is limited to design of high damping rubber bearing for G+8 and G+10 buildings. Perform the static pushover analysis and nonlinear time history analysis for the selected ground motion data[11].Compare the results with different seismic parameters for fixed base building and base isolated building.

1. INTRODUCTION

Base isolators are the most effective method to reduce vibrations transmitted from ground to the structure. The role of the base isolator under seismic loading, is to isolate the structure from the horizontal components of the earthquake ground movement, whereas the vertical components are transmitted to the structure relatively unchanged. Base isolators deflect and absorb the seismic input energy transmitted horizontally to the structures. Base isolation involves mounting a building on bearings of low lateral stiffness. The principle of seismic isolation is to introduce flexibility in the basic structure in the horizontal plane, while at the same time adding damping elements to restrict the resulting motion. The basic concept of base isolation is to increase the natural period of the building to take it away from resonance with the forcing motions of earthquake. Increase in the period of vibration of the structure reduces the design base shear. A well designed seismic isolation system provides rigidity under low load levels such as wind and minor earthquake.

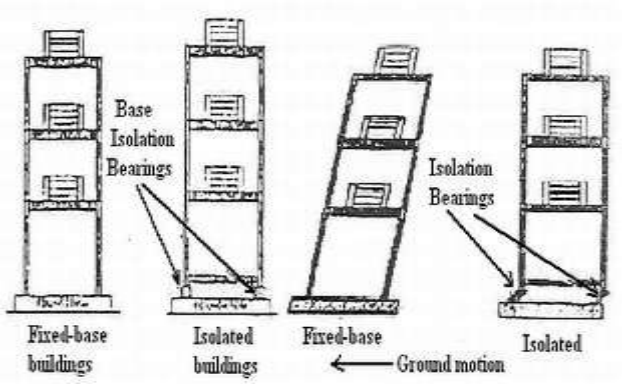


Fig1. Effect of seismic (base) isolation on the response of a structure.

High damping rubber bearing:

High damping rubber bearing[5] is composed of special rubber with excellent damping attribute, sandwiched together with layers of steel without any lead plugs. HDR adopt best rubber material of high damping ability, which enable it to absorb large energy of earthquake, taking advantage of its high elasticity, friction damping and viscosity damping characteristics as well as high durability. The bulk modulus is several orders of magnitude larger than their shear modulus, so that the material will deform only in shear. The behavior of the rubber bearing is affected by the loaded area and hence the shape factor. A linear elastic theory is the most common method to predict the compression stiffness of a thin elastomeric pad. When the vertical load is applied the height of the rubber decreases and in the mean times the rubber overflows on the lateral part of the isolator.

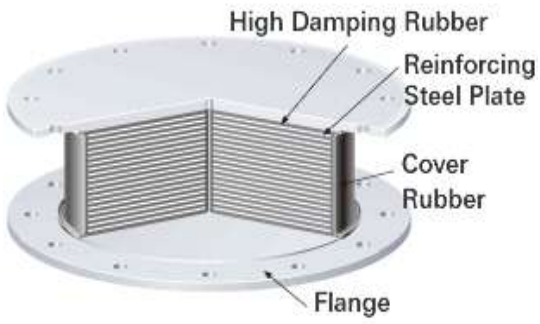


Fig 2 .High damping rubber bearing

2. OBJECTIVE OF THE PROJECT

The main objective of project was to comparative study [12] of fixed base and base isolated structure by dynamic analysis. The results were compared for Base shear, displacements and storey drift. The objective of the project is as explained below:-

1. The G+8 and G+ 10 storeys RC frame is isolated using high damping rubber bearing, to reduce the base shear when compared with conventional building.
2. To design the high damping rubber bearing by using the data from SAP2000
3. To increase the mode period[7] of the base isolated structure when compared to conventional building.
4. To decrease the displacement and storey drift of the base isolated when compared to conventional.
5. To decrease the story drift of a base isolated structure when compared with fixed base structure.
6. To study the effectiveness of providing high damping rubber bearing for Kobe ground motion data.

3. METHODOLOGY

1. The software used for analysis of a structure is SAP2000.

2. The dynamic analysis is carried for structure.

3. The codes used are IS 1893 (PART I) 2016, UBC 1997, IBC 2006.

Provisions Published by FEMA-451 (Federal Emergency Management Agency) in 2003

4. The building is modelled first then the loads are applied as per code provisions of IS 875 (PART II).

5. After analysis of a fixed base structure the maximum axial load is noted from support reaction results.

6. Then once axial load is noted the high damping rubber bearing is designed and properties are calculated.

7. Then these properties are used as link properties for base isolation structure in SAP2000[11].

8. Then the Base Isolation Structure is analyzed[4] and then results are tabulated and discussed

4. LITERATURE STUDY

Syed Ahmed Kabeer K. I. and Sanjeev Kumar K.S. (2014) in this paper studied how to prevent loss during earthquake by using Base- isolation. The mechanism of the base isolator increases the natural period of the overall structure, and decreases its acceleration response to earthquake/seismic motion. The study is based on to check for the adequacy of the base isolation against earthquake damage when compared to the conventional earthquake resistant design. A building was analyzed using the equivalent lateral force method and response spectrum analysis as fixed base and as isolated base with lead rubber bearing. In this paper they did study for reinforced concrete structures to show the ultimate capacity of the selected bearing system, and to make a comparison for the difference between the isolated base and the fixed base buildings. Finally they concluded lead rubber bearing reduces significantly the displacement, moment and shear generated for the same. {Ref.7}

Sameer S. Shaikh and P.B. Murnal.(2015) In this paper A three story building is modeled to compare the response of the structure by using SAP2000. Time history analysis is conducted for the 1994 Northridge and 1940 El-Centro earthquakes. The analysis result shows that when isolator position is shifting it significantly affects the response quantities. It is possible to arrive at optimum location of the isolator so as to get the maximum benefit of base isolation. {Ref.11}

Ajai Kumar Rai and Brajesh Mishra.(2017) In this paper studied base isolation techniques, reviews of the current practices and past researches but also need of these techniques by analyzing the earthquake data of the seven prominent cities/districts of the eastern Uttar Pradesh. This has been achieved by evaluating the each city/district by existing civil engineering structures of cultural / historical / archaeological importance, existing & pace of growth of high rise buildings, depth of alluvial soil over the soil/rock, geological, geographical and topographical features and earthquake magnitude. {Ref.4}

Kishan Bhojani, et.al. (2017) In this paper studied base isolation system which can be used in multi-storey building to reduce seismic response of the structure. This study represents the initialize study of dynamic parameter like effective damping for four earthquake time history. The optimum effective damping has been found out under the

effect of Loma Prieta earthquake time history. Study has been conducted to evaluate the effect on maximum displacement, maximum acceleration, maximum base shear in bare frame and frame with isolator. In this study laminated rubber bearing are used as base isolator. After studding they concluded that. thickness of the isolator decreases with increase in damping. Ii. In linear analysis the displacement is increased while in non-linear analysis displacement is decreased. {Ref.5

4. MODELLING IN SAP2000

Hysteretic isolator links were used to simulate rubber bearings in SAP2000. An isolator link assigned to each column at the foundation level as a single joint element to connect the superstructure to the ground. High damping rubber Bearing links were applied as link of rubber isolator. The behavior of link elements in SAP2000 is defined in the Link/Support Property. Directional properties U1, U2, U3, R1, R2, and R3 are mechanical behavior in six directions. The properties for axial deformation (U1) is linear only, shear deformations (U2, U3) are linear and nonlinear. And tensional deformation (R) about U1 is linear only. Rotations above U2 and U3 are (R2 & R3) are linear only. All internal deformations of the isolator links are assumed to be independent of each other.

Table 1: Model Details of G+8 Building.

SR.NO.	Particulars	Description
1	Type Of Frame	SMRF.
2	Area	22.5 x 27 sq.m
3	No.of Storey's	G+8
4	Height of storey	4 m
5	Height of building	36 m (class B)
6	flexural members per floor	71
7	Compression members per floor	42
8	No.of slabs per floor	30
9	slab thickness	200 mm
10	Size of column	300 x 900 mm
11	Size of Beam	300 x 600 mm
12	Wall thickness	230 mm
13	Concrete grade	M30
14	Steel grade	Fe 500, Fe 415

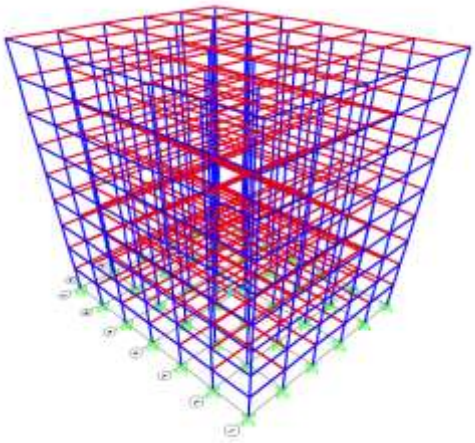


Fig.3 G+8 building 3D Model

Properties of G+8 building for analysis in SAP 2000

U1 Linear Effective Stiffness = 11300000000 N/m

U2 and U3 Linear Effective Stiffness =1338366.667 N/m

U2 and U3 Nonlinear Stiffness = 10229264.52 N/m

U2 and U3 Yield strength = 63421.44 N

U2 and U3 Post Yield stiffness ratio 0.0998

Damping = 20%

Table 2: Model Details of G+10 Building.

SR.NO.	Particulars	Description
1	Type Of Frame	SMRF
2	Area	27 x 31.5 sq.m
3	No. Of Storey's	G+10
4	Height of storey	4 m
5	Height of building	44 m (class B)
6	flexural members per floor	97
7	Compression members per floor	56
8	No.of slabs per floor	42
9	slab thickness	200 mm
10	Size of column	300 x 1000 mm
11	Size of Beam	300 x 600 mm
12	Wall thickness	230 mm
13	Concrete grade	M30
14	Steel grade	Fe 500, Fe 415

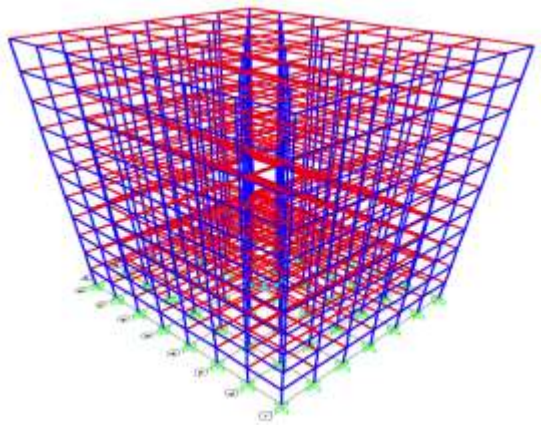


Fig.4 G+10 building 3D Model

Properties of G+10 building for analysis in SAP 2000

U1 Linear Effective Stiffness = 12900000000 N/m

U2 and U3 Linear Effective Stiffness = 1927744.44 N/m

U2 and U3 Nonlinear Stiffness = 14694272.67 N/m

U2 and U3 Yield strength = 91398.376 N

U2 and U3 Post Yield stiffness ratio 0.149

Damping = 20%

Table 3: Bearing Details of G+8 & G+10 Building.

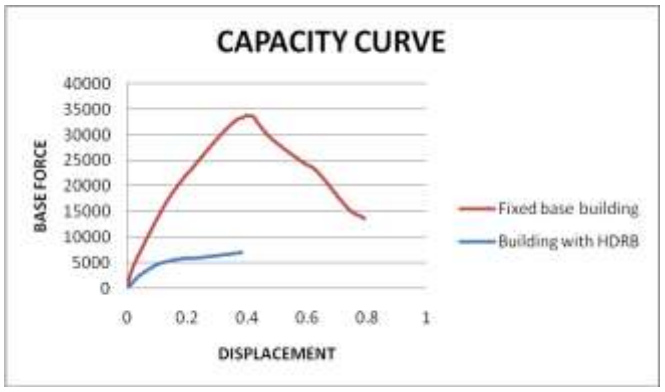
SR.NO	Parameters	G+8	G+10
1	Diameter of Bearing	505 mm	620 mm
2	Thickness of individual rubber layer	20mm	22mm
3	Numbers of rubber layer	10	10
4	Thickness of individual steel plates	2.8mm	2.8mm
5	Numbers of steel plates	9	9
6	Thickness of top and bottom steel plates	25mm	25mm
7	Total height of bearing	276mm	296mm

Above Table 3. Shows, dimensions of bearing which are calculated on the basis of required stiffness. Time period is assumed to be 2 sec.

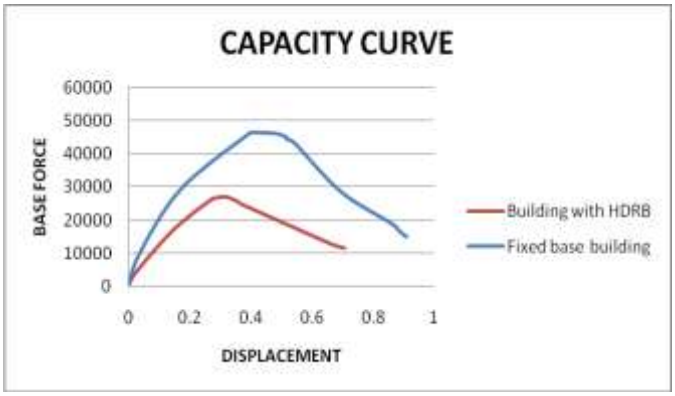
6. RESULT OBTAINED FROM SOFTWARE SAP 2000

All results are computed after analysis of model in software SAP2000.

Results obtained from pushover analysis

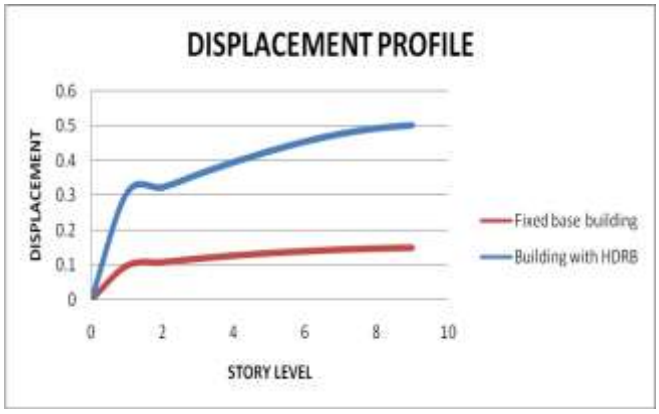


Graph 1: Capacity curve of G+8 storey building with & without HDRB

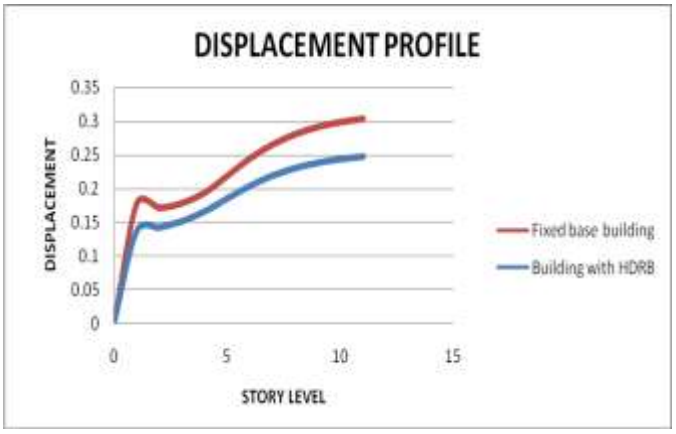


Graph 2: Capacity curve of G+10 storey building with & without HDRB

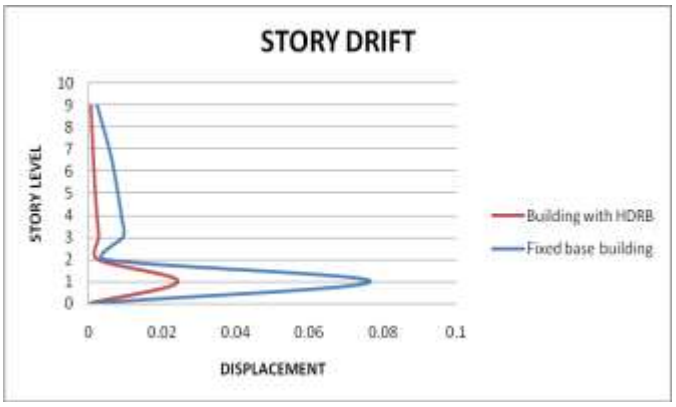
Results obtained from time history analysis



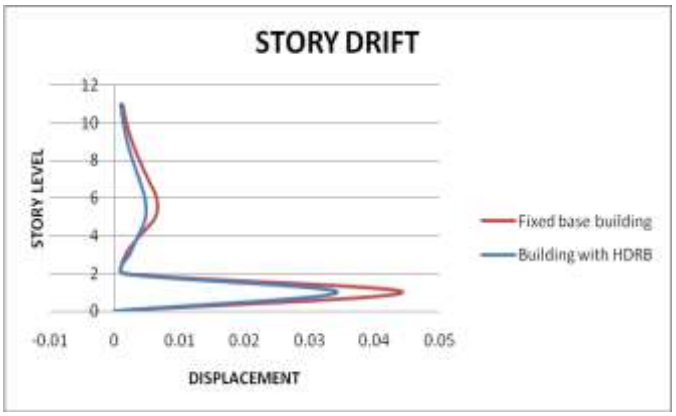
Graph 3: Displacement profile of G+8 storey building for Kobe ground motion data



Graph 5: Displacement profile of G+10 storey building for Kobe ground motion data



Graph 7: inter storey drift of G+8storey building for Kobe ground motion data



Graph 9: inter storey drift of G+10 storey building for Kobe ground motion data

7. CONCLUSION

From the comparative study of fixed base and base isolation methods by using high damping rubber bearing the following conclusions are made:

1. Time periods are increased which increases, reaction time of a structure during earthquake.

2. Base shear get reduced after using the high damping rubber bearing (HDRB) as base isolation system, which reduces the seismic effect on building.

3. It is observed that when increasing the number of a story, maximum storey displacement becomes considerable.

4. From nonlinear analysis displacement of base isolated building reduced to 25% - 40% over the fixed base building. Base shear get reduces 55% - 80% and storey drift is get reduces up to 60 -76%.

5. It can be concluded that the performance of base isolated structure is efficient in seismic prone areas.

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4. "Earthquake-Resistant design of building Structures" by Dr Vinod Hosur
5. "Earth-quake Resistant Design of Structures" by S K Duggal
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Dynamic analysis and Design of G+ 8 storey RC structure by providing lead rubber bearing as base isolation system

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Abstract – *Earthquake is most extreme condition of any building may be required to survive during its lifetime. Seismic base isolation is a simple structural design approach to minimize earthquake damage. These are very stiff in the vertical direction and can carry the vertical load of the building but are very flexible in horizontally, thereby enabling the building move laterally like a rigid mass under strong ground motion. The main purpose of this study is to check the behaviour of the buildings in seismic zone by using lead rubber base isolation concept. and reduce the base shear, displacement and lengthen the period of oscillation due to earthquake ground excitation, applied to the superstructure of the G+8 building by installing lead rubber isolation (LRB) at the foundation level then compare the performance between the fixed base condition and base isolated condition by using SAP software.*

Key Words: *Fixed base, base isolation, lead rubber bearing, Nonlinear Time history analysis, pushover analysis Software SAP2000*

SCOPE OF STUDY

The scope of this study is limited to design of lead rubber bearing for G+8 building. Perform static pushover analysis and nonlinear time history analysis for the Kobe ground motion data. Compare the results with different seismic parameters for fixed base structures and base isolated structures.

1. INTRODUCTION

Base isolation is a passive control system; it does not require any external force or energy for its activation. The term isolation refers to reduce interaction between structure and the ground, when the seismic isolation system is located under the structure; it is referred as "base isolation". It is a system that may be defined as a flexible or sliding interface between a structure and its foundation, for the purpose of decoupling the horizontal motions of the ground from the horizontal motions of the structure. "The principle of base isolation is very simply it changes the response of the building which allows moving the ground below the building so that the earthquake ground motion is not allowed to reached the building".

This improves[9] its response to an earthquake due to additional means of energy dissipation by reducing the transmitting vibrations into the superstructure. Base isolation not only reduces the seismic demand of structure, cost of structure, damages caused during the earthquake but also it enhances the performance of structure under seismic load and after the earthquake , safety of the structure and preservation of property system. The characteristics of proper designed seismic isolation systems should be its flexibility to increase period of vibration and thus reduce force response and energy dissipation to control the isolation system displacement through rigidity under low load levels such as wind and minor earthquakes.

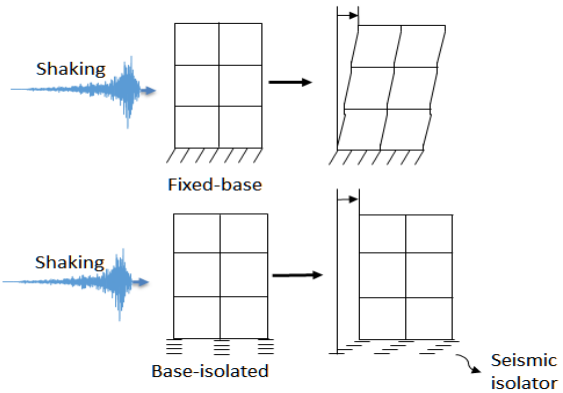


Fig.1 Effect of seismic (base) isolation on the response of a structure.

Lead rubber bearing

Lead rubber bearings were invented in New Zealand in 1975. There are three main pieces of equipment, layers of steel plates, rubber layers and lead core, respectively. The layers of steel provide vertical stiffness and the layers of rubber supply the device with high lateral flexibility. Lead core is the device that will supply extra stiffness to the isolators and appropriate damping to the system.

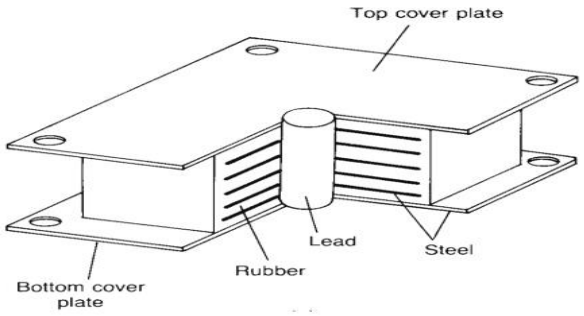


Fig.2 Lead rubber bearing

2. OBJECTIVE OF THE PROJECT

The main objective of project is comparative study of fixed base and base isolated structures by dynamic analysis. The results were compared for Time period, Base shear, and displacements and. The objective of the project is as explained below:

1. To design the lead rubber bearing for G+8 RC frame by using SAP2000.[10]
2. To increase the mode period of the lead rubber isolated structure when compared to conventional building
3. To decrease the base shear and displacement of the lead rubber isolated structure when compared to conventional building [9]
4. To study the effectiveness of providing Lead core rubber bearing for Kobe and superstition ground motion data.
5. Comparative study with different seismic parameters.

3. METHODOLOGY

1. The software used for analysis of a structure is SAP2000
2. The dynamic analysis is carried for structural analysis
3. The codes used are IS 1893 (PART I) 2016, UBC 1997, IBC 2006.
4. Provisions Published by FEMA-451 (Federal Emergency Management Agency) in 2003
5. The building is modelled first then the loads are applied as per code provisions of IS 875 (Part II) Reaffirmed in 2008 for live and dead load.
6. Static pushover analysis and Non linear time history analysis is carried out for the fixed base and lead rubber isolated structures.
7. After the analysis of a fixed base structure the maximum axial load is noted from support reaction results.
8. Then Properties of Lead core rubber bearing are calculated and these properties are used as link properties for base isolation structure.
9. Then the Base Isolation Structure is analyzed and
10. Results are tabulated and discussed.

4. LITERATURE STUDY

Syed Ahmed Kabeer K. I. and Sanjeev Kumar K.S. (2014) in this paper studied how to prevent loss during earthquake by using Base- isolation. The mechanism of the base isolator increases the natural period of the overall structure, and decreases its acceleration response to earthquake/seismic motion. The study is based on to check for the adequacy of the base isolation against earthquake damage when compared to the conventional earthquake resistant design. A building was analyzed using the equivalent lateral force method and response spectrum analysis as fixed base and as isolated base with lead rubber bearing. In this paper they did study for reinforced concrete structures to show the ultimate capacity of the selected bearing system, and to make a comparison for the difference between the isolated base and the fixed base buildings. Finally they concluded lead rubber bearing reduces significantly the displacement, moment and shear generated for the same. {ref.5}

Sameer S. Shaikh and P.B. Murnal.(2015) In this paper A three story building is modeled to compare the response of the structure by using SAP2000. Time history analysis is conducted for the 1994 Northridge and 1940 El-Centro earthquakes. The analysis result shows that when isolator position is shifting it significantly affects the response quantities. It is possible to arrive at optimum location of the isolator so as to get the maximum benefit of base isolation {ref.9}.

Ajai Kumar Rai and Brajesh Mishra.(2017) In this paper studied base isolation techniques, reviews of the current practices and past researches but also need of these techniques by analyzing the earthquake data of the seven prominent cities/districts of the eastern Uttar Pradesh. This has been achieved by evaluating the each city/district by existing civil engineering structures of cultural / historical / archaeological importance, existing & pace of growth of high rise buildings, depth of alluvial soil over the soil/rock, geological, geographical and topographical features and earthquake magnitude.{ref.11}

Venkatesh and Mr.arunkumar.H.R.(2016)In this paper studied the designing of earthquake resistant structure. Earthquake is one of major natural disaster in which many structures damage and collapse due to improper design against seismic motion. Earthquake also affects the economy of the nation, so essential proper measures of prevention must be developed. There are many concepts of designing a

building as earthquake resistant structure; the concept studied in this project is base isolation. There are many types of base isolation systems but lead rubber bearing (LRB) is used as base isolation system in this project, LRB is most

widely used as isolation system for buildings. {ref.10}

6. LOADING

Table.1 Seismic details as per IS 1893 Part 1:2016

Sr.No.	Particulars	Description
1	Seismic Zone	III
2	zone factor	0.16
3	Soil type	Type II (Medium)
4	Importance Factors	1.5
5	Response reduction Factor	5
6	Damping of the structure	5%
7	Is code	1893 Part I 2016
8	Time History	Superstition

Table.2 Wind load details as per IS 875 Part 3 1987

Sr.No.	Particulars	Description
1	Wind speed V_b	39 m/s
2	Terrain category	2
3	Importance factor	1.15
4	Risk coefficient (k_1 factor)	1
5	Topography Factor (k_3 factor)	1
6	Wind direction X and Y direction	0^0 &90^0

Live load = 3 KN/m^2, Floor finish =1 KN/m^2

Super dead load - 0.23 X 20 X 3.4 = KN/m^2

7. MODELLING

Table.3 Model Details of G+8 Building

SR.NO.	Particulars	Description
1	Type Of Frame	SMRF.
2	Area	22.5 x 27 sq.m
3	No.of Storey's	G+8
4	Height of storey	4 m
5	Height of building	36 m (class B)
6	flexural members per floor	71
7	Compression members per floor	42
8	No.of slabs per floor	30
9	slab thickness	200 mm
10	Size of column	300 x 900 mm
11	Size of Beam	300 x 600 mm
12	Wall thickness	230 mm
13	Concrete grade	M30
14	Rebar grade	Fe 500, Fe 415

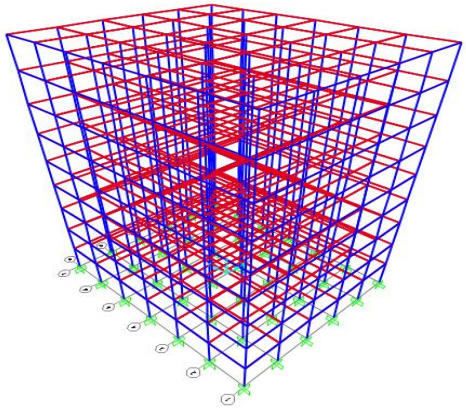


Fig.3 G+8 3D Model

8. ANALYSIS OF MODEL

Non-linear Static Pushover Analysis (NSPA

The method is simple to implement and provides the information about strength, deformation and ductility of the structure as well as the demand. The pushover method applies the analysis under permanent vertical is loads and gradually increasing lateral load.

Time history analysis

Nonlinear time history analysis involves the computation of dynamic response at each time increment with due consideration given to the inelasticity in members. Nonlinear analysis allows for flexural yielding (or other inelastic

actions) and accounts for subsequent changes in strength and stiffness.

9. DESIGN OF LEAD RUBBER BEARING

1) Maximum support reaction

After analysis of fixed base building maximum support reaction is noted.

Max. Support reaction = 1015.04 KN

Effective isolation Time period = $2\pi \sqrt{\frac{w}{Ke.g}}$

$2\pi \sqrt{\frac{1015.04}{1021.2\ x\ 9.81}}$ = 2 sec

2 Calculate design displacement (Dd)

Assume Design time period T_D= 2 sec

$$Dd = \frac{g}{4\pi 2} \times \frac{Cvd.Tb}{B}$$

$$Dd = \frac{9.81}{4\pi^2} \times \frac{0.54 \times 2}{1} = 0.268\ m$$

3. Energy dissipated per cycle (W_D)

$W_D = 2\pi.keff.\ D_D^2.Beff$

$2\pi \times 1021.2 \times 0.268^2 \times 0.05$ = 23.04KN.m

4. Force at design displacement characteristic

Strength Qd

$$Qd = \frac{Wd}{4D_D} = \frac{23.04}{4 \times 0.268} = 21.5\ KN$$

5 Effective stiffness of isolator (Ke)

$$Keff = \frac{w}{9} \times \left(\frac{2\pi}{T}\right) x \left(\frac{2\pi}{T}\right)$$

$Keff = \frac{1015.04}{9.81} \times \left(\frac{2\pi}{2}\right) x \left(\frac{2\pi}{2}\right)$ = 1021.2 KN/m

6 Stiffness in Rubber

$K_2 = Keff - \frac{Q}{Dd}$

$= 1021.2 - \frac{21.5}{0.268} = 940.97\ KN/m$

Where, $\frac{Q}{Dd}$ = stiffness of lead core

7. Yield displacement (DY)

DY $= \frac{Q}{k1-k2}$ we have, k1 = 10 K2.....Thumb rule for lead rubber bearing by J.M Kelly

$$DY = \frac{Q}{10k2-k2} = \frac{Q}{9k2} = \frac{21.5}{9 \times 940.97} = 0.00254m$$

8. Calculation of area and diameter of lead plug yield strength of lead is around 10 Mpa the

Area of lead plug needed for entire isolation is,

$$ApB = \frac{QR}{10 \times 103} = \frac{21.69}{10 \times 1000} = 0.00216\ m2$$

Diameter of lead plug d $= \sqrt{0.0028 \times \frac{4}{\pi}} = 0.053\ m = 53\ mm$=60mm

9. Total thickness of Rubber layer (tr)

tr $= \frac{DD}{V}$ where v = 100% (maximum shear strain of rubber)

tr $= \frac{0.268}{1} = 0.268\ m$

10. Area of Bearing

$$ALRB = \frac{keff(R) \times tr}{G} = \frac{940.26 \times 0.268}{0.7 \times 1000} = 0.359m\ 2$$

11. Diameter of Bearing

QLRB $= A \times \frac{4}{\pi} = 0.359 \times \frac{4}{\pi} = 0.676$m

S = D/4t = 0.646/0.02*4 = 8.45

Provide 20 mm thk 14 rubber bearing

12. Dimension of lead rubber bearing (LRB)

Let, thickness of shim plates be 2.8mm

No. of shim plates = (14-1) = 13

End plate thickness is between 25mm

Total height (rubber+ shim + end plates) = 0.02* 14

+13*0.0028+2*0.025 = 0.366 m

After above calculation properties required for SAP is calculated are listed below.

Properties for analysis in SAP 2000

U1 Linear Effective Stiffness = 10600000000 N/m

U2 and U3 Linear Effective Stiffness = 1018112.85/m

U2 and U3 Nonlinear Stiffness = 9940970 N/m

U2 and U3 Yield strength = 23858.328N

U2 and U3 Post Yield stiffness ratio 0.095

Damping = 5%.

In SAP2000 an isolator link assigned to each column at the foundation level as a single joint element to connect the superstructure to the ground. Lead rubber Bearing links were applied as link of rubber isolator. The behavior of link elements in SAP2000 is defined in the Link/Support Property. Directional properties U1, U2, U3, R1, R2, and R3 are mechanical behavior in six directions. The properties for axial deformation (U1) is linear only, shear deformations (U2, U3) are linear and nonlinear. And torsional deformation (R) about U1 is linear only. Rotations above U2 and U3 are (R2 & R3) are linear only.

Table 4. Lead Rubber Bearing details

SR.NO	Parameters	G+8
1	Diameter of Bearing	676 mm
2	Thickness of individual rubber layer	20mm
3	Numbers of rubber layer	14
4	Thickness of individual steel plates	2.8mm
5	Numbers of steel plates	13
6	Thickness of top and bottom steel plates	25mm
7	Total height of bearing	366mm
8	Diameter of lead core	60mm

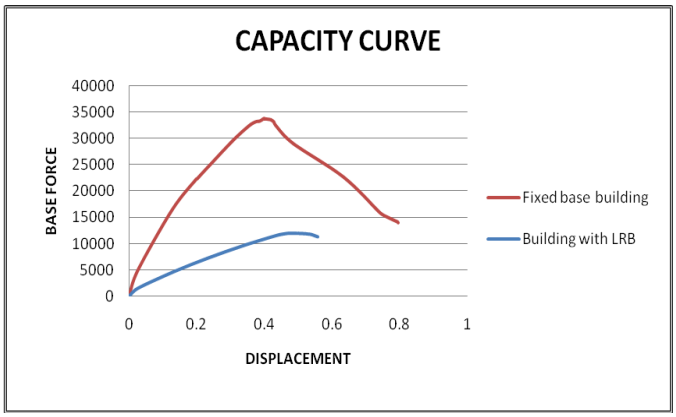
9. RESULT OBTAINED FROM SOFTWARE SAP2000

All results are computed after analysis of model in software SAP2000.

Table 5. Time period

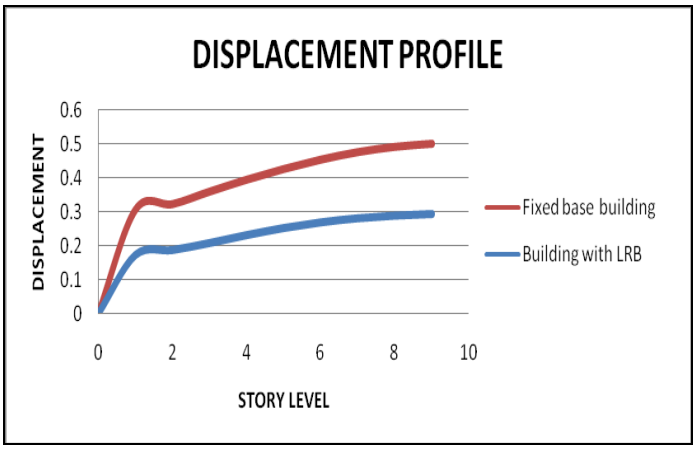
Storey	Fixed base building		Lead rubber isolated building	
G+8	Mode 1	Mode 2	Mode 1	Mode 2
	1.60455	1.01441	4.27183	3.53122

Results obtained from pushover analysis

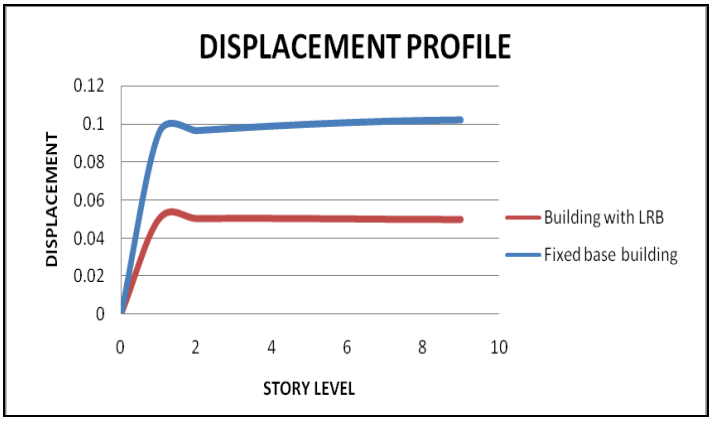


Graph 1: Capacity curve of G+8 storey building with & without LRB

Results obtained from time history analysis

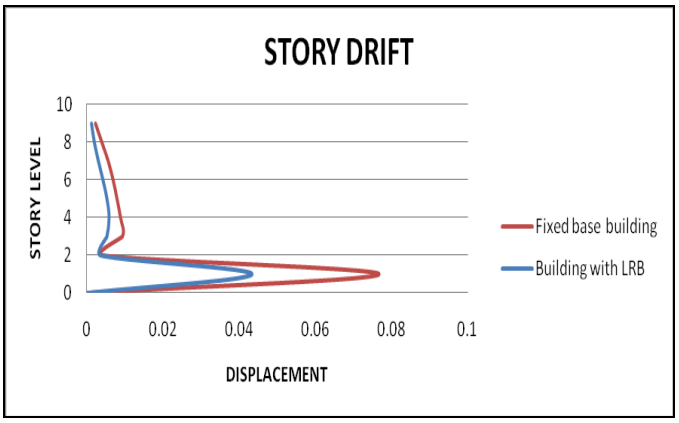


Graph 2: Displacement profile of G+ 8 storey building for Kobe ground motion data

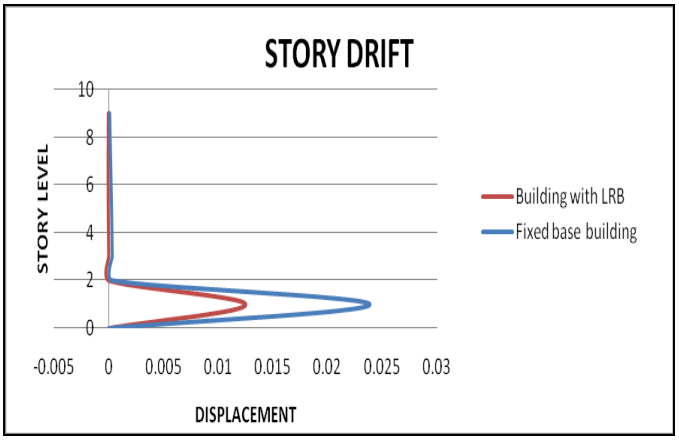


Graph 3: Displacement profile of G+ 8 storey building for superstition ground motion data

Storey drift of structure



Graph 4: Inter Story Drift of G+8 Story with LRB for Kobe Ground motion data.



Graph 4: Inter Story Drift of G+8 Story with LRB for superstition Ground motion data.

10. CONCLUSION

From the comparative study of fixed base and base isolation methods by using lead rubber bearing the following conclusions are made:

1. Time periods are increased which increases reaction time of a structure during earthquake.
2. Base shear reduced after the lead rubber bearing (LRB) is provided as base isolation system which reduces the seismic effect on building.
3. It is observed that when increasing the number of a story maximum storey displacement is becomes considerable.
4. From nonlinear analysis displacement of base isolated building reduced to 25% over the fixed base building. Base shear get reduces 67% and storey drift is get reduces up to 50 - 60%.
5. It can be concluded that the performance of base–isolated structure is efficient in seismic prone areas.

7. REFERENCES

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Comparative Study of an Industrial Pre – Engineered Building with Conventional Steel Building

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Abstract - *In recent years, the introduction of Pre-Engineered Building (PEB) concept in the design of structures has helped in optimizing design. Long span, Column free structures are the most essential in any type of industrial structures and Pre Engineered Buildings (PEB) fulfil this requirement along with reduced time and cost as compared to conventional structures. This methodology is versatile not only due to its quality predesigning and prefabrication, but also due to its light weight and economical construction. The present work presents the comparative study and design of conventional steel frames with concrete columns and steel columns and Pre Engineered Buildings (PEB). In this work, an industrial building of length 44m and width 20m with roofing system as conventional steel truss and pre-engineered steel truss is analyzed and designed by using STAAD Pro V8i.*

Keywords: Pre-Engineered Building, Staad.Pro, Tapered Section.

1. INTRODUCTION

India has the second fastest growing economy in the world and a lot of it, is attributed to its construction industry which figures just next to agriculture in its economic contribution to the nation. In its steadfast development, the construction industry has discovered, invented and developed a number of technologies, systems and products, one of them being the concept of Pre-engineered Buildings (PEBs). As opposed to being on-site fabricated, PEBs are delivered as a complete finished product to the site from a single supplier with a basic structural steel framework with attached factory finished cladding and roofing components. The structure is erected on the site by bolting the various building components together as per specifications. PEBs are developed using potential design software. The onset of technological advancement enabling 3d modelling and detailing of the proposed structure and coordination has revolutionized Conventional building construction. Pre-Engineered Buildings (PEB) is the future for India. Most of the Indian business community is just started to realize the benefits of PEB's. Where you have been building with concrete for as long as anyone can remember, it is difficult to change. However India's most progressive companies are seeing the benefits of PEB's.

1.1. What is Pre-Engineered Building?

PEB are tailor made buildings which are combination of built up section, hot rolled section, cold formed element and profiled sheets based on client's requirement & actual design calculations using tapered sections. Pre-engineered steel buildings can be fitted with different structural accessories including mezzanine floors, canopies, fascias, interior partitions etc. and the building is made water proof by use of special mastic beads, filler strips and trims. This is very versatile buildings systems and can be finished internally to serve any functions and accessorized externally to achieve attractive and unique designing styles. It is very advantageous over the conventional buildings and is really helpful in the low rise building design. From the excavation to occupancy no other building system matches pre-engineered building system when it comes to speed and value.

Pre - Engineered buildings are generally low rise buildings; however the maximum cave heights can go up to 25 to 30 meters. Low rise buildings are ideal for offices, houses, showrooms, shop fronts etc. The application of pre-engineered concept to low rise buildings is very economical and speedy. Buildings can be constructed in less than half the normal time especially when complimented with other engineered sub-systems.

The most common and economical type of low-rise building is a building with ground floor and two intermediate floors plus roof. The roof of a low rise building may be flat or sloped. Intermediate floors of low rise buildings are made of mezzanine systems. Single storied houses for living take minimum time for construction and can be built in any type of geographic location like extreme cold hilly areas, high rain prone areas, plain land, extreme hot climatic zones etc.

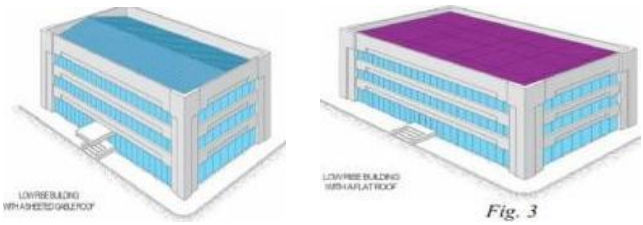


Fig.1.1 Roofing system

1.2 Features

Pre-engineered buildings are known for their ease of construction. An example can very well explain the difference between the traditional method of construction

and the method followed by pre-engineered buildings. The conventional method of constructing a building is to transport bricks, timber, cement, sand, steel and construction aggregate, etc. to the site, and to construct the building on site from these materials. In prefabricated construction, only the foundations are constructed in this way, while sections of walls, floors and roof are assembled in a factory, transported to the site, lifted into place by a crane and bolted together.

Some of the features of Pre Engineered Buildings are as follows:

a. Like it doesn't need any timber for doors and windows it's all steel made, so our environment is intact.

b. The building is made water proof by use of special mastic beads & filler strips.

c. The time and energy involved in the construction of a Pre-engineered Building is much less than the conventional industrial structures.

d. The complete building system is Pre-engineered to facilitate easy production & assembly on site.

e. These buildings can be installed at the client's site, within a limited period of time with less labor hours.

f. As the construction of these building takes lesser time, Pre-engineered buildings saves a great amount of labour cost.

g. Moreover, a Pre-engineered Building can be easily uninstalled and set up again at a different site.

1.3 Components:

There are basically nine major components in a pre-engineered building such as:

a. Main framing or vertical columns

b. End wall framing

c. Purlins, girts and eave struts

d. Sheeting and insulation or prefab panels

e. Crane system

f. Mezzanine system

g. Bracing system

h. Paints and finishes

i. Miscellaneous services

2. Applications

In the USA, where the PEB concept was originally conceived during the early years of this century, nearly 70% of all single storey non-residential construction now utilizes pre-engineered buildings. Applications range from small car parking sheds to 90 m (+), wide clear span aircraft hangars to low-rise multi-storey buildings. Almost every conceivable building use has been achieved using the pre-engineered building approach.

The most common applications of pre-engineered buildings are:

a. Industrial

- Workshops
- Warehouses
- Cold stores
- Car parking sheds
- Slaughter houses
- Bulk product storage
- Factories



Fig.2.1 Ware house

b. Institutional

- Schools
- Exhibition halls
- Hospitals
- Theaters/auditoriums
- Sports halls

c. Agricultural

- Poultry buildings

- Dairy farms
- Green Houses
- Grain storage
- Animal confinement

d. Aviation & Military

- Air crafts hangers
- Administration buildings
- Residential barracks



Fig.2.2 Air crafts hangers

3. Detail specification PEB and conventional steel structures:

Detail specification of hanger shed.

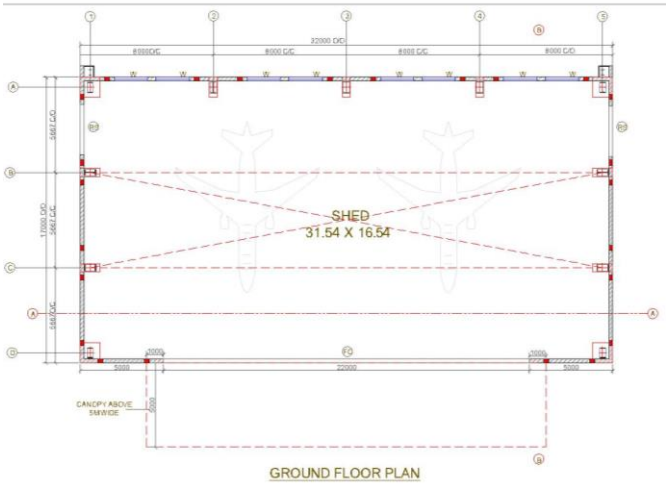


Fig.3.1 Plan of hanger shed

Size of Shed:-30.00 (L) X 17.00 (W) Out to Out

Slope: - 1:10

Height: - 10.0m @ Eaves level

4. Results

In terms of percentage, the steel required for primary frame in pre engineering building is 48.77% less as compared to conventional steel building.

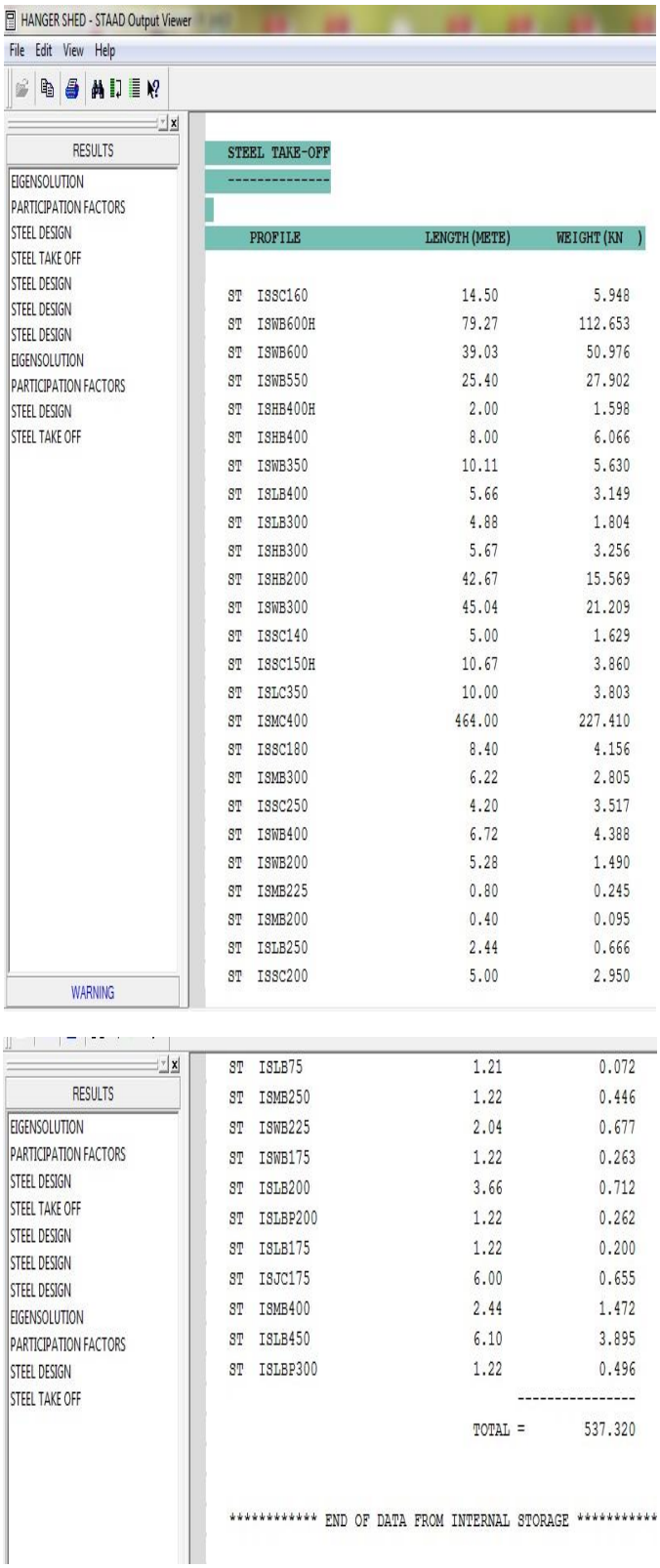


Fig.4.1 Steel take off of conventional hanger shed

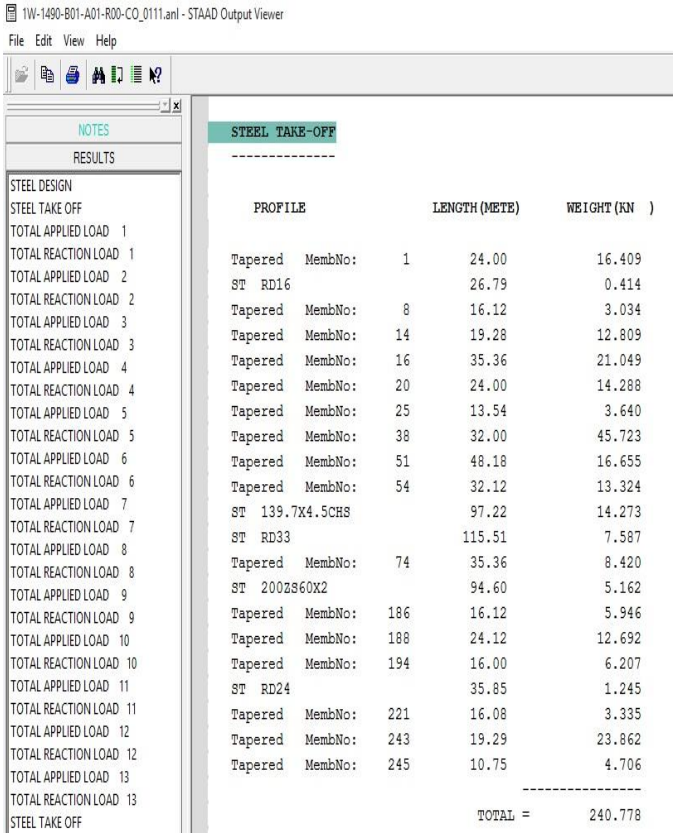


Fig.4.2 Steel take off of PEB hanger shed

5. Comparison on basis of design and analysis of hanger shed considering it as Conventional Steel Building and Pre Engineered

Points of Comparison	Pre-Engineered Steel Buildings	Conventional Steel Building
Structure Weight	Pre-Engineered Buildings are about 30% lighter through the efficient use of steel Primary framing members are tapered (varying depth) built-up plate sections with large depths in the areas of highest stress	Primary steel members arc selected from standard hot rolled "1" sections which are in many segments of the members, heavier than what is actually required by design. Members have constant cross section regardless of varying magnitude of the local stresses along the member length.
	Secondary members are light weight cold formed "Z" or "C" shaped numbers.	Secondary members are selected from standard hot rolled "I" and "C" sections, which are heavier.
Design	Quick and efficient. Since PEB's are mainly formed of standard sections and connections, design time is significantly reduced. Basic designs are used over and over: Specialized computer analysis and design programs optimize material required. Drafting is also computerized using standard details that minimize project custom details. Design, shop details sketches and erection drawings are supplied free of charge by the manufacturer drawings are usually prepared within 2 weeks. PEB engineers design and detail pre-engineered buildings almost every day throughout the year resulting in faster and more efficient designs. Consultant's in house design and drafting time is considerably reduced. Allowing more time for co-ordination and review, and increased margins on design fees	Each conventional steel structure is designed from scratch by the consultant, with fewer design aids available to the engineer. Substantial engineering and detailing is required on every project. Generalized computer analysis program require extensive input/output and design alterations. Extensive consultant time is devoted to design and drafting, as well as co-ordination and review, often at a significant expense. Each project is a special case; engineers need more time to develop the design and details of the unique structure. More complicated design requiring extensive design and drafting time from consultants.
Delivery	Average 6 to 8 weeks.	Average 20 to 26 weeks.
Foundations	Simple design, easy	Extensive, heavy

	to construct and light weight	foundations complicated.
Erection Simplicity	Since the connections of the components are standard, the learning curve of erection for each subsequent project is faster. Periodic free-of-charge erection ' support at the site is usually provided by PEB manufacturers.	The connections are normally complicated and differ from project to project, resulting in longer learning curves of erection for new projects
Erection Cost and time	Both cost & time of erection are accurately known, based upon extensive experience with similar buildings. PEBs are often erected by specialized PEB builders with extensive experience in the erection of similar buildings, offering very competitive rates. PEB builders usually have a stock of standard components, in their camps; enabling them to complete jobs on time should any shortage or site damage occur to materials. The erection process is easy, fast, step by step and with hardly any. Requirement for equipment. Erection is slow and extensive field labour is required. Heavy equipment	Typically, they are 20% more expensive than PEB. In most of the cases, the erection costs and time are not estimated accurately
	is often needed.	
Seismic Resistance	The low weight flexible frames offer higher resistance to seismic forces	Rigid heavy weight structures do not perform well in seismic zones.
Overall Price	Price per square meter may be as much as 30% lower than conventional steel.	Slightly cheaper sue to use of poor quality material.
Architecture	Outstanding architectural design can be achieved at low cost using standard architectural features and interface details. Traditional wall and fascia materials, such as concrete, masonry and wood, can be utilized.	Special architectural design and features must be developed for each project, which Often require research and thus resulting in much higher costs
Sourcing & Co-ordination	Building is supplied complete with cladding and all accessories, including erection (if desired) from one single source.	Many source of supply project management time is required to co-ordinate suppliers and sub-contractors.
Cost of Change Orders	PEB manufacturers often stock a large amount of basic raw materials that can he flexibly used in many types of PEB projects. Change orders are easily accommodated at all stages of the order fulfillment process. Little or no material is wasted even' if a change order is made after fabrication starts.	Substitutions of hot rolled sections that are infrequently rolled by mills is expensive and time consuming. Change orders that are made, after hot rolled sections are shipped for fabrication, often result in redundancies to a lot of hot rolled sections, which ultimately result in more cost to the end-user.
Building	Designed to fit the system, with	Every project requires special

Accessories	standardized, interchangeable parts, including pre-designed flashing and trims. They are mass produced for economy and are available with the building. They have been tried in thousands of existing buildings.	design for accessories and special sourcing for each item. Flashing and trims must be uniquely designed and fabricated
Future Expansions	All project records are kept in electronic format indefinitely, making it easy for the owner or designer to obtain a copy of his building records at any time. Future expansion is simple, easy and cost effective. One supplier can co-ordinate changes.	It will be difficult to obtain project records, after a long period of time. It is required to contact more than one party, involved I the project to obtain accurate information. Future expansion would be more difficult and more likely, costlier
Responsibility	Single source of supply results in total responsibility by one supplier, including design liability PEB manufacturers can be relied upon to service their buildings long after they are supplied to protect their reputation.	Multiple responsibilities can result in questions of who is responsible when components do not fit properly, insufficient material is supplied, or materials fail to perform, particularly at the supplier/contractor interface. The consultant carries total design liability.
Performance	All components have been specified and designed specifically to act together as a system, for maximum efficiency, precise fit and peak performance in the field.	Components are custom designed for a special application on a specific job. Design and detailing errors are possible when assembling the diverse components into unique buildings.
	Experience with similar buildings, in actual field Conditions worldwide, has resulted in design improvements over time, which allows dependable prediction of performance	Each building design is unique, so prediction of how components will perform together is uncertain. Materials which have performed well in some climates may not do so in other environments

6. Comment

As per the current case study if the Industrial Steel Building is designed for 70m x 25m x 13m for a particular site as per site requirement and the respective loading conditions as per the IS codes by using either portal frame truss, A-type frame truss, saw-tooth type truss or pre-engineered sections then the saw tooth type truss framed structure is found to be 60% more cost effective than other conventional type of trusses and in comparison to this the pre-engineered building is found to be more 30% lighter in weight, economical, strength full, highly efficient with minimum chances of error etc. and best suiting structure spanning from 20m to 80m for single storey building.

7. Conclusion

Hence the pre-engineered buildings are more advantageous over conventionally designed buildings in terms of cost effectiveness, time saving, future scope, subtleness and economy. This paper of comparative study between conventional and pre-engineered building shows their experimental and analytical studies carried out in this field. The results show that the steel structures are far more economical energy efficient and flexible in design than other type of structures for industrial use.

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CAM OPERATED SUGARCANE BUD CUTTING MACHINE

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Abstract - *With the increasing levels of technology, the efforts being put to produce any kind of work has been continuously decreasing. The efforts required in achieving the desired output can be effectively and economically be decreased by the implementation of better designs.*

Now a day's most of the agricultural equipment is working on the automatic system. We know that agriculture is the backbone of the Indian economy and Indian farmers are facing the problem of shortage of worker for doing the on-field work. To overcome this problem, we are designing the sugarcane bud cutting machine which reduces the wastage of sugarcane and also reduces the transportation cost. The production of bud using this automatic sugarcane bud cutting machine is high as compare to other conventional machines available in the market.

The buds cut by using this machine are light in weight and economic sugarcane seeding material. This technique of farming using the buds helps to the farmer developing the new varieties of the sugarcane. There is problem of initial growth using the sugarcane bud but it can be overcome using the suitable growth regulators and fertilizers. Also, this machine faster production rate which make it suitable for the competition with conventional sugarcane bud cutting machine.

Key Words: Automatic machine, Easy transportation, Economical, High productivity.

1. INTRODUCTION

Sugarcane is a vegetative propagated Crop. In India, for conventional system of cultivation, about 6 – 8 tones seed cane /ha is used as planting material, which comprises of about 32,000 stalk pieces having 2-3 buds. Sugarcane cuttings with one, two or three buds known as sets are used as seed. This large mass of planting material poses a great problem in transport, handling and storage of seed cane and undergoes rapid deterioration thus reducing the viability of buds and subsequently their sprouting.

One alternative to reduce the mass and improve the quality of seed cane would be to plant excised auxiliary buds of cane stalk, popularly known as bud chips. These bud chips are less bulky, easily transportable and more economical seed material. The bud chip technology holds great promise in rapid multiplication of new cane varieties. The left-over cane can be well utilized for preparing juice or sugar or jiggery. Despite of all these benefits of bud chips for rapid multiplication of new cane, a common problem many sugar cane farmers are facing in a developing country like India is affordable (low cost) bud chipping machine. The existing (traditional) tools used for bud chipping of sugar cane are unsafe, messy and need skill and training. The risk of injury is also too high. This necessitates the development of a bud chipping machine for sugar cane. In this direction, literature survey, patent search, market survey and concept generation were carried out. Different concepts were developed using concept generation.





Fig.1.1–Existing Manually Operated Sugarcane Bud Cutting Tools

Agriculture is one of the most significant sectors of the Indian Economy. Agriculture is the only means of living for almost two thirds of the workers in India. The agriculture sector of India has occupied 33% of India's geographical area and is contributing 15.1% of India's GDP. Agriculture still contributes significantly to India's GDP despite decline of its share in India's GDP. There are number of crops grown by farmers. These include different food crops, commercial crops, oil seeds etc., sugarcane is one of the important commercial crops grown in India. Sugarcane is the main source of sugar in Asia and Europe. Sugarcane is grown primarily in the tropical and sub-tropical zones of the southern hemisphere. Sugarcane is the raw material for the production of white sugar, jiggery (Gur) and Khand sari. It is also used for chewing and extraction of juice for beverage purpose. The sugarcane cultivation and sugar industry in India plays a vital role towards socioeconomic development in the rural areas by mobilizing rural resources and generating higher income and employment opportunities.

About 7.4percent of the rural population, covering about 34 million sugarcane farmers, their dependents and a large number of agricultural labors are involved in sugar cane cultivation, harvesting and ancillary activities. Little portion of stem with one bud is known as bud chip. Bud chips are used to raise settling in nursery. They were found to produce a good crop when transplanted in main field. The principal advantage of bud chips is substantial saving in seed material. Seed requirement is reduced to less than one ton per hr.

The farmers usually remove the bud chips from whole cane using a sharp-edged knife in such a way that each bud has a little portion of stem. The method is laborious time consuming and dangerous. The seed cutter machines can efficiently conserve time and labour and cost as it chips more buds in less time.

Hence, non-availability of quality seed material is one of the major problems faced by farmers in developing countries. Further, the bulky cane cuttings used for planting as seed harbor many pests and diseases thereby decreasing cane yield and quality drastically. Accumulation of diseases over vegetative cycles leads to further yield and quality decline over the years. In fact, poor quality seed is a major constraint in sugarcane production. Development of tissue culture technology for rapid multiplication of disease-free planting material has greatly facilitated mass production of quality seed in sugarcane. A number of micro propagation techniques have been adopted successfully by farmers and industry in some sugarcane growing countries of Asia-Pacific, e.g. India, Australia and the Philippines.

2. PROBLEM STATEMENT

It has been observed in rural areas most of the people cut the sugarcane buds manually. This consumes a lot of sugar cane and time to cut the buds. In order to identify this cause, we have designed and fabricated the sugar cane bud chipping machine which works on electricity. It reduces about 70% of seeding cost. And get more yield the machine reduces tremendous labor and produces more number of buds in less time. This machine can be easily lifted as it is light in weight. It will prove one of the good ideas for the farmers.

3. COMPONENTS

3.1) Electric Motor (Single Phase):-

Electric motor is an electrical machine that is used to convert electrical energy into mechanical energy. For smaller loads as in household application. Although traditionally used in fixed-speed service, induction motors are increasingly being used with variable-frequency drives in variable-speed service. VFDs offer especially important energy savings opportunities for existing and prospective induction motors in variable-torque centrifugal fan, pump and compressor applications.



Fig-3.1 Electric motor

3.2) Shaft: -

A Shaft is a rotating element, usually circular in cross section; line shaft is used to transmit power from one shaft to another, or from the machine which produces power, to the machine which absorbs power. Shaft is used to transmit power from motor to gearbox and from gearbox to mechanism. A shaft is an element used to transmit power and torque, and it can support reverse bending. Most shafts have circular cross sections, either solid or tubular. Shafts have different means to transmit power and torque. Shafts are able to avoid vibration of the elements, and assure an efficient transmission of power and torque, some changes in the cross-section of the shaft can be made.

3.3) Cutter: -

This is the main section of the scooping machine. The scoop cutter is used to cut the sugarcane bud and to get the same size of sugarcane bud. Because of scooping cutter, the wastage of sugarcane reduces and safety of farmer increases.

3.4) Spring:-

A spring is an elastic object used to store mechanical energy. When a coil spring is compressed or stretched slightly from rest, the force it exerts is approximately proportional to its change in length. Spring is used to give the upward and downward direction to the cutter. Because of spring the cutter moves upward and downward direction. Spring is assembled with the cutter.

3.5) Cam: -

A cam is a rotating or sliding piece in a mechanical linkage used especially in transforming rotary motion into linear motion or vice versa.It is often a part of a rotating wheel (e.g. an eccentric wheel) or shaft (e.g. a cylinder with an irregular shape) that strikes a lever at one or more points on its circular path. The cam can be a simple tooth, as is used to deliver pulses of power to a steam hammer, for example, or an eccentric disc or other shape that produces a smooth reciprocating (back and forth) motion in the follower, which is a lever making contact with the cam.

3.6) Main Pulley: -

The main pulley is V-belt pulley mounted on the input shaft by means of an Allen head grub screw. This pulley is a reduction pulley that is reduces the motor speed 5 times so also torque available at the machine input shaft is amplified.



Fig. 3.6 Main pulley

3.7) Pedestal bearing: -

It is also called Plummer block. Figure shows half sectional front view of the Plummer block. It consists of cast iron pedestal, phosphor bronze bushes or steps made in two halves and cast-iron cap. A cap by means of two square headed bolts holds the halves of the steps together.



Fig. 3.7 Pedestal bearing

The steps are provided with collars on either side in order to prevent its axial movement.

The snug in the bottom step, which fits into the corresponding hole in the body, prevents the rotation of the steps along with the shaft. This type of bearing can be placed anywhere along the shaft length.

The main function of a rotating shaft is to transmit power from one end of the line to the other. It needs a good support to ensure stability and frictionless rotation. The support for the shaft is known as “bearing”.

The shaft has a “running fit” in a bearing. All bearing is provided some lubrication arrangement to reduced friction between shaft and bearing.

3.8) V- belts: -

V-belts (also known as V-belt or wedge rope) solved the slippage and alignment problem. It is now the basic belt for power transmission. They provide the best combination of traction, speed of movement, load of the bearings, and long service life. They are generally endless, and their general cross-section shape is trapezoidal (hence the name "V"). The "V" shape of the belt tracks in a mating groove in the pulley (or sheave), with the result that the belt cannot slip off. The belt also tends to wedge into the groove as the load increases—the greater the load, the greater the wedging action—improving torque transmission and making the V-belt an effective solution, needing less width and tension than flat belts. V-belts trump flat belts with their small center distances and high reduction ratios. The preferred center distance is larger than the largest pulley diameter, but less than three times the sum of both pulleys. Optimal speed range is 1,000–7,000 ft/min (300–2,130 m/min). V-belts need larger pulleys for their larger thickness than flat belts.



Fig.3.8- V-belt

For high-power requirements, two or more V-belts can be joined side-by-side in an arrangement called a multi-V, running on matching multi-groove sheaves. This is known as a multiple-V-belt drive (or sometimes a "classical V-belt drive").V-belts may be homogeneously rubber or polymer throughout, or there may be fibers embedded in the rubber or polymer for strength and reinforcement. The fibers may be of textile materials such as cotton, polyamide (such as Nylon) or polyester or, for greatest strength, of steel or aramid (such as Twaron or Kevlar).

When an endless belt does not fit the need, jointed and link V-belts may be employed. However, they are weaker and only usable at speeds up to 4,000 ft/min (1,200 m/min). A link v-belt is a number of rubberized fabric links held together by metal fasteners. They are length adjustable by disassembling and removing links when needed.

3.9) Gear Train:-

A gear train is a mechanical system formed by mounting gears on a frame so the teeth of the gears engage.

Gear teeth are designed to ensure the pitch circles of engaging gears roll on each other without slipping, providing a smooth transmission of rotation from one gear to the next

Features of gears and gear trains include:

1) The ratio of the pitch circles of mating gears defines the speed ratio and the mechanical advantage of the gear set.

2) A planetary gear train provides high gear reduction in a compact package.

3) It is possible to design gear teeth for gears that are non-circular, yet still transmit torque smoothly. The speed ratios

of chain and belt drives are computed in the same way as gear ratios

4. DESIGN

Design consists of application of scientific principles, technical information and imagination for development of new or improvised machine or mechanism to perform a specific function with maximum economy & efficiency. Hence a careful design approach has to be adopted. The total design work has been split up into two parts;

4.1 System design

4.2 Mechanical Design.

System design mainly concerns the various physical constraints and ergonomics, space requirements, arrangement of various components on main frame at system, man + machine interactions, No. of controls, position of controls, working environment of machine, chances of failure, safety measures to be provided, servicing aids, ease of maintenance, scope of improvement, weight of machine from ground level, total weight of machine and a lot more.

In mechanical design the components are listed down and stored on the basis of their procurement, design in two categories namely,

1) Designed Parts

2) Parts to be purchased

For designed parts detached design is done & distinctions thus obtained are compared to next highest dimensions which are readily available in market. This amplifies the assembly as well as postproduction servicing work. The various tolerances on the works are specified. The process charts are prepared and passed on to the manufacturing stage.

The parts which are to be purchased directly are selected from various catalogues & specified so that anybody can purchase the same from the retail shop with given specifications.

4.1 SYSTEM DESIGN:

In system design we mainly concentrated on the following parameters: -

4.1.1 System Selection Based on Physical Constraints

While selecting any machine it must be checked whether it is going to be used in a large-scale industry or a small-scale industry. In our case it is to be used by a small-scale industry. So, space is a major constrain. The system is to be very compact so that it can be adjusted to corner of a room.

The mechanical design has direct norms with the system design. Hence the foremost job is to control the physical parameters, so that the distinctions obtained after mechanical design can be well fitted into that.

4.1.2 Arrangement of Various Components

Keeping into view the space restrictions the components should be laid such that their easy removal or servicing is possible. More over every component should be easily seen none should be hidden. Every possible space is utilized in component arrangements.

4.1.3 Components of System

As already stated the system should be compact enough so that it can be accommodated at a corner of a room. All the moving parts should be well closed & compact. A compact system design gives a high weighted structure which is desired.

4.1.4 Man-Machine Interaction

The friendliness of a machine with the operator that is operating is important criteria of design. It is the application of anatomical & psychological principles to solve problems arising from Man – Machine relationship. Following are some of the topics included in this section.

1. Design of foot lever
2. Energy expenditure in foot & hand operation
3. Lighting condition of machine.

4.1.5 Chances of Failure

The losses incurred by owner in case of any failure is important criteria of design. Factor safety while doing mechanical design is kept high so that there are less chances of failure. Moreover, periodic maintenance is required to keep unit healthy.

4.1.6 Servicing Facility

The layout of components should be such that easy servicing is possible. Especially those components which require frequents servicing can be easily disassembled.

4.1.7 Scope of Future Improvement

Arrangement should be provided to expand the scope of work in future. Such as to convert the machine motor operated; the system can be easily configured to required one. The die & punch can be changed if required for other shapes of notches etc.

4.1.8 Height of Machine from Ground

For ease and comfort of operator the height of machine should be properly decided so that he may not get tired during operation. The machine should be slightly higher than the waist level, also enough clearance should be provided from the ground for cleaning purpose.

4.1.9 Weight of Machine

The total weight depends upon the selection of material components as well as the dimension of components. A higher weighted machine is difficult in transportation & in case of major breakdown, it is difficult to take it to workshop because of more weight.

4.2 MECHANICAL DESIGN

ELECTRIC MOTOR DETAILS

POWER= 180 WATT.

SPEED = 1425 rpm.

OPERATING SPEED = 1400 rpm.

DIA OF PULLEY = 406 MM.

PULLEY WEIGHT = 20 N

LENGTH = 875 MM.

1) Design of first shaft

As per design data Book.

Angle of lapping between belt & pulley=180 degree = π rad.

Km = combined shock & fatigue factor for bending= 1.5 (table 14.2 khurmi- gupta page 531).

Kt = combined shock & fatigue factor for bending = 2

Coefficient of friction μ = 0.3.

Allowable shear stress = 35 mpa = 35 N/mm^2

NOW;

$$\text{Power (P)} = \frac{2\Pi NT}{60}$$

$$\Rightarrow 180 = \frac{2 \times \Pi \times 1400 \times T}{60}$$

$$\Rightarrow T = \frac{180 \times 60}{2 \times \Pi \times 1400}$$

T = 1.22 N.m = 1.22 × 10^3 N-mm.

T1 & T2 = Tension in tight side & slack side of belt resp. In newtons

T = (T1- T2)R

1.22 × 10^3 = (T1- T2) × 203.

(T1 – T2) = $(1.22 \times 10^3)/203$

(T1- T2) = 6.00 N.....1

We know that,

2.3 log $(T1/T2)$ = μ Ø.

log $(T1/T2) = (0.3 \times \pi)/2.3$

log $(T1/T2)$ = 0.4098.....taking antilog.

$(T1/T2)$ = 2.57.....3.....2

From above equations.

T1 = 2.18 N.

T2 = 3.82 N.

Total vertical load acting on the pulley.

Wt = T1 + T2 +W

= 6 + 20

= 26 N.

Bending moment acting on the shaft.

M = Wt × L

= 26 × 875.

= 22750 N.mm.

d=dia of shaft.

We know equivalent twisting moment.

kyTe = $\sqrt{(Km\,M)^2 + (Kt\,T)^2}$

Te = $\sqrt{(1.5 \times 22750)^2 + (2 \times 6)^2}$

= 34125.00 N.mm.

Equivalent twisting moment (Te).

Te = $\pi/16 \times \tau \times d\text{^}3$

Te = $\pi/16 \times 35 \times d\text{^}3$.

$d\text{^}3 = (34125.00 \times 16)/(\pi \times 35)$

d = 17.06 mm.

d ≈ 17 mm.

As we are using 25mm dia. Shaft. So our design is safe.

2) Calculation of cranking force

Crank force = T design × eccentricity.

Belt pulley have reduction ratio 1:3. Hence,

T design = overload factor × 3 × T motor.

Consider 100% overload.

T design. = 1 × 3 × (1.22 × 10^3).

T design. = 3.66 N.m.

Crank force = 3.66 × 100 .

Crank force = 366000 N.mm.

4.3 MATERIAL SELECTION: -

REF: -PSG DESIGN DATA (1.10&12 1.17)

Table no. 4.3

MATERIAL DESIGNATION	TENSILE STRENGTH N/mm²	YEILD STRENGTH N/mm²
MS	600	380

3) Design of connecting rod as pull force.

cross section area = 100 × 25 = 2500 mm² .

direct tensile load = 366000 N.mm.

Check for failure of connecting rod under direct tensile load.

Ft = load/ area.

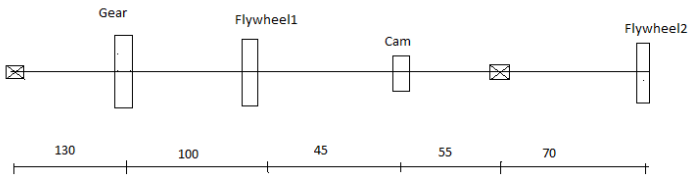
= 366000/2500.

= 146.4 N/mm².

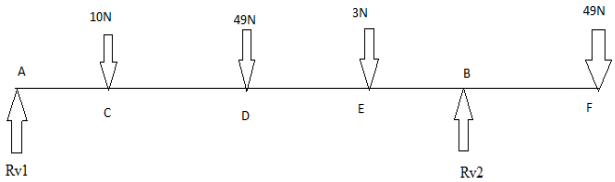
As Ft act < Ft all

The link is safe under tensile load.

4) Design of second shaft



Vertical Force Diagram:



Horizontal Force Diagram:



Mt = $\frac{60\times10^6\times0.18}{2\pi\times630}$ = 2728.370 N-mm

Pt = $\frac{2\,Mt}{dg}$

= $\frac{2\times2728..37}{120}$

Pt = 45.47 N

Pr = Pt tanα

= 45.47×tan (20)

= 16.56 N

For vertical force diagram

Rv1 + Rv2 = 16.55 + 49 + 3 + 49

Taking moment about A

16.55×130 + 49×230 + 3×275 - Rv2×330 +49×455 = 0

Rv2 = $\frac{36541.5}{330}$

= 110.73 N

Rv1 = 117.55 – Rv2

= 6.81 N

Moment about D = 6.81× 230 + 10×100

= 566.3 Nmm

Moment about E = 6.81×275 + 10×145 + 49×45

= 1782.25 Nmm

Moment about B = 49×70

= 3430 Nmm

Moment about C = 6.81×130

= 885.3 Nmm

For horizontal force diagram

Rh1 + Rh2 = Pr

Moment about A is

45.47×130 – Rh2×330 = 0

Rh2 = $\frac{5911.11}{330}$

Rh2 = 17.91 N

Rh1 = 45.47 – 17.91

= 27.56 N

Moment about C = 27.56×130

= 3538.2 Nmm

Moment about B = 27.56×330 – 45.47×200

= 0.8 Nmm

Moment about D = 0

Mb = $\sqrt{(3582.8)^2 + (3430)^2}$

= 4959.97 Nmm

Now

$$d^3 = \frac{16}{\pi \times \tau max} \sqrt{(Kb\ Mb)^2 + (Kt\ Mt)^2}$$

$$= \frac{16}{\pi \times 35} \sqrt{(2 \times 4959.9)^2 + (1.5 \times 2728.37)^2}$$

= 1561.48 mm

d = 11.60 mm

The next size available in market is 15 mm

Therefore d = 15 mm

But for safety purpose we take d = 25 mm

Gear Design:

We know,

Zp = 27 Zg = 60

Dp = 55 mm Dg = 145 mm

Module = Dg/Zg

= 145/60

= 2.41

As both the gears are made up of same material, the with smaller size subjected to greater stresses hence smaller gear is needing to design,

From design datebook

Lewis factor Y for 27 teeth=0.348

By analyzing the application, the service factor is considered as 1.5

For velocity factor, Cv = $\frac{6}{6+V}$ _____

V = $\frac{\pi \times Dp \times np}{60 \times 10^3}$

= $\frac{\pi \times 55 \times 1400}{60 \times 10^3}$

= 4.03 m/s

Cv = $\frac{6}{6+4.03}$

= 0.59

Sb = m × b × (sigma B) $_{generated}$ × Y

1.22 ×10^3 = 2.41 × 10 × (sigma B) $_{generated}$ × 0.348

(b=10*m .....[here])

(sigma B) $_{generated}$ =145.46 N/mm2 {less than 200 N/mm2}

Hence assumption is correct, Design is safe

5. WORKING :-

When motor starts pulley rotates which is connected to the 2-inch pulley which drive to the 16-inch pulley. 16-inch pulley drive 25 mm shaft on which the circular cam is mounted. Cam drives the shafts which slide in the pedestal bearing and guide bush Shafts another end cutting blade is connected.

This project is we worked under by the cam and follower mechanism. The mechanism converts the rotary motion into the reciprocating motion. The machine has the prime mover at the bottom of the machine. The motor and pulley are connected with one V-type belt.

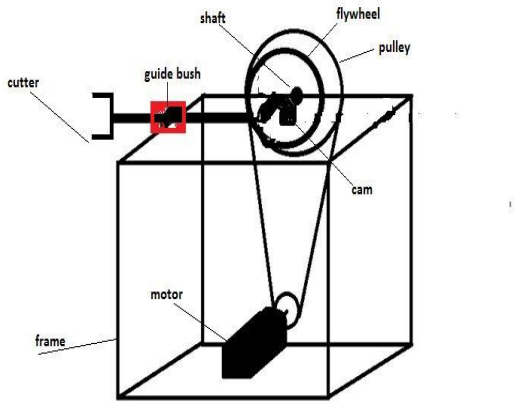


Fig.5.1- Working Model



Fig5.2 Working model

6. CONCLUSIONS

This is a new concept applied for sugarcane bud cutting process which finds suitable and viable and reduces human effort compared to traditional methods. This machine provides comfort to work for different positions depending upon ergonomics. The time requirement as well as efficiency of machine depends upon the size of sugarcane.

The sugarcane bud cutting machine is very useful for small scale farmers for planting sugarcane buds, also time is saved by this process as compared to traditional system of sugarcane bud cutting. Extra piece of sugarcane bud waste in small scale farm which can be saved by using sugarcane bud cutting machine that can be used as fodder for animals.

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STATIC ANALYSIS OF MULTI-STORIED BUILDING AS PER IS 1893-2002 AND IS 1893-2016

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Abstract - *This paper concerned with study on revision of IS 1893-2016.The static analysis of multi-storied building is done by using FEM based software. In present study, the static analysis is carried out as per IS 1893-2016 and results such as lateral displacement, base shear, storey drift are compared with IS1893-2002. This paper deals with the comparison of design forces for multi-storied buildings, obtained by using IS 1893-2016 code, with those obtained by the previous IS1893-2002 version. From the results of seismic analysis of buildings it is concluded that the IS1893-2016 is more conservative for earthquake analysis of multi-storey buildings.*

Key Words: Multi-storied building, static analysis, IS1893-2016, IS1893-2002.

1. INTRODUCTION

When earthquakes occur, a building undergoes dynamic motion. This is because the building is subjected to inertia forces that act in opposite direction to the acceleration of earthquake excitations. These inertia forces, called seismic loads, are usually dealt with by assuming forces external to the building. So, apart from gravity loads, the structure will experience dominant lateral forces of considerable magnitude during earthquake shaking. It is essential to estimate and specify these lateral forces on the structure in order to design the structure to resist an earthquake. Indian seismic code IS: 1893 has also been revised in year 2016. This paper presents the seismic load estimation of multi storied buildings as per IS: 1893(part) -2016. The process gives static analysis of multi-storied building by using FEM based software and the results are used to compare old codal provions viz. lateral displacement, base shear, storey drift computed as per the two versions of seismic code. So, this paper deals with comparative study of IS 1893-2002 and IS 1893-2016. Model considered for this paper is 15 storied residential building using FEM based software. The height of each storey is taken as 3 meter and base height 0.45 m making the total height of the structure 45.45 meter. Static Analysis of the structure is done and results generated by software are compared as per IS 1893:2002 and IS 1893-2016.

2. LITERATURE SURVEY

S. Farrukh Anwar, A. K. Asthana (2013) "Evaluation of Seismic Design Forces of Indian Building Code" [1]: The recent fifth revision of Indian Seismic Code, IS: 1893 has been split into five separate parts for different types of structures. The new code IS: 1893 (Part-1)? 2002 contains provisions specific to buildings only, along with general provisions applicable to all structures. This paper deals with the comparison of seismic design forces for multi-storied buildings, obtained by using the new code, with those obtained by the previous 1984 version. From the results of seismic analysis of buildings it is concluded that the new code is more conservative for buildings resting on soft and medium soils.

S.K. Ahirwar, S.K. Jain and M. M. Pande (2008) "earthquake loads on multistorey buildings as per is: 1893-1984 and is: 1893-2002: a comparative study" [2]: As a result Indian seismic code IS: 1893 has also been revised in year 2002.This paper presents the seismic load estimation for multi-storey buildings as per IS: 1893-1984 and IS: 1893-2002 recommendations. Four multistorey RC framed buildings ranging from three storied to nine storied are considered and analyzed. The process gives a set of five individual analysis sequences for each building and the results are used to compare the seismic response viz. storey shear and base shear computed as per the two versions of seismic code. The seismic forces, computed by IS: 1893-2002 are found to be significantly higher, the difference varies with structure properties. It is concluded that such study needs to be carried out for individual structure to predict seismic vulnerability of RC framed buildings that were designed using earlier code and due to revisions in the codal provisions may have rendered unsafe.

Sudhir K Jain (2003) "Review of Indian seismic code, IS 1893 (Part 1) : 2002"[3] : The Indian seismic code IS 1893 has now been split into a number of parts and the first part containing general provisions and those pertaining to buildings has been released in 2002. There has been a gap of 18 years since the previous edition in 1984. Considering the advancements in understanding of earthquake-resistant design during these years, the new edition is a major upgradation of the previous version. This paper reviews the new code; it contains a discussion on Clauses that are confusing or vague and need clarifications immediately. The typographical and editorial errors are pointed out. Suggestions are also included for next revision of the code.

C.V.S. Lavanya, Emily.P.Pailey, Md. Mansha Sabreen (2017) "Analysis and design of g+4 residential building using Etabs" [4]: ETABS stands for Extended Three

Dimensional Analysis of Building Systems. The main purpose of this software is to design multi-storied building in a systematic process. The effective design and construction of earthquake resistant structures have great importance all over the world. This project presents multi-storied residential building analysed and designed with lateral loading effect of earthquake using ETABS. This project is designed as per INDIAN CODES- IS 1893-part2:2002, IS 456:2000 and analysis is carried out by considering severe seismic zones and behaviour is assessed by taking type-II Soil condition,

Mahesh Patil, Yogesh Sonawane (2015) "Seismic Analysis of Multistoried Building"[5] : The effective design and the construction of earthquake resistant structures have much greater importance in all over the world. In this paper, the earthquake response of symmetric multistoried building is studied by manual calculation and with the help of ETABS 9.7.1 software. The method includes seismic coefficient method as recommended by IS 1893:2002. The responses obtained by manual analysis as well as by soft computing are compared. This paper provides complete guide line for manual as well software analysis of seismic coefficient method.

Following methods are adopted for analysis of building for design earthquake loads.

1. Equivalent Static Method, and
2. Dynamic Analysis Method.

Dynamic analysis can be performed in three ways,

1. Response Spectrum Method,
2. Modal Time History Method, and
3. Time History Method.

For Tall Buildings, Response Spectrum Method and Time History Method are adopted

3. PROBLEM FORMULATION

Consider the residential multi-storey building having strength greater than 200 people. Building details are as follows.

Building Plan:

a) Colum Size: 400mm x 600mm up to 8 storeys.
400 mm x 400mm up to 15 storeys.
b) Beam size: 230mm x 450 mm
c) Storey Height: base height 0.45 m,3 m each floor
d) Live load: 2 KN/m2
e) Floor finish: 1KN/m2
f) Seismic: V
g) Colum Material Grade: M30
h) Beam and slab concrete Grade: M25

Load Combinations for code IS 1893-2002.

1.5(DL +IL)
1.2[DL + LL + (ELx+0.3Ely)]
1.2[DL + LL - (ELx+0.3Ely)]
1.2[DL + LL + (ELy+0.3Elx)]
1.2[DL + LL - (Ely+0.3Elx)]
1.5[DL+ (ELx+0.3Ely)]
1.5[DL- (ELx+0.3Ely)]
1.5[DL+ (ELy+0.3Elx)]
1.5[DL- (Ely+0.3Elx)]
0.9DL+1.5(ELx+0.3Ely)]
0.9DL-1.5(ELx+0.3Ely)]
0.9DL+1.5(ELy+0.3Elx)]
0.9DL-1.5(Ely+0.3Elx)]

Load Combinations for code IS 1893-2016.

1.2[DL+LL+ (ELx+0.3Ely+0.3ELz)]
1.2[DL+LL-(ELx+0.3Ely+0.3ELz)]
1.2[DL+LL+ (ELy+0.3Elx+0.3ELz)]
1.2[DL+LL-(Ely+0.3Elx+0.3ELz)]
1.5[DL+ (ELx+0.3Ely+0.3ELz)]
1.5[DL-(ELx+0.3Ely+0.3ELz)
1.5[DL+ (Ely+0.3ELx+0.3ELz)]
1.5[DL-(Ely+0.3ELx+0.3ELz)]
0.9DL+1.5(ELx+0.3ELy+0.3ELz)
0.9DL-1.5(ELx+0.3Ely+0.3ELz)
0.9DL+1.5(Ely+0.3ELx+0.3ELz)
0.9DL-1.5(Ely+0.3ELx+0.3ELz)

4. OBJECTIVES:

1. To study behaviour of multi-storied building as per revision of IS 1893 Part1-2016.

2. To analyse G+ 14 residential multi-storey building having capacity greater than 200 people.

3. To study parameters such as lateral displacement, Base shear, storey drifts multi-storied building.

4. To compare analysis results obtained for new and old codes.

5. MODELING AND ANALYSIS

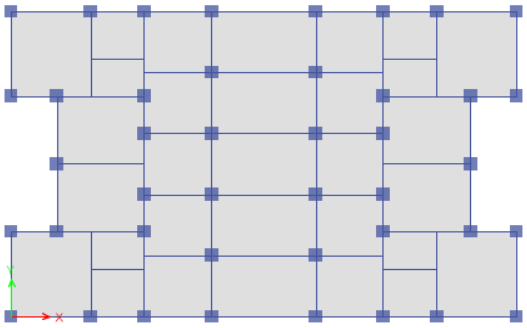


Fig -1: structural plan of G+14 residential building

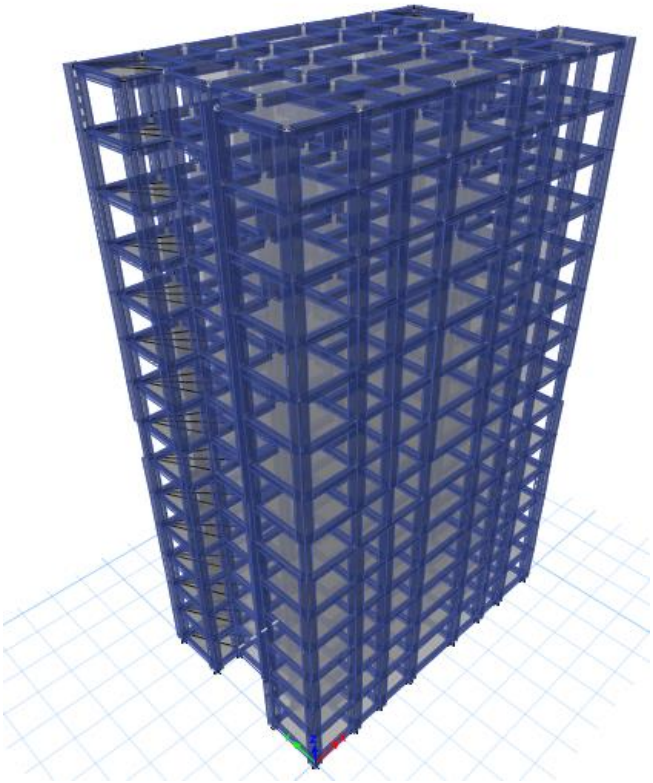


Fig -2: 3D view G+14 residential building

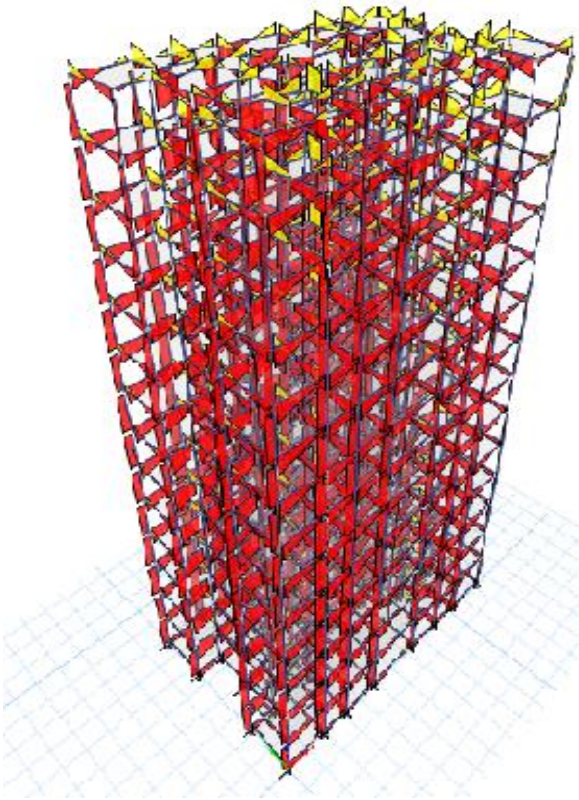


Fig -5: Shear force of G+14 residential building

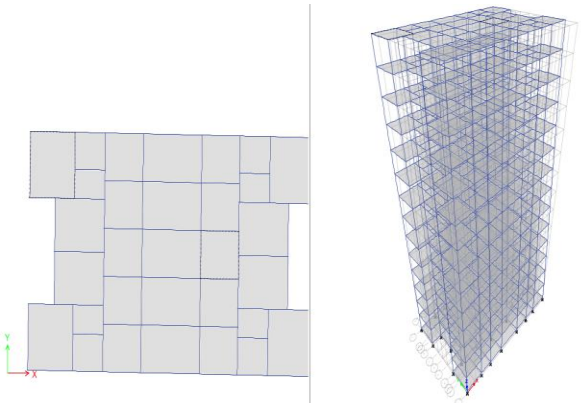


Fig -3: Displacement along X direction.

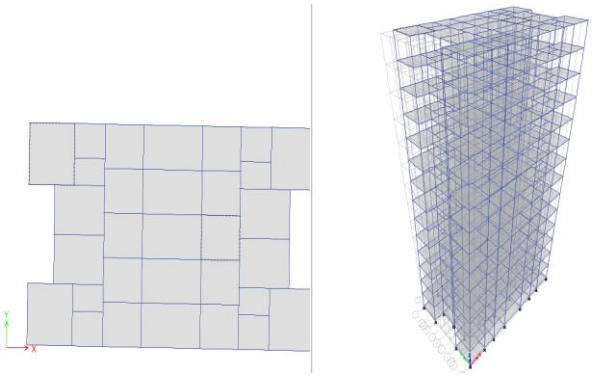


Fig -4: Displacement along Y direction.

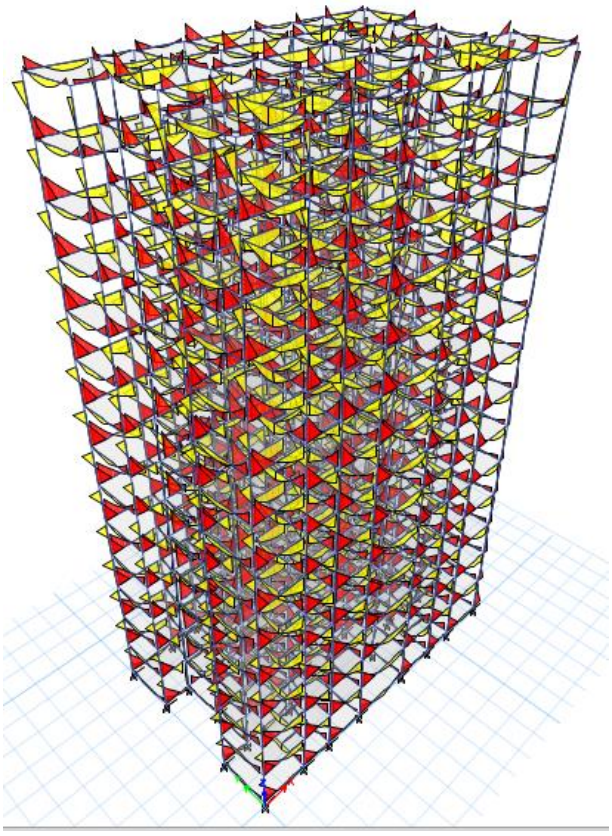


Fig -6: Bending moment of G+14 residential building

6. RESULTS

Consider results for Equivalent static method

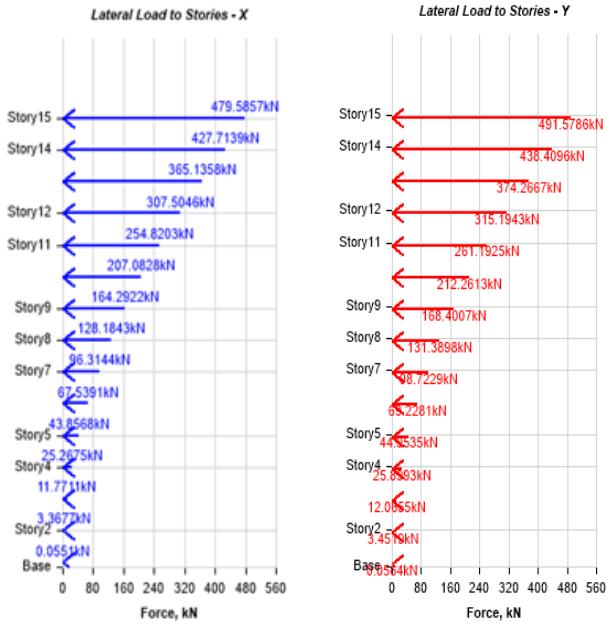


Fig-7: Lateral load for different stories as per IS 1893-2002.

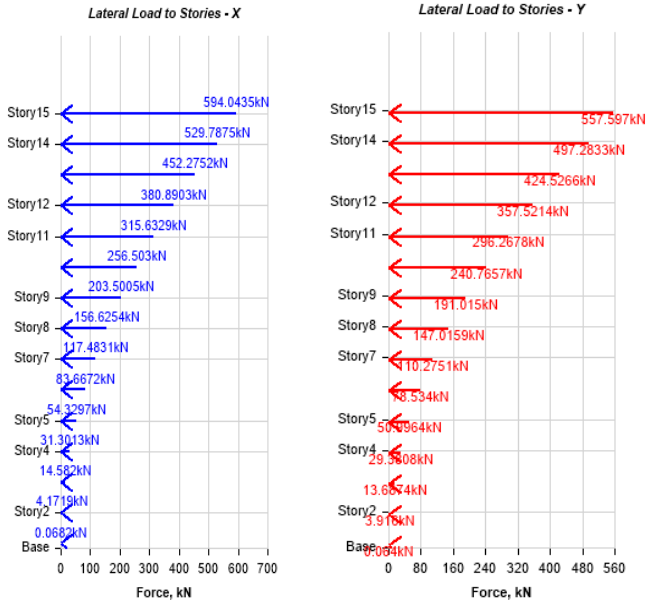


Fig-8: Lateral load for different stories as per IS 1893-2016.

Base shear

Table: Base shear in X- direction and Y Direction

Sr. No	IS Codes	Direction X	Direction Y
1	IS 1893-2002	2582.49	2647.07
2	IS 1893-2016	3194.86	2998.84
3	% INCREASE	23.71	13.28



Chart 1: Maximum displacement along EQx as per IS 1893-2002

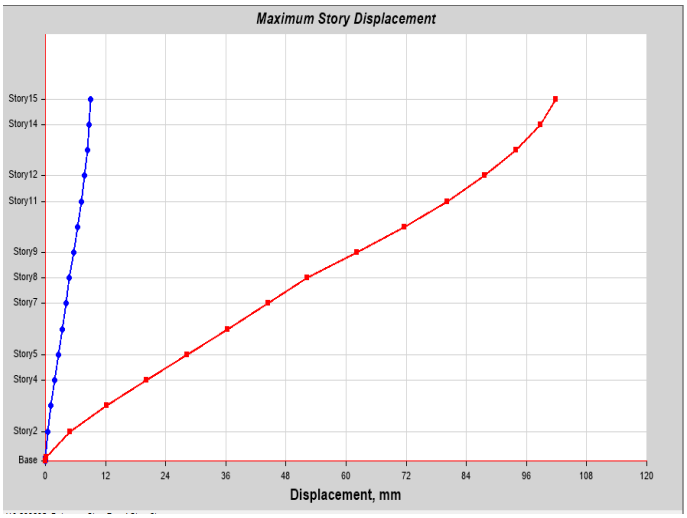


Chart 2: Maximum displacement along EQy as per IS 1893-2002

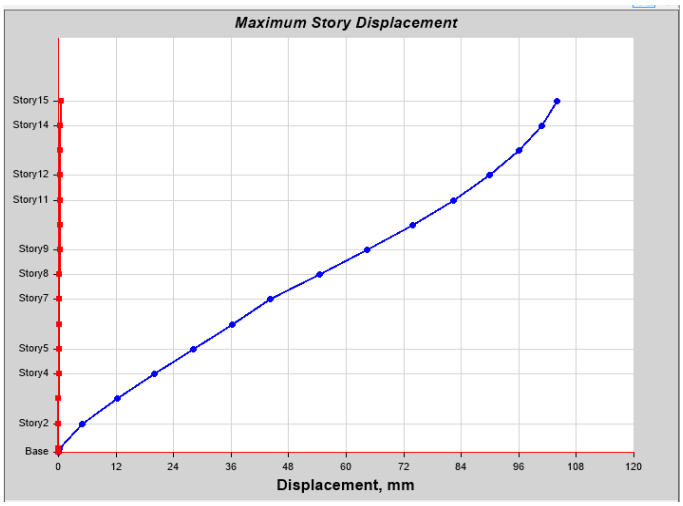


Chart 3: Maximum displacement along EQx as per IS 1893-2016

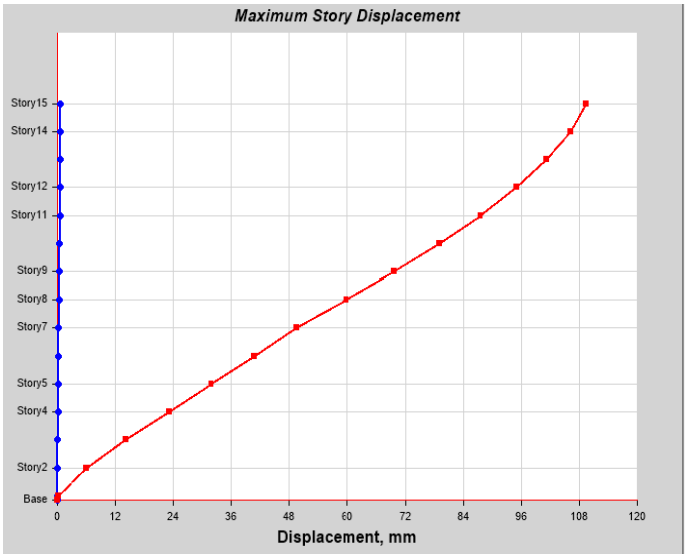


Chart 4: Maximum displacement along EQy as per IS 1893-2016

Maximum Lateral displacement

Table: maximum lateral displacement along EQx and EQy

Storey	IS Codes	EQX(mm)	EQY(mm)
15	IS1893-2002	93.2	101.9
15	IS1893-2016	104	109.3
	% INCREASE	11.59	7.26

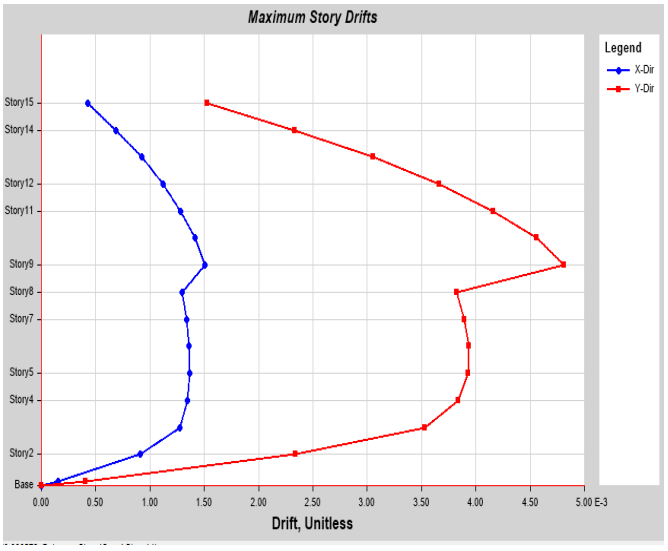


Chart 5: storey drift as per IS 1893- 2002

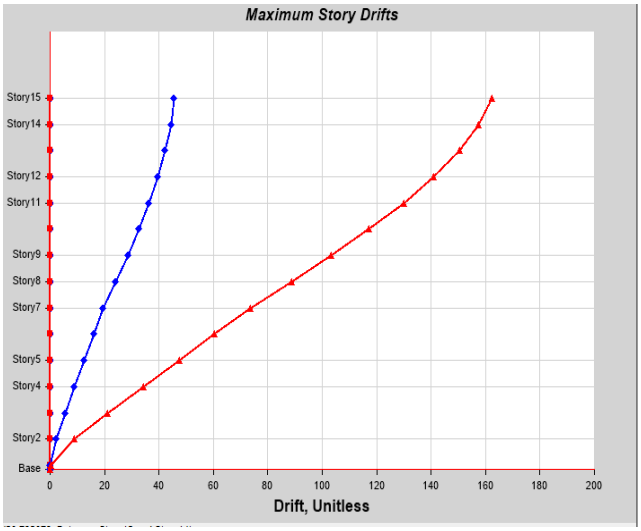


Chart 6: storey drift as per IS 1893- 2016.

Storey Drift

Table: Storey Drift in X- direction and Y Direction

Storey	IS Codes	X (mm)	Y (mm)
15	IS1893-2002	0.001273	0.001529
8	IS1893-2016	0.001874	0.001984
	% INCREASE	47.21	29.76

Design reaction at base

Table: Design Forces along X and Y direction

IS 1893-2002			
Joint label	Load combination	Fx(max) KN	Fy(max) KN
14	1.5[DL- (ELx+0.3Ely)]	217.367	
20	1.5[DL- (Ely+0.3Elx)]	-	245.92
IS 1893-2016			
Joint label	Load combination	Fx(max) KN	Fy(max) KN
14	1.5[DL-(ELx+0.3Ely+0.3ELz)	304.74	
12	1.5[DL-(Ely+0.3ELx+0.3ELz)]		365.74

Design reaction

Table: Design moment along X and Y direction.

IS 1893-2002			
Joint label	Load combination	Mx(max) KN-m	My(max) KN-m
39	1.5[DL+ (ELy+0.3Elx)]	245.72	
27	1.5[DL- (ELx+0.3Ely)]	-	255.01
IS 1893-2016			
Joint label	Load combination	Mx(max) KN-m	My(max) KN-m
15	1.5[DL+(Ely+0.3ELx+0.3ELz)]	362.78	
12	1.5[DL-(ELx+0.3Ely+0.3ELz)		310.25

7. CONCLUSIONS

1. Maximum lateral displacement, lateral load to stories increases when storey height increases. In case of storey drift displacement value is high at top storey as compare to bottom storey.

2. Maximum displacement found along EQx and EQy.As per IS1893-2002 is 93.2 mm and 101.9 mm and as per IS 1893-2016 is 104 mm and 109.3 mm.

3. Storey drift found along x and y direction. As per IS1893-2002 is 0.001273 mm and 0.001529 mm and as per IS 1893-2016 is 0.001874 mm and 0.001984mm.

4. Design forces obtained at base along x and y direction. As per IS1893- 2002 is 217.367 KN and 245.92 KN whereas for new code IS1893-2016 is obtained is 304.74 KN and 365.74 KN along x and Y direction

5. Design moment obtained at base along x and y direction as per IS1893- 2002 is 245.72 KN-m and 255.01 KN-m whereas for new code IS1893-2016 it is 362.78 KN-m and 310.25 KN-m along x and Y direction

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DYNAMIC ANALYSIS OF MULTI-STORIED BUILDING AS PER IS 1893-2002 AND IS 1893-2016

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Abstract - *This paper concerned with study on revision of IS 1893-2016.The dynamic analysis of multi-storied building is done by using FEM based software. In present study, the dynamic analysis is carried out as per IS 1893-2016 and results such as lateral displacement, base shear, storey drift are compared with IS1893-2002. This paper deals with the comparison of design forces for multi-storied buildings, obtained by using IS 1893-2016 code, with those obtained by the previous IS1893-2002 version. From the results of dynamic analysis of buildings it is concluded that the IS1893-2016 is more conservative for earthquake analysis of multi-storey buildings.*

Key Words: Multi-storied building, dynamic analysis, IS1893-2016, IS1893-2002.

1. INTRODUCTION

When earthquakes occur, a building undergoes dynamic motion. This is because the building is subjected to inertia forces that act in opposite direction to the acceleration of earthquake excitations. These inertia forces, called seismic loads, are usually dealt with by assuming forces external to the building. So, apart from gravity loads, the structure will experience dominant lateral forces of considerable magnitude during earthquake shaking. It is essential to estimate and specify these lateral forces on the structure in order to design the structure to resist an earthquake. Indian seismic code IS: 1893 has also been revised in year 2016. This paper presents the seismic load estimation of multi storied buildings as per IS: 1893(part) -2016. The process gives dynamic analysis of multi-storied building by using FEM based software and the results are used to compare old codal provions viz. lateral displacement, base shear, storey drift computed as per the two versions of seismic code. So, this paper deals with comparative study of IS 1893-2002 and IS 1893-2016. Model considered for this paper is 15 storied residential building using FEM based software. The height of each storey is taken as 3 meter and base story height 0.45 m making the total height of the structure 45.45 meter. Dynamic Analysis of the structure is done and results generated by software are compared as per IS 1893:2002 and IS 1893-2016.

2. LITERATURE SURVEY

S. Farrukh Anwar, A. K. Asthana (2013) "Evaluation of Seismic Design Forces of Indian Building Code" [1]: The recent fifth revision of Indian Seismic Code, IS: 1893 has been split into five separate parts for different types of structures. The new code IS: 1893 (Part-1)? 2002 contains provisions specific to buildings only, along with general provisions applicable to all structures. This paper deals with the comparison of seismic design forces for multi-storied buildings, obtained by using the new code, with those obtained by the previous 1984 version. From the results of seismic analysis of buildings it is concluded that the new code is more conservative for buildings resting on soft and medium soils.

S.K. Ahirwar, S.K. Jain and M. M. Pande (2008) "earthquake loads on multistorey buildings as per is: 1893-1984 and is: 1893-2002: a comparative study" [2]: As a result Indian seismic code IS: 1893 has also been revised in year 2002.This paper presents the seismic load estimation for multi-storey buildings as per IS: 1893-1984 and IS: 1893-2002 recommendations. Four multistorey RC framed buildings ranging from three storied to nine storied are considered and analyzed. The process gives a set of five individual analysis sequences for each building and the results are used to compare the seismic response viz. storey shear and base shear computed as per the two versions of seismic code. The seismic forces, computed by IS: 1893-2002 are found to be significantly higher, the difference varies with structure properties. It is concluded that such study needs to be carried out for individual structure to predict seismic vulnerability of RC framed buildings that were designed using earlier code and due to revisions in the codal provisions may have rendered unsafe.

Sudhir K Jain (2003) "Review of Indian seismic code, IS 1893 (Part 1) : 2002"[3] : The Indian seismic code IS 1893 has now been split into a number of parts and the first part containing general provisions and those pertaining to buildings has been released in 2002. There has been a gap of 18 years since the previous edition in 1984. Considering the advancements in understanding of earthquake-resistant design during these years, the new edition is a major upgradation of the previous version. This paper reviews the new code; it contains a discussion on Clauses that are

confusing or vague and need clarifications immediately. The typographical and editorial errors are pointed out. Suggestions are also included for next revision of the code.

C.V.S. Lavanya, Emily.P.Pailey, Md. Mansha Sabreen (2017) "Analysis and design of g+4 residential building using Etabs" [4]: ETABS stands for Extended Three Dimensional Analysis of Building Systems. The main purpose of this software is to design multi-storied building in a systematic process. The effective design and construction of earthquake resistant structures have great importance all over the world. This project presents multi-storied residential building analysed and designed with lateral loading effect of earthquake using ETABS. This project is designed as per INDIAN CODES- IS 1893-part2:2002, IS 456:2000 and analysis is carried out by considering severe seismic zones and behaviour is assessed by taking type-II Soil condition,

Mahesh Patil, Yogesh Sonawane (2015) "Seismic Analysis of Multistoried Building"[5] : The effective design and the construction of earthquake resistant structures have much greater importance in all over the world. In this paper, the earthquake response of symmetric multistoried building is studied by manual calculation and with the help of ETABS 9.7.1 software. The method includes seismic coefficient method as recommended by IS 1893:2002. The responses obtained by manual analysis as well as by soft computing are compared. This paper provides complete guide line for manual as well software analysis of seismic coefficient method.

Following methods are adopted for analysis of building for design earthquake loads.

1. Equivalent Static Method, and

2. Dynamic Analysis Method.

Dynamic analysis can be performed in three ways,

1. Response Spectrum Method,

2. Modal Time History Method, and

3. Time History Method.

For Tall Buildings, Response Spectrum Method and Time History Method are adopted

3. PROBLEM FORMULATION

Consider the residential multi-storey building having strength greater than 200 people. Building details are as follows.

Building Plan:

a) Colum Size: 400mm x 600mm up to 8 storeys.

400 mm x 400mm up to 15 storeys.

b) Beam size: 230mm x 450 mm

c) Storey Height: base height 0.45 m,3 m each floor

d) Live load: 2 KN/m2

e) Floor finish: 1KN/m2

f) Seismic: V

g) Colum Material Grade: M30

h) Beam and slab concrete Grade: M25

Load Combinations for code IS 1893-2002.

1.5(DL +IL)

1.2[DL + LL + (ELx+0.3Ely)]

1.2[DL + LL - (ELx+0.3Ely)]

1.2[DL + LL + (ELy+0.3Elx)]

1.2[DL + LL - (Ely+0.3Elx)]

1.5[DL+ (ELx+0.3Ely)]

1.5[DL- (ELx+0.3Ely)]

1.5[DL+ (ELy+0.3Elx)]

1.5[DL- (Ely+0.3Elx)]

0.9DL+1.5(ELx+0.3Ely)]

0.9DL-1.5(ELx+0.3Ely)]

0.9DL+1.5(ELy+0.3Elx)]

0.9DL-1.5(Ely+0.3Elx)]

Load Combinations for code IS 1893-2016.

1.2[DL+LL+ (ELx+0.3Ely+0.3ELz)]

1.2[DL+LL-(ELx+0.3Ely+0.3ELz)]

1.2[DL+LL+ (ELy+0.3Elx+0.3ELz)]

1.2[DL+LL-(Ely+0.3Elx+0.3ELz)]

1.5[DL+ (ELx+0.3Ely+0.3ELz)]

1.5[DL-(ELx+0.3Ely+0.3ELz)

1.5[DL+ (Ely+0.3ELx+0.3ELz)]

1.5[DL-(Ely+0.3ELx+0.3ELz)]

0.9DL+1.5(ELx+0.3ELy+0.3ELz)

0.9DL-1.5(ELx+0.3Ely+0.3ELz)

0.9DL+1.5(Ely+0.3ELx+0.3ELz)

0.9DL-1.5(Ely+0.3ELx+0.3ELz)

4. OBJECTIVES:

1. To study behaviour of multi-storied building as per IS1893-2002 and revision of IS 1893 Part1-2016.

2. To dynamic analyse G+ 14 residential multi-storey building having capacity greater than 200 people.

3. To study parameters such as lateral displacement,Base shear, storey drifts multi-storied building.

4. To compare analysis results obtained for new and old codes.

5. MODELING AND ANALYSIS

Consider G+14 residential multi-storey building having strength greater than 200 people. Building details are as follows.



Fig -1: Building typical floor plan.

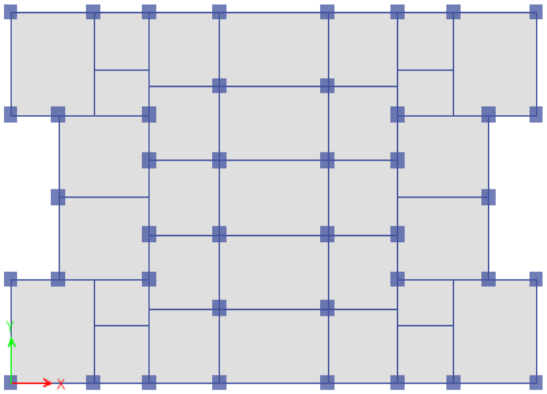


Fig -2: structural plan of G+14 residential building

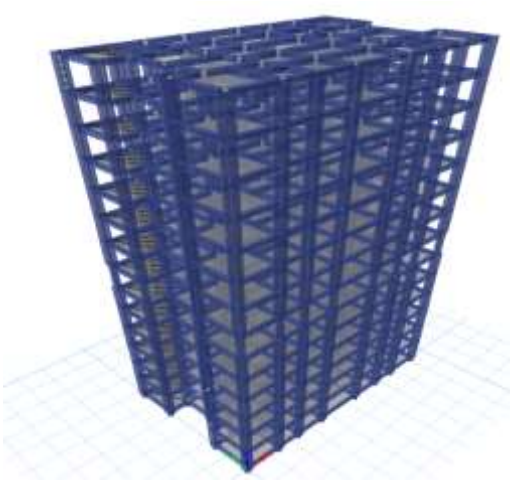


Fig -3: 3D view G+14 residential building

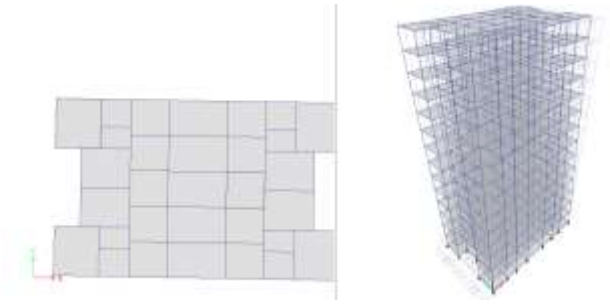


Fig -4: Displacement along X direction.

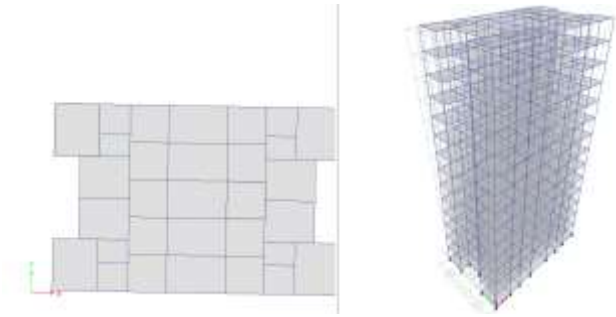


Fig -5: Displacement along Y direction.

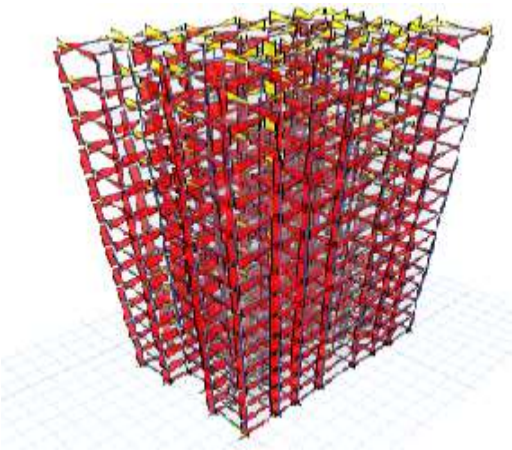


Fig -5: Shear force of G+14 residential building

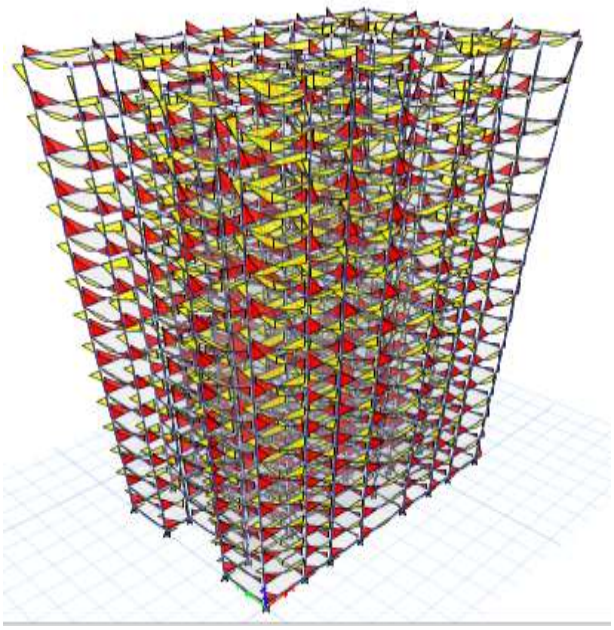


Fig -6: Bending moment of G+14 residential building

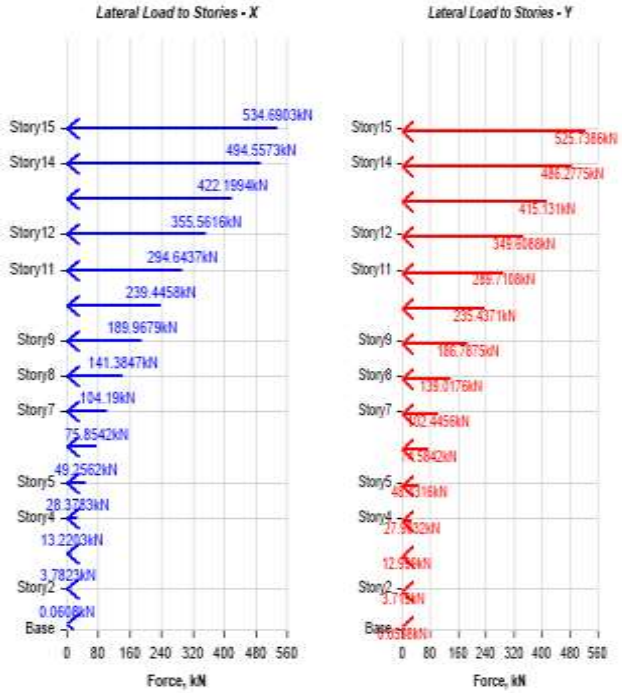


Fig-7: Seismic load for different stories as per IS 1893-2002.

6. RESULTS

Consider results for Equivalent static method

Table: seismic load in X- direction and Y Direction

Story	Elevation m	X KN	Y KN
Story15	42.45	534.6903	525.7386
Story14	39.45	494.5573	486.2775
Story13	36.45	422.1994	415.131
Story12	33.45	355.5616	349.6088
Story11	30.45	294.6437	289.7108
Story10	27.45	239.4458	235.4371
Story9	24.45	189.9679	186.7875
Story8	21.45	141.3847	139.0176
Story7	18.45	104.19	102.4456
Story6	15.45	75.8542	74.5842
Story5	12.45	49.2562	48.4316
Story4	9.45	28.3783	27.9032
Story3	6.45	13.2203	12.999
Story2	3.45	3.7823	3.719
Story1	0.45	0.0608	0.0598
Base	0	0	0

Table: seismic load in X- direction and Y Direction

Story	Elevation m	X KN	Y KN
Story15	42.45	642.215	631.4712
Story14	39.45	593.9298	583.9938
Story13	36.45	507.033	498.5506
Story12	33.45	427.0054	419.8619
Story11	30.45	353.8472	347.9275
Story10	27.45	287.5582	282.7476
Story9	24.45	228.1386	224.322
Story8	21.45	169.7834	166.9431
Story7	18.45	125.1344	123.0409
Story6	15.45	91.0957	89.5718
Story5	12.45	59.1534	58.1638
Story4	9.45	34.0804	33.5103
Story3	6.45	15.8767	15.6111
Story2	3.45	4.5423	4.4663
Story1	0.45	0.0729	0.0717
Base	0	0	0

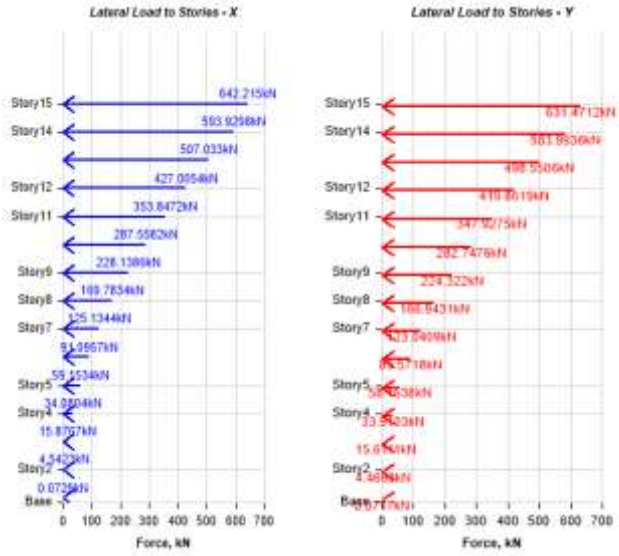


Fig-8: seismic load for different stories as per IS 1893-2016.

Base shear

Table: Base shear in X- direction and Y Direction

Sr. No	IS Codes	Direction X	Direction Y
1	IS 1893-2002	2575.46	2404.52
2	IS 1893-2016	3092.92	2887.73
3	% INCREASE	20.09	20.09

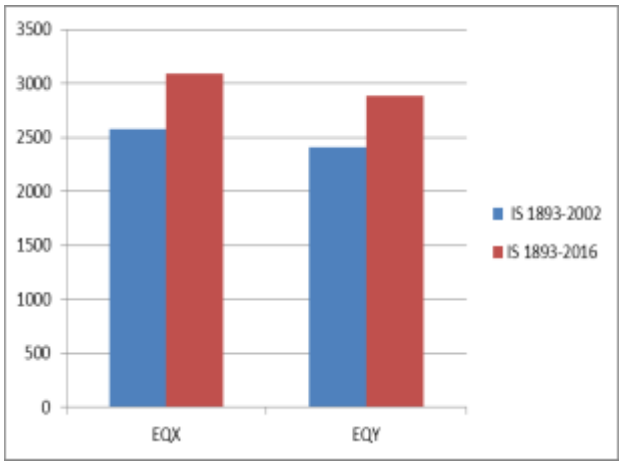


Fig-9: Graph for Base shear for Dynamic analysis as per is 1893-2002 and IS 1893-2016



Chart 1: Maximum displacement along EQx as per IS 1893-2002



Chart 2: Maximum displacement along EQy as per IS 1893-2002



Chart 3: Maximum displacement along EQx as per IS 1893-2016



Chart 4: Maximum displacement along EQy as per IS 1893-2016

Maximum Lateral displacement

Table: maximum lateral displacement along EQx and EQy

Storey	IS Codes	EQX(mm)	EQY(mm)
15	IS1893-2002	88.09	94
15	IS1893-2016	106.9	112.8
	% INCREASE	20.25	20.00

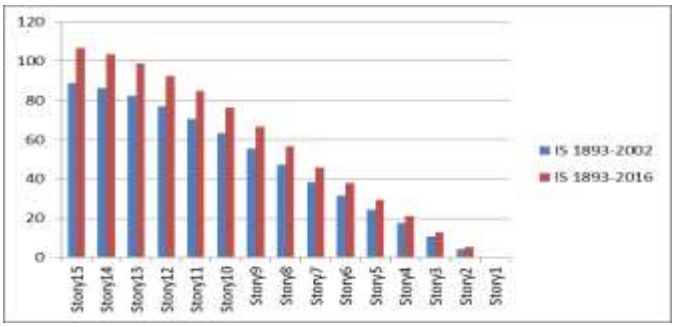


Fig-10: Graph for maximum lateral displacement along X-direction as per is 1893-2002 and IS 1893-2016.

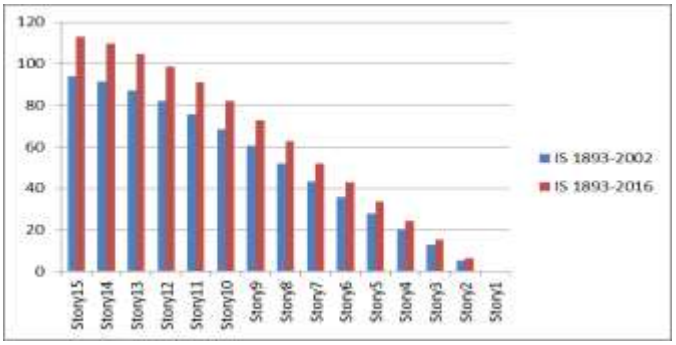


Fig-11: Graph for maximum lateral displacement along Y-direction per is 1893-2002 and IS 1893-2016.

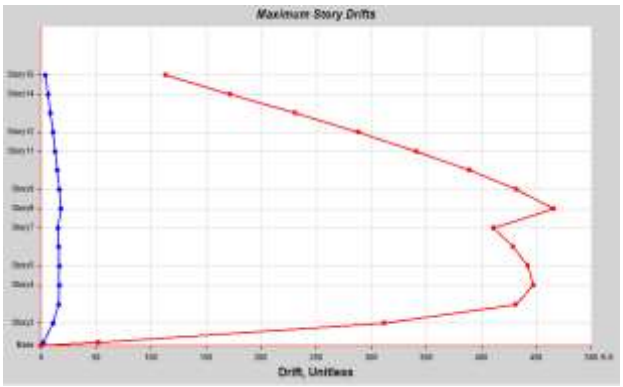


Chart 5: storey drift as per IS 1893- 2002

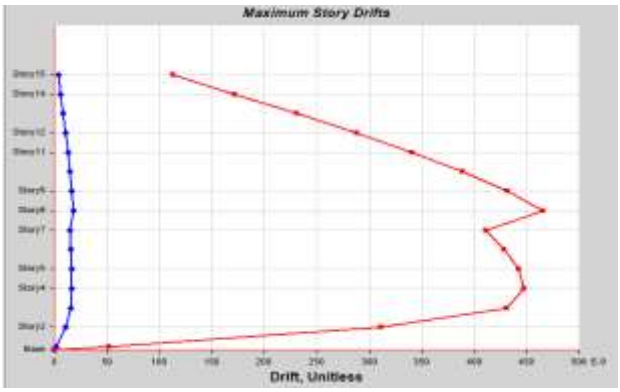


Chart 6: Storey drift as per IS 1893- 2016.

Storey Drift

Table: Storey Drift in X- direction and Y Direction

Storey	IS Codes	X (mm)	Y (mm)
15	IS1893-2002	0.001287	0.001358
8	IS1893-2016	0.001889	0.002002
	% INCREASE	46.78	47.42

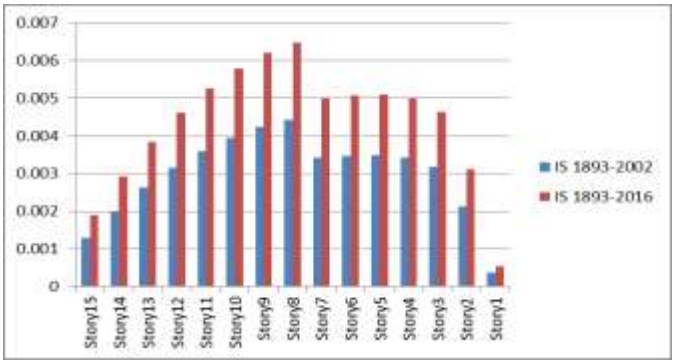


Fig-12: Graph for storey drift along X-direction as per is 1893-2002 and IS 1893-2016.

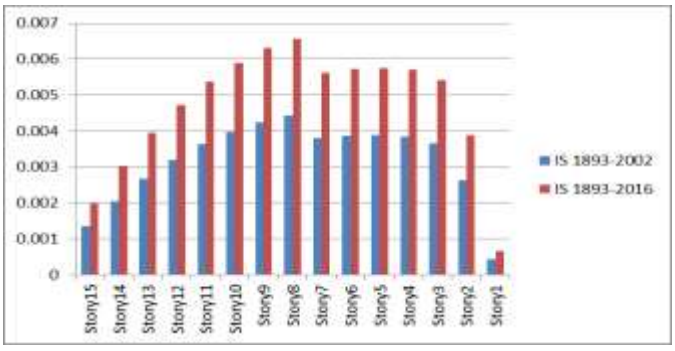


Fig-10: Graph for storey drift along Y-direction as per is 1893-2002 and IS 1893-2016.

Design reaction at base

Table: Design Forces along X and Y direction

IS 1893-2002			
Joint label	Load combination	Fx(max) KN	Fy(max) KN
14	1.5[DL- (ELx+0.3Ely)]	258.6289	
20	1.5[DL- (Ely+0.3Elx)]	-	310.05
IS 1893-2016			
Joint label	Load combination	Fx(max) KN	Fy(max) KN
14	1.5[DL-(ELx+0.3Ely+0.3ELz)	314.2302	
12	1.5[DL-(Ely+0.3ELx+0.3ELz)]		379.0894

Design moment

Table: Design moment along X and Y direction.

IS 1893-2002			
Joint label	Load combination	Mx(max) KN-m	My(max) KN-m
39	1.5[DL+ (ELy+0.3Elx)]	262.301	
27	1.5[DL- (ELx+0.3Ely)]	-	229.4918
IS 1893-2016			
Joint label	Load combination	Mx(max) KN-m	My(max) KN-m
15	1.5[DL+(Ely+0.3ELx+0.3ELz)]	385.7304	
12	1.5[DL-(ELx+0.3Ely+0.3ELz)		326.3409

7. CONCLUSIONS

1. Maximum lateral displacement, lateral load to stories increases when storey height increases. In case of storey drift displacement value is high at top storey as compare to bottom storey.

2. Maximum displacement found along EQx and EQy.As per IS1893-2002 is 88.90 mm and 94 mm and as per IS 1893-2016 is 106.90 mm and 112.80 mm.

3. Storey drift found along x and y direction. As per IS1893-2002 is 0.001273 mm and 0.001358 mm and as per IS 1893-2016 is 0.001889 mm and 0.002002mm.

4. Design forces obtained at base along x and y direction. As per IS1893- 2002 is 258.63 KN and 310.05 KN whereas for new code IS1893-2016 is obtained is 314.23 KN and 379.08 KN along x and Y direction

5. Design moment obtained at base along x and y direction as per IS1893- 2002 is 262.30 KN-m and 229.49 KN-m whereas for new code IS1893-2016 it is 385.73 KN-m and 326.34 KN-m along x and Y direction

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A REVIEW ON EXPERIMENTAL ANALYSIS OF FLEXURAL BEHAVIOUR OF RC BEAMS BY USING HIGH STRENGTH STEEL

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Abstract – *This review paper is related to the study of RCC beam by using high strength steel TMT bars. Reinforced cement concrete is a general material which is widely used for various types of constructions and structural elements. The quality of steel has an important role in deciding the quality of concrete and also high grade steel in building construction, would help in decreasing the quantity of steel. In this paper objective of work and their methodology is suggested. The outcomes may lead to change a practice of material as reinforcement other than steel in RCC beam.*

***Key Words*: TMT bars, High Strength Steel, Fe 600, Earthquake Resistance, and Mix Design.**

1. INTRODUCTION

Concrete is very strong in compression but comparatively weak in tension. Steel is very strong in tension and provides tensile strength to concrete. The properties of thermal expansion for both steel and concrete are approximately the same; this along with excellent flexural property makes steel the best material for reinforcement in concrete structure. Another reason steel works effectively as reinforcement is that it bonds well with concrete. For decades, methods of design and analysis for concrete members reinforced with normal strength steel have been developed. Recently, reinforcing steel with strength higher than conventional steel has become commercially available. The introduction of high strength reinforcing steel can be useful to reduce the quantity of reinforcement required, thereby lessening reinforcement congestion and improving constructability. Steel is the time proven match for reinforced concrete structures. Reinforced concrete structure is designed on the principle that steel and concrete act together to withstand induced forces. Concrete is established to be a universal building material because of its high compressive strength and it's adoptability to take any form and shape. The low tensile strength of concrete is offset by the use of steel reinforcement the resulting combination of the two being known as reinforced concrete, although the steel reinforcement provides the cracked concrete beam with flexural strength. It does not prevent cracking and loss of stiffness due to cracking, since in order to satisfy serviceability requirements, the increased strain capacity offered by high strength steel. .

Reinforce cement concrete is a general material which is widely used for various types of constructions and structural elements. For the efficient use of RCC it is necessary to know the properties and the behavior of RCC elements under various constrains. To estimate and analyse the basic properties and behavior of RCC an experimental study is needed. In the present study an experiment in which flexural behavior of RCC under various constrains was the major criteria. For the experimental analysis simply supported beams of under reinforced sections are considered. When the beam is simply supported and is subjected to some external loading the corresponding deflections are examined such that the flexural behavior of the RCC beams of under reinforces sections analyses. When in an RCC beam, if the steel tends to fail before the stress in concrete reaches the maximum permissible stress such beams are known as under reinforced sections. In order to study the flexural behavior of any material one had need some basic constant conditions as their limitations. In the present study stress-strain behavior of Concrete and steel are taken as a base and the flexural behavior of the material in various fibers. Many methods were adopted to increase the strength and flexural behavior of the structure. Flexural strength provides two useful parameters, namely: "the first crack strength, which is primarily controlled by the matrix", and "the ultimate flexural strength or modulus of rupture, which is determined by the maximum load that can be attained." Flexural properties of structural materials are generally important to design engineers to guide appropriate selection of materials. This work gives the review of work done by various researchers who investigated the flexural capacity of steel and concrete beams. The review revealed the advantages of construction & the most effective utilization of steel and concrete. They also have improved fire and corrosion resistance.

Thermo mechanically treated (TMT) bars were introduced in India during 1980- 1985. Thermo mechanical treatment is an advanced heat treatment process in which hot bars coming out of last rolling mill stand are rapidly quenched through a series of water jets. Rapid quenching provides intensive cooling of surface resulting in the bars having hardened surface with hot core. The bars are then allowed to cool in ambient conditions. During the course of such slow cooling, the heat released from core tempers the hardened surface while core is turned in to ferrite-pearlite aggregate composition. TMT process thus changes the structure of material to a composite structure of ductile ferrite pearlite composition with tough surface rim of

tempered marten site providing an optimum combination of high strength, ductility, flexural and other desirable properties. TMT bars of grade Fe415, Fe500 and Fe550 are now available in India. Fe600 can be used in building bridges, marine facilities and many others to create leaner structures with lesser steel congestion improving construction quality and saving cost.

2. RELEVANCE

The rapid development of economic construction, people are increasingly looking for more and more new materials for building construction. This is an essential part of human life. Reinforced concrete is widely used in modern engineering structures as a kind of excellent traditional building material. This is because first of all, the steel bar is protected by concrete and has the characteristics of durability and fire resistance. Secondly, its integrity is better. Fe 550 and Fe 600 are not introduced in design engineering codes till now, coupled with the above mentioned factors, very less private client/contractor projects and none of public government projects are able to propose for using these higher grades of reinforcement in their technical specification. It is likely that in near future Fe550 or Fe600 or even higher grades might come up and find place in construction industry, with the huge infrastructure development/construction happening in India. It is very useful to reduction of steel consumption. TMT steel means Thermo Mechanically Treated steel. TMT reinforcement steel is used in reinforced concrete construction to provide better strength in tension, bending and shear as well as in compression. TMT manufacturing process is expected to improve properties such as yield strength, ductility and toughness of TMT bars. With above properties, TMT steel is highly economical and safe for use. TMT steel bars are more corrosion resistant than Tor steel. TMT bars are earthquake resistant.

3. LITERATURE REVIEW

Prabir C. Basu, Shylamoni P, Roshan A.D (2004): Steel is the time proven match for reinforcing concrete structures. Reinforced concrete structure is designed on the principle that steel and concrete act together to withstand induced forces. The properties of thermal expansion for both steel and concrete are approximately the same; this along with excellent flexural property makes steel the best material as reinforcement in concrete structures. Another reason steel works effectively as reinforcement is that it bonds well with concrete. When passive reinforcement (steel bars) is employed, the structure is known as reinforced concrete (RC) structure. Passive steel reinforcing bars, also known as rebars, should necessarily be strong in tension and, at the same time, be ductile enough to be shaped or bent. Now-a-days, alloy steels are also being introduced as reinforcing steel. Three grades of rebar are presently available in India for structural use. The rebars are graded according to their specified yield strength. These are Fe415, Fe500 and Fe550. CTD rebars of grade more than Fe415 are scarcely available in market. However, TMT rebars of Fe500 grade are easily available in the market.

Robert F. Mast, Mina Dawood, Sami H. Rizkalla, Paul Zia (2008): this paper present a methodology for the flexural strength design of concrete beams reinforced with high-strength reinforcing steel that conforms to the requirements of ASTM A1035-07. The design method is based on simple analysis techniques that satisfy fundamental principles of equilibrium and compatibility. Strain limits for tension-controlled sections and compression-controlled sections are proposed that are consistent with the approach of the current and past ACI 318 Codes. The proposed method is compared with experimental results previously reported by others. The stress-strain characteristics of the reinforcement are quite different from conventional Grade 60 (400 MPa) steel reinforcement. The new steel is considerably stronger than conventional reinforcing steel and lacks a well-defined yield point. There are several practical advantages to using this new high strength material, including reduction of congestion in heavily reinforced members, improved concrete placement, savings in the cost of labor, reduction of construction time and, in some cases, enhanced resistance to corrosion. The flexural behavior of concrete beams reinforced with high-strength reinforcing bars has been investigated experimentally by a number of researchers. The available research indicates that, when properly designed, beams reinforced with high-strength reinforcing bars will achieve similar strength characteristics to beams reinforced with conventional steel reinforcements.

Saifullah, M. Nasir-uz-zaman, S.M.K. Uddin, M.A. Hossain, M.H. Rashid (2011): Experimental based analysis has been widely used as a means to find out the response of individual elements of structure. To study these components finite element analyses are now widely used & become the choice of modern engineering tools for the researcher. In the present study, destructive test on simply supported beam was performed in the laboratory & load-deflection data of that under-reinforced concrete beams was recorded.. Finally results from both the computer modeling and experimental data were compared. From this comparison it was found that computer based modeling is can be an excellent alternative of destructive laboratory test with an acceptable variation of results. In addition, an analytical investigation was carried out for a beam with ANSYS, SAS 2005 with different reinforcement ratio (under, balanced, over). The observation was mainly focused on reinforced concrete beam behavior at different points of interest which were then tabulated and compared. From these observation it shows that 1st cracking location is 0.43L ~ 0.45L from the support. Maximum load carrying capacity at 1st cracking was observed for over reinforced beam but on the other it was the balanced condition beam at ultimate load. Maximum deflection at failure was also observed for the beam that balanced reinforced.

D.N. Shinde, Pudale Yojana M, Nair Veena V (2014): Existing concrete structures may, for a variety of reasons, be found to perform unsatisfactorily. This could manifest itself by poor performance under service loading, in the form of excessive deflections and cracking, or there could be inadequate ultimate strength. Additionally, revisions in structural design and loading codes may render many structures previously thought to be satisfactory, noncompliant with current provisions. In the present economic climate, rehabilitation of damaged concrete structures to meet the more stringent limits on serviceability and ultimate strength of the current codes, and strengthening of existing concrete structures to carry higher permissible loads, seem to be a more attractive alternative to demolishing and rebuilding. This paper investigates the Flexural behavior of R.C.C. beam wrapped with GFRP (Glass Fiber Reinforced Polymer) sheet. Beams, with (150×150) mm rectangular cross section and of span 700 mm were casted and tested. Three main variables namely, strength, ductility and damage level of R.C.C. under reinforced beam and R.C.C. beam weak in flexure were investigated. In first set of four R.C.C. under reinforced beams to were strengthened with GFRP sheet in single layer from tension face which is parallel to beam axis subjected to static loading tested until failure; the remaining two beams were used as a control specimen. In second set of four beams weak in flexure two were strengthened with GFRP sheet tested until failure; the remaining two were used as a control specimen. Flexural retrofitting also increases the shear strength of concrete. The beam failure mode was as expected that is beam weak in flexure produced flexural mode of failure and R.C.C. balanced section also exhibited flexural cracks.

S Tejaswi, J Eeshwar Ram (2015): Concrete is the material which is rapidly used in various conditions to sustain the compression loads and the corresponding bending and shear stress due to the applied compressive loads. The major drawback in concrete is that it is poor in tension though it is very efficient in compression. Hence to overcome this major drawback the concrete must be reinforced such that to make a homogeneous substance which can sustain both tension and compression. Steel is the material use as reinforcement for concrete. The stress strain behavior for both concrete and steel are mostly similar. Hence in the combination of both that is in reinforced cement concrete the maximum stress point within the elastic will reach simultaneously. Reinforce cement concrete is a general material which is widely used for various types of constructions and structural elements. For the efficient use of RCC it is necessary to know the properties and the behavior of RCC elements under various constrains. To estimate and analyse the basic properties and behavior of RCC an experimental study is needed. In the present study an experiment in which flexural behavior of RCC under various constrains was the major criteria. For the experimental analysis simply supported beams of under reinforced, balanced and over reinforced sections are considered. When the beam is simply supported and is subjected to some external loading the corresponding deflections are examined such that the flexural behavior of the RCC beams of under reinforce, balanced and over reinforced sections analysed. In order to study the flexural behavior of any material one had need some basic constant conditions as their limitations. In the present study stress-strain behavior of Concrete and steel are taken as a base and the flexural behavior of the material in various fibers.

Sharandeep Singh, Dr.Hemant Sood (2015), This paper presents a comparison of DOE, ACI, BIS and USBR methods of concrete mix design, combining the test results of these methods. The M35 and M40 grades of concrete have been designed for comparison using crushed aggregates. Designing same standard mixes by all these methods resulted in complete comparison in terms of proportioning parameters of different mix design methods, thus defining the effect of variation in proportion on the properties of concrete. In this experimental study the strength, durability and other mechanical properties of concrete, designed as per different mix design methods are compared. The study indicates that the outcomes of concrete designed as per USBR method are relatively a lot more eminent than that of the rest of the methods used for comparison. Whereas, the ACI method was failed to achieve the target mean strength in case of M40 and it was redesigned with an increased quantity of cement. However, the results of DOE method cannot be overlooked. M35 and M40 grades of concrete were used to carry out the comparison based on the mechanical properties of concrete. It was observed that all the methods achieved the target mean strength either, in case of M40 or M35 except the ACI method in case of M40 for which the cement content has to be raised to fulfill the minimum requirements of strength. The overall comparison shows that the USBR method comes out with the best results among the four mix design methods compared in terms of strength, toughness and durability, but the method is little more expensive than DOE method. The DOE method has been recognized for delivering optimum performance in a relative economic budget except when toughness of concrete is not a mandatory concern. So in daily concrete practice where only strength and durability is required in a comparatively low budget, DOE method of concrete design should be practiced with the stipulation that the toughness of concrete is not a prime requirement, and where site conditions require strength, toughness and durability side by side irrespective of the budget, the USBR method can be practiced for optimum results.

Er. N. K. Roy, Er. R. R. Sandhwar (2015): Thermo mechanically treated (TMT) bars were introduced in India during 1980-1985. Thermo mechanical treatment is an advance heat treatment process in which red hot bars coming out of last rolling mill stand are rapidly quenched through a series of water jets. Rapid quenching provides intensive cooling of surface resulting in the bars having hardened surface at top, while core remained red hot. The rebars are then allowed to cool in ambient conditions. During the course of such slow cooling, the heat released from core tempers the hardened surface while core is turned into ferrite-pearlite aggregate composition. TMT process

thus changes the structure material to a composite structure of ductile ferrite-pearlite composition with tough surface rim of tempered marten site providing an optimum combination of high strength, ductility, bendability and other desirable properties. Ductility of TMT bars are same as that of mild steel Hence it is very suitable for making hooks, vibrating structures subjected to reversible stresses as in case of machine foundation and for high rise structures subjected to strong earthquake and wind forces. TMT bars of grade Fe 415, Fe500 and Fe550 are now available in India. Most of steel companies in India like SAIL, TATA TISCO and RINL are now a day's producing Fe500 or Fe 550 grade of TMT bars and not Fe-415 grade of steel bars. Design Engineers should accordingly make calculations and drawings taking actual strength of steel into account.

Keertika Sharma, S. S. Kushwah, Aruna Rawat (2016): the present paper explores the flexural performance of fiber reinforced polymer (FRP) fortified in reinforced concrete (RC) beams. The RC beams are designed and analyzed for an effective span of 3 m. The beam is subjected to linear action of three different live loads acting as two point loads on RC beam. In all nine beams, three each are strengthened with carbon FRP, glass FRP and aramid FRP bars, respectively. The three different percentage of reinforcement ratios are taken for steel bars and FRP bars. More three beams are used as control specimens are strengthened with steel reinforcement bars designed as under-reinforced RC beam. Static responses of all the beams are evaluated in terms of strength, deflection and compositeness between FRP bars and concrete. The linear and non-linear FE analysis of steel reinforcement and FRP bars beams are carried out in finite element method ANSYS software. The finite element (FE) results are verified using linear analysis method using IS 456-2000 code for steel reinforcement bars and ACI 440-2006 for FRPs bars. The results show that the FRP strengthened beams exhibit increased flexural strength. The non-linear analysis of the beams shows more deflection at centre and load point as compared to linear FEM of the RC beams strengthened with FRPs and steel bars.

Peddi Hema Arpitha Chowdary, Sreenu Bhuvanagiri (2016): In the present study, destructive test on simply supported beam was performed in the laboratory & load-deflection data of that under-reinforced concrete beams was recorded. After that finite element analysis was carried out by ABAQUS ACE 6.10 by using the same material properties. Finally results from both the computer modeling and experimental data were compared. From this comparison it was found that computer based modeling is can be an excellent alternative of destructive laboratory test with an acceptable variation of results. In addition, an analytical investigation was carried out for a beam with ABAQUS ACE 6.10 with different reinforcement ratio (plain, under, balanced, over). The observation was mainly focused on reinforced concrete beam behavior at different points of interest which were then tabulated and compared. Maximum load carrying capacity was observed for over reinforced beam but on the other it was the balanced condition beam at ultimate load.

3. OBJECTIVE

The main objectives of this work is summarised as below,

1. The main aim of this investigation is to examine the possibility and feasibility of high grade steel as reinforcement for beam.
2. The objective of this work is to carry out the investigation of RC beams using high strength steel.
3. To study the flexural behavior of reinforced concrete beams.
4. To evaluate the ultimate load carrying capacity of beams reinforced with high strength steel as reinforcement.
5. To compare the experimental results of high strength steel i.e. Fe 500 and Fe 600.

4. METHODOLOGY

For carrying out proposed work following methodology was adopted:

1. Collection of required data to carry out the analysis from journals, technical magazines, reference books and web source.
2. Mix design was prepared for M40 and m50 grade concrete according to IS 10262-1982.
3. Casting cube by using M40 and M50 grade concrete.
4. Casting of RC beam by using M40 and M50 grade concrete with high grade steel Fe500 for analysis of parameters.
5. Casting of RC beam by using M40 and M50 grade concrete with high grade steel Fe600 for analysis of parameters.
6. Preparation of RC beams with three number of specimen for each material.
7. Various test like Compressive Strength, Flexural Strength on casted specimens were performed.
8. Comparison to be made between these analysis to know possibility and feasibility.
9. Drawing final conclusion from the analysis of result.

5. CONCLUSIONS

It is expected that study gives such an analytical data which helps for determination of Possibility and feasibility of high strength.

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BIOGRAPHIES



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Comparative Study of Dynamic Analysis of Transmission Towers

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Abstract – *This paper describes the estimation of feasible solution to optimize transmission line tower for weight parameter. The cost of transmission line towers is about 35% to 40% of the total cost of the transmission tower. But lesser study is carried out in the field of minimizing weight of transmission line tower, also less literature is available on transmission line tower with cold form sections. Analysis of transmission line tower carried out as per standard codes, also comparative study is carried on the basis of different types of bracing systems (warren, horizontal, diagonal and diamond) and materials such as hot rolled and cold form sections. By designing transmission line tower with hot rolled sections using STAAD pro, hot rolled sections gives light weight design.*

Key Words: **Optimization of tower, Hot rolled steel section, STAAD Pro.**

1. INTRODUCTION

Now a day's electricity is on high demand in the field of industries, commercial and residential use. The need of electricity increases due to rapid progress in industrial area and infrastructure. Requirement of electricity varying across the country and for far away locations of power plants, a network of electric transmission lines is required. The shape and size of the transmission line tower have received extensive attention. The tower is defined as tall structures with relatively small cross section and with a large ratio between the height and the maximum width. Tower structure acts as a single cantilever beam which is freely standing self-supporting and fixed at base. Guy tower is the structure which is pin- connected to its foundation and supported with guys or another element. Water towers, radio and television towers and the towers of power transmission lines are the examples of structures which belonging to the tower family. The transmission line tower is used to support conductors carrying electrical power and one or two ground wires at suitable distances above the GL and from each other the cost of transmission line towers is about 35% to 40% of the total cost of the transmission tower. The aim of every designer is to design the best (optimum) system, so that towers are constructed economical by developing different light weight configuration of transmission line tower. Following points are to be considered while designing the transmission line tower:

a) Selection of clearance

b) Tower configuration analysis

c) Tower weight estimation

d) Line cost analysis and span optimization

e) Economic evaluation of line

1.2 Types of tower

Tower structure is act as a single cantilever beam which is freely standing self-supporting and fixed at base. The structure which is pin- connected to its foundation and supported with guys or another element. Depending upon the size and type of loading, towers are grouped into two heads. a) Towers with large vertical loads (b) Towers with mainly horizontal wind loads. Towers with large vertical loads (such as those of overhead water tanks, oil tanks, meteorological instrumentation towers etc.) have their sides made up of vertical or inclined trusses. The towers, falling under the second category and subjected predominantly to wind loads, may be of two types:

i. Self-supporting tower

ii. Guyed Tower

I. Self-supporting tower

Free standing towers, known as lattice towers, are generally square in plan and are supported by four legs, fixed to the base. These towers act as vertical cantilever trusses, subjected to wind or seismic loads.

II. Guyed tower

In contrast to this, guyed towers are hinged to the base, and are supported by guy wires attached to it at various levels, to transmit the wind forces to the ground.

1.2.1 Tower configurations and bracings

The self-supporting towers, subjected predominantly to wind loads, are called lattice towers. Such towers are square or rectangular in plan. Following are the different types of bracings:-

a) Single web horizontal bracings: This is the simplest form of bracing. The wind shear at any level is shared by the single diagonal of the panel. Such bracings are used for towers up to 30 m height.

b) Warren type bracings: This is a double diagonal system without horizontal bracings and used for towers up to 50 m height.

c) Single web diagonal bracings: Struts are designed in compression and diagonals in tension.

d) Diamond type bracings: Similar to warren system. Horizontal member carries no primary loads designed as redundant supports.

1.3 METHODOLOGY

The four transmission line tower models using Hot Rolled section were developed. The analysis of transmission line towers was carried as per IS standards. The wind force was applied on the tower as per IS 875:2016. The total forces which will act on tower was calculated manually after that design of transmission line tower using STAAD Pro. Based on weight parameter the most economical and sustainable bracing system for tower was found out. Detailed analysis and design of tower using hot rolled sections was carried out.

1.4 ANALYSIS OF TOWER

In tower design is based primarily on dead load, wind load, sag tension, broken wire condition, temperature effects, safety criteria, load acting on conductor, insulator, ground wire and in addition wind load acting on tower as per IS 875-2016.

A. Problem for Research:-

The following parameters for transmission line and its components are assumed from I.S. 802: Part 1: Sec: 1:1995, I.S. 5613: Part 2: Sec: 1:1989.

- •Transmission Line Voltage : 220 kV (A/C)
- •No. of Circuits : Double Circuit
- • Right of Way (recommended): 35, 000 mm
- • Tower Configuration : Vertical Conductor
- • Angle of Line Deviation : 0 to 2 degrees
- • Bracing Pattern : Four types
- •Terrain Type : Plain
- • Cross Arm : Pointed

B. Geometry of Tower

i. Height of Tower Structure

$H = h_1 + h_2 + h_3 + h_4$

$= 31.61$ m

ii. Base width of tower:

As per IS 802 (part 1 / section 1) 1995, base width of tower is to be taken as 1/5 th to 1/10th of total height.

Base width of tower = 1/6 X Total height of tower

= 5.3 m

C. Loads on Tower

a. Dead Load on Tower

1. Self-weight of tower taken by STAAD PRO itself.
2. Dead load on conductor = 8.579 kN
3. Dead load on ground wire =3.47 kN

b. Wind Load on Tower

Wind load is major load acting on tower. Wind loads on tower is calculated separately by following Indian Standards. For finding the drag coefficients for members of tower, the solidity ratio is taken from Table 30 in IS 875 (part 3) -2016 in the similar way prescribed in IS 826 (part 1/section 1).

$$\mathbf{F_{wc} = P_d \times C_{dc} \times L \times D \times G_C}$$

Where, F_{wc} = wind load on conductor

P_d = design wind pressure

C_{dc} = drag coefficient for ground wire

L = wind span

d = diameter of conductor/ground wire

G_c = gust response.

Following data is to be taken from IS: 802 (Part 1/section 1):1995

Wind zone	= 3
Basic wind speed(V_B)	=44 (m/s)
Design period	=150 years
Reliability level	= 2

Risk coefficient (k_1) =1.11

Terrain category = 2

Terrain coefficient = 1.00

Reference wind speed = $V_R = V_b/k_0$

= 32 m/s

Design wind speed (V_d) = V_R x k_1 x k_2

= 35.52 m/s

Design wind pressure (P_d) = 0.6 V_d^2

= 757 N/m^2

1. Wind load on conductor: -

$$F_{wc} = P_d \times C_{dc} \times L \times D \times G_C$$

= 9.3 kN

Where, F_{wc} = wind load on conductor

P_d = design wind pressure

C_{dc} = drag coefficient for ground wire=1.2

Drag coefficient for conductor = 1.0

L = wind span = 175 m

d = diameter of conductor/ground wire = 28.62mm

G_c = gust response. = 2.34

2. Wind load on ground wire:

$$F_{wg} = P_d \times C_{dc} \times L \times D \times G_C$$

= 3.52 kN

Where, F_{wg} = wind load on ground wire
P_d = design wind pressure
C_{dc} = drag coefficient for ground wire=1.2
Drag coefficient for conductor = 1.2
L = wind span = 175 m
d = diameter of ground wire = 9.45x10 $^{-3}$ m
G_c = gust response = 2.3

3. Wind load on insulator string:

$$F_{wi} = P_d \times C_{di} \times A_i \times G_i -$$

= 0.04 kN

Where, F_{wi} = wind load on insulator string

P_d = design wind pressure

C_{di} = drag coefficient for insulator string =1.2
A_i = 50 % of the area of insulator string projected on a plane which is parallel to longitudinal axis of the string.
Gi = gust response = 2.4

c. Calculation of Sag Tension

Indian standard codes of practice for use of structural steel in over-head transmission line towers have prescribed following conditions for the sag tension calculations for the conductor and the ground wire:

1. Maximum temperature (75°C for ASCR and 53°C for ground wire) with design wind pressure (0% and 36%).

2. Every day temperature (32°C) and design wind pressure (100%, 75% and 0%).

3. Minimum temperature (0°C) with design wind pressure (0% and 36%).

In this paper, the consideration of the sag of ground wire as 90% the sag of the conductor at 0°C and 100% wind condition.

Sagging = $wl^2/8T_2$ = 0.973 x 320 x320/8 x 2282.5

= 5.46 m

By increasing 4% of calculated sag we get

= 5.46 × 4%

= 5.70 m.

As per IS 5613 (part 2), section 1:1989

For both conductor and ground wire, all tension values are given FOS < 4 .So consider the minimum tension (tension for FOS = 4).To finding maximum sagging in all condition, parabolic equation used.

d. Broken Wire Condition

As per IS 802 (part 2/section 1) 1995 clause 12.3.3, for self-supporting transmission line tower, longitudinal load per sub conductor and ground wire shall be considered as 10 kN and 5 kN respectively.

e. emperature Effects

As per IS 802 (Part 1/section 1) 1995 clause 10.24, the tower may be designed to suit the conductor temperature of 750 C (max) for ACSR conductor.

f. Safety Criteria

As per CBIP manual for transmission line tower, safety criteria are to be considered for the calculation of safety criteria separate excel sheet is prepared to avoid repetitive calculations.

D. Finite Element Analysis of Tower:

Following models were analysed and designed using hot rolled and cold form sections

a. Diamond Shaped Bracing System

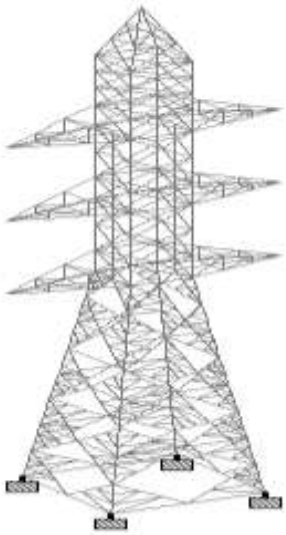


Fig 1 Diamond shaped bracing tower

b. Warren Type Bracing System

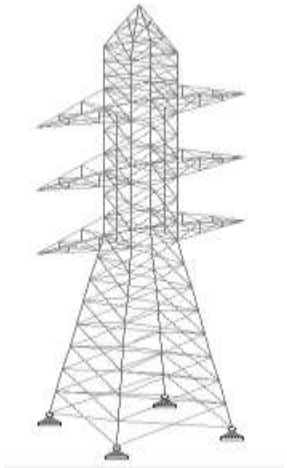


Fig 2 Warren type bracing tower

c. Single Web Horizontal System

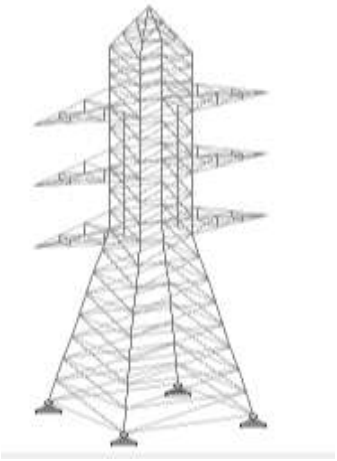


Fig 3 Single web horizontal tower

d. Single Web Diagonal System

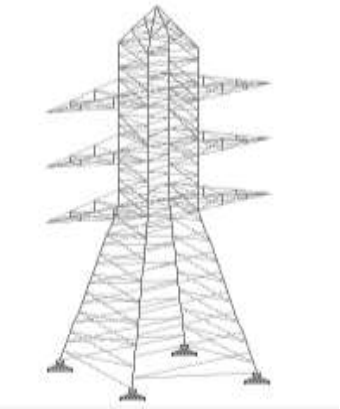


Fig 4 Single Web Diagonal Tower

2. DESIGN OF TOWER

Design of tower is carried out in STAAD Pro.V8i software. Loads on tower is calculated manually as per IS 802:1995 & CBIP manual.

3. MODELLING APPROACH

Transmission tower is modelled using STAAD Pro.V8i. Tower with different type of bracing system are modelled. Tower configuration for each viz. base width, height length etc. is same.

4. RESULTS AND DISCUSSION

The loading on transmission line tower was calculated manually, then that values of loading are applied on FE model and analyze that model. But for achieving perfect result hot rolled sections are analyzed in STAAD Pro.V8i software.

A. Weight of Hot Rolled Section Tower for Four Types of Bracing System:-

Following results are given idea about the weight of transmission line tower for different bracing system which is made with hot rolled sections.

Table 1:- Weight of tower with hot rolled sections

Sr. No.	Types of tower bracing system	Weight of tower
1	Diamond shaped bracing system	311.215 kN
2	Warren type bracing system	626.123 kN
3	Single web horizontal bracing system	375.829 kN
4	Single web diagonal bracing system	454.818 kN

Discussion:

As per above results seen that, the transmission line tower with diamond shaped bracing system using hot rolled section is optimum as compared to other three types of bracing system. The diamond shaped bracing system tower has 40-50% weight less than the other type of bracing system. Also the stability against the wind, broken wire condition and such other sudden loading, the other structures are not feasible.

B. Base reaction of Hot Rolled Section Tower for Four Types of Bracing System:-

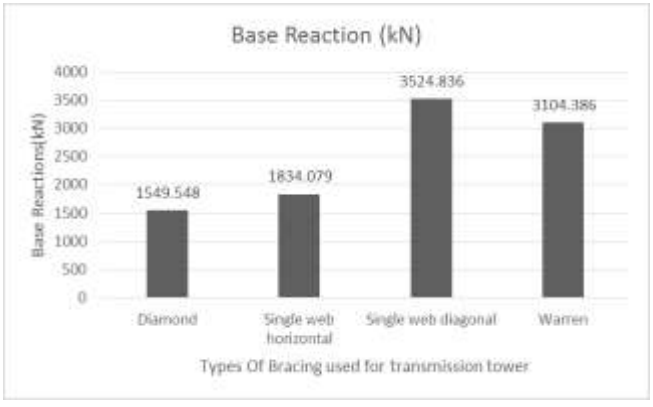


Fig 5 Base reaction vs types of bracing system for transmission tower

Discussion:

The above graph represents the value of base shear of transmission tower for different types of bracing system. The maximum value of base reaction is for single web diagonal type bracing system having value as 3524.836 kN. The minimum value of base reaction is for diamond type bracing system having value as 1549.548 kN.

C. Displacement of Hot Rolled Section Tower for Four Types of Bracing System:-

The displacement values are extracted as results by selecting top point and intermediate point of the transmission tower models.

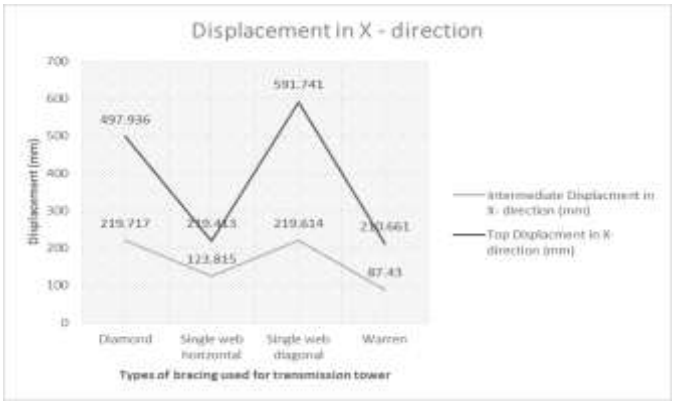


Fig 6 Displacement in X direction vs types of bracing system for transmission tower

Discussion:

The above graph shows the displacement in X direction for transmission tower having four different types of bracing system. The maximum top displacement of 591.714 mm is for single web diagonal type of bracing system and maximum intermediate displacement of 219.717 mm is for diamond type of bracing system. The minimum top displacement of 210.661 mm is for warren type bracing system and minimum intermediate displacement of 87.430 mm is for warren type of bracing system.

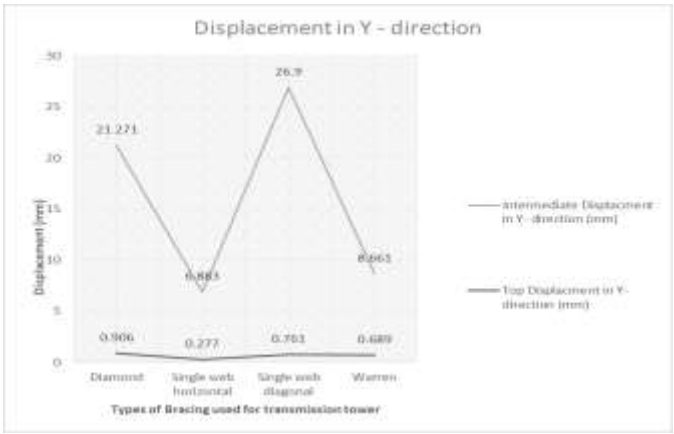


Fig 7 Displacement in Y direction vs types of bracing system for transmission tower

Discussion:

The above graph shows the displacement in Y direction for transmission tower having four different types of bracing system. The maximum top displacement of 0.906 mm is for diamond type of bracing system and maximum intermediate displacement of 26.900 mm is for single web diagonal type of bracing system. The minimum top displacement of 0.277 mm is for single web horizontal type bracing system and minimum intermediate displacement of 6.883 mm is for single web horizontal type of bracing system.

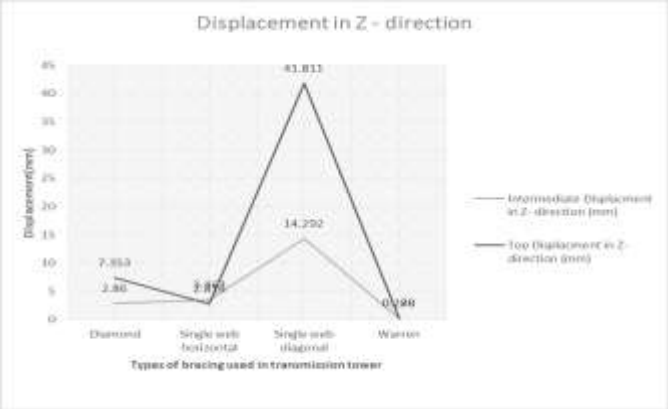


Fig 8 Displacement in Z direction vs types of bracing system for transmission tower

Discussion:

The above graph shows the displacement in Z direction for transmission tower having four different types of bracing system. The maximum top displacement of 41.811 mm is for single web diagonal type of bracing system and maximum intermediate displacement of 14.292 mm is for single web diagonal type of bracing system. The minimum top displacement of 0.288 mm is for warren type bracing system and minimum intermediate displacement of 0.278 mm is for warren type of bracing system.

5. CONCLUSIONS

The following conclusions are drawn for transmission tower by using four different types of bracing viz. diamond bracing, single web horizontal bracing, single web diagonal bracing and warren bracing on the basis of the researches and analysis done through the STAAD Pro V8i.

1) The base reaction for single web horizontal type bracing is maximum while for diamond type bracing is minimum.

2) The displacement value is higher for single web diagonal type bracing while, for warren type bracing has lower value. This implies that single web diagonal type tower behaves more rigidly than other types of tower.

3) The weight of the diamond bracing tower is less as compared to other three type of bracing tower.

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Flexural Behaviour of RCC Beam with Partial Replacement of Fine Aggregate with Manufactured Sand

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Abstract - Cement concrete is most widely used building material because of its high strength. As there is development in infrastructure, demand for production concrete is also increased. The consumption of natural sand is high due to extensive use in concrete and mortar. The demand of natural sand is high in developing countries. In this situation the developing country like India, natural sand deposits are depleted and causing serious threat to environment. Properties of aggregate affect the durability and performance of concrete. The most commonly used fine aggregate is river sand or pit sand. Natural sand are weathered and worn out particles of rocks and are of various grades or sizes depending upon extent of wearing. Now-a-days good sand is not readily available; it is transported from long distances. The manufactured sand produced by proper machines can be beater substitute to river sand. Sand should have particles from 150 microns to 4.75 mm. fine particles should be in proper proportion then it will have minimum voids. The day by day as river sand cannot meet the rising demand of construction section because of its limited supply, the cost of river sand has sky rocketed and its consistent supply cannot be guaranteed. River sand in many parts of the country is not graded properly and has excessive silt and organic impurities and these can be detrimental to durability of steel in concrete whereas manufactured sand has no silt or organic matter. The flexural behavior of RCC beams of under loading the corresponding deflections are examined such that flexural behavior of RCC beam of under reinforce, balanced and over reinforced sections are analyzed. In the present study analyze the flexural behavior of RCC beam in replacement of natural sand as M-sand.

Key Words: Compressive strength, Flexural strength, Natural sand, Manufactured sand.

1. INTRODUCTION

1.1 Natural and Manufactured Sand

The Natural sand is one of the main constituents of the concrete making about 35% of volume of concrete used in building construction industry. It is mainly excavated from the riverbeds. Due to the construction of dams on river. These natural resources are erasing fast .in hilly areas and other such places where sand is not abundantly available this becomes a good substitute. Natural sand always contains high percentage of inorganic salts of chlorides, sulphate sand other deleterious organic salts and impurities. Chlorides and sulphate adversely affect on the strength and durability of concrete and reinforcing steel thereby reducing the life of structure. Due to excessive excavation silt in natural sand has been found more in volume. Excessive silt causes reduction in strength of concrete affecting durability. Manufactured sand(M-sand) is different in shape, grading and content of very fine sand as compared with river sand and it is well known that the material properties of M-sand concrete are also different from those of river sand concrete.

1.2 Compressive strength

The compressive strength is the resistance of material to breaking under compression. Concrete specimens are a cast and tested under the action of compressive loads to determine the strength of concrete. The compressive strength of concrete strength of 150mm size cubes tested at 28 days(fck). The characteristic strength is defined as the strength of concrete below which not more than 5% of the test results are excepted to fall. Average 28 days compressive strength of at least three 150 mm concrete cubes prepared with water proposed to be used shall not be less than 90% of average of strength of three similar concrete cubes prepared with distilled water. For compressive strength test prepare cubes with 25%, 50% and 75% replacement levels and with 100% natural sand to compare the results. From these compressive strength results find out the max strength for replacement and that replacement level is used to find out flexural strength of beam.

1.3 Flexural strength

Flexural strength also known as modulus of rupture or bend strength or transverse rupture strength is a material property defined as the stress in a material just before it yields in a flexure test. The transverse bending test is most frequently employed, in which a specimen having either circular rectangular cross-section is bent until fracture or yielding using two point loading. The flexural strength represents the highest stress experienced within the

material at its moment of yield. It is measured in terms of stress. to estimate and analyze the basic properties of and behavior of RCC an experimental study is needed. In the present study an experiment in which flexural behavior of RCC under various constrains is the major criteria. For experimental analysis simply supported beams of under reinforced, balanced and over reinforced sections are considered. When the beam is simply supported and is subjected to some external loading the corresponding deflections are examined such that the flexural behavior of RCC beams of under loading the corresponding deflections are examined such that flexural behavior of RCC beam of under reinforce, balanced and over reinforced sections are analyzed. In the present study analyze the flexural behavior of RCC beam in replacement of natural sand as M-sand.

2. LITERATURE REVIEW

B Balapgol, S.A.Kulkarni, K.M.Bajoria (2002),This paper presents the results of an experimental study on strength and durability of concrete with crushed basalt stone fine aggregates as a substitute to diminishing natural sand. The strength and durability properties of concrete viz. compressive strength, flexural strength and permeability of hardened concrete where investigated. An experimental study was performed to observe the performance of concrete incorporating crushed basalt stone fine aggregates replacing the natural sand. The test results indicate that the performs of concrete crushed basalt stone fine aggregates were excellent. The compressive strength of concrete for different grades increased from 8% to 26 %, the flexural strength was increased from 1% to 5% and coefficient of permeability was decreased significantly. The test result indicated that strength and durability of concrete would be better with crushed sand replacing the natural sand. The flexural strength of concrete was determined by bending test in accordance with Indian standards [4]. To find flexural strength three beam specimens of size 700x150x150 mm for each of 8 mixes were tested after 7 days and 28 days curing under universal testing machine with two -point loading. The average flexural strengths for concrete with crushed sand and natural sand were reported and compare the results. The concrete with crushed sand performed better than concrete with natural sand as the grade of concrete mix increased. The flexural strength of concrete with crush sand was marginally increased on strength of concrete with natural sand.

SunilaaGeorge, Jino John, P.N.Magudeswaran and R. Thenmozhi (2008), The river sand is used as fine aggregate in concrete. Large scale construction activities have led to increased cost of river sand which leads to illegal sand mining. Hence, several state governments have imposed restrictions on sand quarry. Another problem noted is environmental degradation. For the past 4-5 years, the crushed sand has not been used much in India as the ordinary crushed sand is flaky, badly graded with rough texture (Prithvi et al. 1991). It produces harsh concrete; but now many improved types of equipment's are set up in India to produce crushed sand of acceptable quality at project site. With manufactured sand as a fine aggregate, the Pune-Mumbai express highway, one of biggest projects undertaken in India, has been completed. The total quantity involved was 20,000,00 m3 of concrete. In this study , concrete mix M30 has been designed using quarry dust and manufactured sand by replacing the river sand. Four mixes proportions were made to test the effect of inclusion of quarry dust and manufactured sand in concrete and the results were compared with the control specimens. It was found that the strength of the concrete is enhanced in both types of replacements.

Anil Kulkarni, Rajeeb Kumar, Vikram Kumar (2011),From crushed stone sand is manufactured sand, which is better in terms of quality and fulfils the requirements of suitable material for use in concrete. M-sand is manufactured by any of the methods by crushing of coarse aggregate (20mm & 10mm) in separate sand plants or using 3 stage vs/ crushed then this material is further processed either by washing with water or dry sieving. If required to improve the grading & reduce fine powder content. This comparison study gives an insight into the various characteristics of fine aggregate playing role in making good pumpable concrete along with other important hardened concrete properties.

T.Shanmugapriya,R.N.Uma (2012),This paper represents the optimization of partial replacement of manufactured sand by natural sand with silica fume in high performance concrete (HPC). The OPC was partially replaced with silica fume by 1.5%, 2.5% and 5% and the natural sand is replaced with M-sand by four proportions (i.e. 10%, 30%, 50%, 70%). The results indicated that there is an increase in compressive and flexural strength of HPC nearly 20% and 15% respectively with the increase of manufacturing sand percentage addition of up to 50% of M-sand as a sand replacement yielded comparable strength with that of control mix. However further additions of M-sand caused reduction in the strength. The optimum percentage of replacement of natural sand by M-sand is 50% results also reveled that increase in percentage of partial replacement of silica fume increased compressive and flexural strength of high performance concrete.

Rajendra.P.Mogre,Dhananjay.K.Parbat,Shirish.D.Dhobe(2015),The paper present experimental results based analysis of compressive and flexural strength of concrete acquired with combination of artificial sand and natural sand utilizes indigenously prepared concrete mixture in the laboratory the experimental plan has been organized on 125 orthogonal array design parametric analysis has made based on Taguchi methodology the mathematical models have also been developed to correlate compressive strength (6fs)and average flexural strength (6fs)with different three parameters.

3. OBJECTIVES

- The main aim of this investigation is to examine flexural test of RCC beam with partial replacement of Fine Aggregate by M-sand.
- To evaluate the ultimate load carrying capacity of RCC beam with partial replacement of M-sand.
- To study the cracking characteristics and Design Over-Reinforce, Under-Reinforce, Balanced sections of RCC beam.
- To study the behavior of beam deflection under two point loading.
- To compare the experimental results of M-sand with natural sand.

4. METHODOLOGY

In order to accomplish the objectives, the project work has been divided into five major parts. They are:

- Collection of required data to carry out the analysis from journals, technical magazines, reference books and web source.
- Casting of RCC beam with M40, M50 Concrete.
- Preparation of RC beam with number of specimen for Natural sand and M-sand.
- Comparison to be made between these analyses to know possibility and feasibility.
- From the results of Experimental analysis the final conclusion will be drawn.

4. MATERIALS AND EXPERIMENTAL PROCEDURE

To attain objectives, materials were collected from various sources. However, the material that is utilized as a part of a work should not make any harm to the environment. To find out the goal of this examination, the experimental work was completed on thirty six beams. The source of the materials utilized for experimental work of the RCC beam and testing strategies are given in the upcoming article.

4.1 Concrete

The concrete used for casting was prepared in the testing laboratory using a hand mix method of concrete. The concrete was (M40 Grade) & (M50 Grade) with mix proportion adopted was (1:1.579:2.755) with water /cement ratio of 0.45. and for M50 proportion adopted was (1:1.363:2.3794)with water cement ratio 0.40.The material proportions per cubic meter of concrete:

M-40

1) 1206.26 kg/m^3 of coarse aggregate (maximum size 20mm)

2) 691.35 kg/m3 of natural river sand (sp.gr =2.60)

3) 437.77 kg/m^3 of ordinary port land cement (53 grades)

4) 197 liters of water

M-50

1) 1174.21kg/m^3 of coarse aggregate (maximum size 20mm)

2) 673.031 kg/m3 of natural river sand (sp.gr =2.60)

3) 493.50 kg/m^3 of ordinary port land cement (53 grades)

4) 197 liters of water

4.2 Details of beam specimen

While reviewing literature of beam come to knew that the beam size is 700X150X150 mm. Accorded to the IS (10086-1982) & IS (516-1959) minimum size of specimen for beam mould is 700X150X150mm. There is no specified mould size was found in Indian standard codes, hence select the beam size as 700X150X150 mm which satisfies provision of IS (10086-1982) & IS (516-1959).

4.3 Preparation of beam specimens

After all the collection of material next step was go through the specimen making from the collected material. The details of Specimen making is enlisted below.

Casting of Beams Specimens

Nine wooden moulds of the same dimensions were fabricated for casting the beam specimens to be tested in this study. The moulds were properly cleaned and greased for easy de-moulding after casting. The concrete required for casting was prepared using a concrete hand mix. Before

pouring concrete, the reinforcement cages were placed inside the mould with suitable sized cover. The concrete was properly compacted. All the beams were cast to the same dimensions of 150 mm depth, 150 mm width and 700 mm overall length.



Placing of the cage in the mould



Beam cast

4.4 Experimental Set-up for Deep Beams Testing

The testing of deep beams in this work was carried out using a 1000 kN Universal Testing Machine (UTM) that was available at the institution for conducting the experiments. The beam specimens were designed to be of the maximum possible dimensions that the UTM can support during testing. The beams are tested as simply supported beam with Two point loads until failure.The load positions were spaced at 210 mm c/c which is one-third of span.



Applying a load on deep beam



Shear failure and cracks on beam



Flexure failure shows in beam



Data acquisition on UTM for beam

5. RESULTS

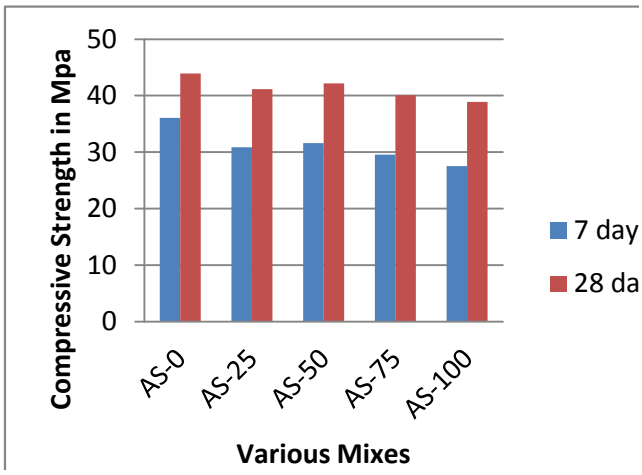
5.1 Compressive strength Test

Standard cube specimens were casted and were kept as it is for 24 hours and then kept in water tank for 7 and 28 days of curing. The concrete cube specimens cast by replacing natural

sand with artificial sand at different replacement levels and tested under compression testing machine. A set of 3 cubes were tested. Find out the compressive strength of cubes. For compressive strength of M40 grade concrete for 7 & 28 days Ref Table no.5.1. and for M50 grade concrete for 7 & 28 days Ref Table no.5.2

Table No.5.1

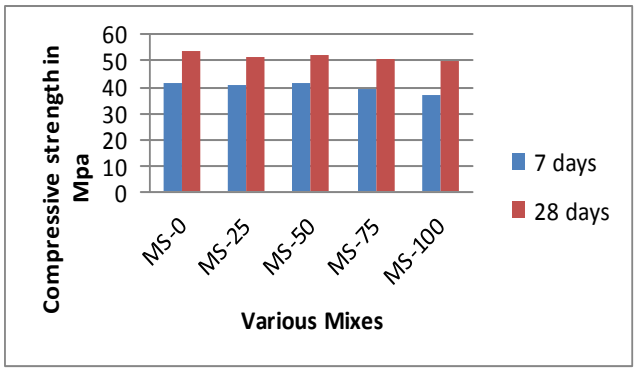
Mix Designation	Average Compressive strength 7 days (mpa) M-40 grade	Average Compressive strength 28 days (mpa) M-40 grade
MS-0	36.06	43.93
MS-25	30.86	41.17
MS-50	31.57	42.16
MS-75	29.58	40.06
MS-100	27.55	38.89



Graph 5.1 Variation in compressive strength (7 & 28 days) for various mixes of M-40 grade concrete.

Table no.5.2

Mix designation	Average Compressive strength 7 days (mpa) M-50 grade	Average compressive strength 28 days (mpa) M-50 grade
MS-0	41.86	53.60
MS-25	40.79	51.10
MS-50	41.53	52.30
MS-75	39.58	50.51
MS-100	37.15	49.79



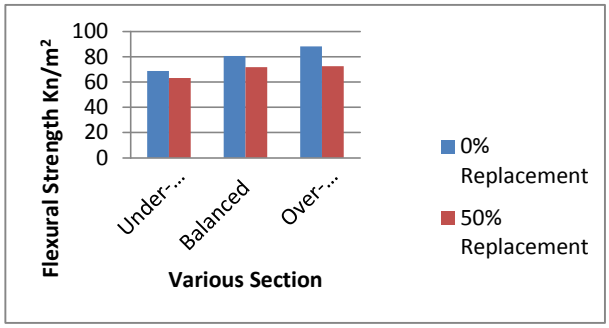
Graph 5.2 Variation in compressive strength (7 & 28 days) for various mixes of M-50 grade concrete

5.2Flexural strength test

The beams were casted with size 700mm x 150mm x 150mm. The beams were in balanced, Over-reinforced , Under-reinforced section. The flexural test was conducted on Universal Testing Machine. The results of flexural test are as below. Ref Table no.5.3 & 5.4 for flexural strength results.

Table no.5.3

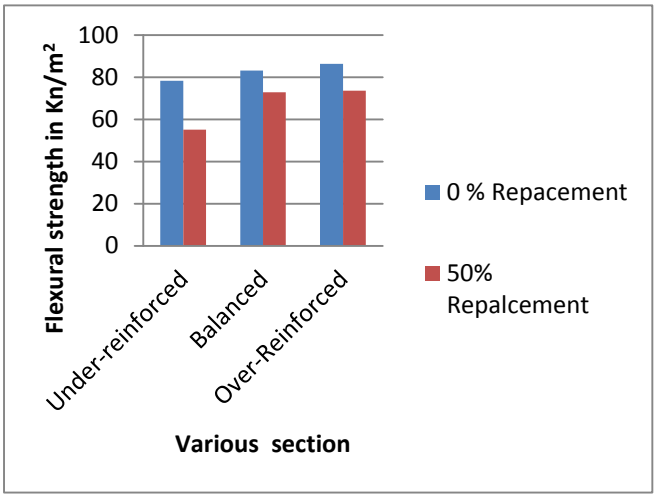
Mix design M40	Under-reinforced section	Balanced section	Over-reinforced section
Reinforcement	Top- 2No.s 8mm ϕ Bottom- 2No.s12mm ϕ	Top- 2No.s 8mm ϕ Bottom- 3No.s12mm ϕ	Top- 2No.s 8mm ϕ Bottom- 4No.s12mm ϕ
Load at Failure Nominal	68.65	80.60	88.30
50% Replacement	63.20	71.70	72.50



Graph No.5.3 Variation in Flexural strength (28 days) for Various section of M40 Grade

Table no.5.4

Mix design M50	Under-reinforced section	Balanced section	Over-reinforced section
Reinforcement	Top- 2No.s 8mm ϕ Bottom- 3No.s12mm ϕ	Top- 2No.s 8mm ϕ Bottom- 4No.s12mm ϕ	Top- 2No.s 8mm ϕ Bottom- 5No.s12mm ϕ
Load at failure Nominal	78.25	83.10	86.25
50% Replacement	55.10	72.88	73.50



Graph No. 5.4 Variation in Flexural strength (28 days) for Various section of M50 Grade

6. CONCLUSIONS

From the data received after all the secession of test carried out on deep beam with different material such as steel, BFRP & bamboo from that following conclusion are drawn.

The result of present work concludes that compressive strength is significantly improved. And we can use M-sand as Fine aggregate in 50 % replacement.

1) The experimental results proved that the compressive strength of cubes with 50% M-sand gives the strength nearby same as that with 0% M-sand. From the results it concludes upto 50% there is increase in strength but beyond 50% replacement it gives lower in strength.

2) The flexural strength test result proves that we can replace M-sand with 50% replacement effectively and it gives the strength nearby same as it with 0% replacement.

3) From above we can conclude that we can replace Natural sand with 50% of M-sand effectively and it proves to be economical.

7. FUTURE SCOPE OF PRESENT STUDY

The present work can be proceed to check the durability of concrete with Replacement with Manufactured sand. We check only the strength and load carrying capacity of concrete. But in future we check durability for long time period.

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BIOGRAPHIES



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Experimental Study on WINSUM CLIMATISATION

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Abstract - *In today's word the requirement of human comfort is more & it should be efficient. The requirement is in all the season & also it must be affordable to all human beings. So that, each & everyone can have comfort conditions in all seasons. This project is attempt to solve this problem at some extent. We have tried to have minimum consumption of electricity than the normal air conditioners. This system is also useful in places where humidity is more. This system is easy to use, it can be used in all season for air comfort conditions.*

***Key Words*: Evaporating unit, Heat Exchanger, Pump, Heating Element, Fan, Duct**

1. INTRODUCTION

Air conditioning is the process of treating air in an internal environment to establish & maintain required standards of temperature, humidity, cleanliness and motion. For human comfort, the air conditioning is necessary in all the seasons. Since the purpose of most air conditioning systems is to provide a comfortable indoor environment, that's why air conditioners are there. But everyone is not able to afford the air conditioners since they are costly, also they consume more electricity. So there should be a system which does the same work as air conditioners & having less consumption of electricity & cost. WINSUM CLIMATISATION is the system which works on same way as like Air conditioners. It can be used in all seasons.

2. LITERATURE REVIEW

T. Ravi Kiran et.Al [1] Conventional refrigeration based vapour compression air conditioning systems consume a large portion of electrical energy produced mostly by fossil fuel. A novel dew point evaporative cooler (DPEC) can sensibly cool the incoming air close to its dew point temperature. In this paper feasibility of DPEC system is investigated for various Indian cities for office buildings during day time. Firstly the weather data of different cities of India is used to find the suitability of dew point technology for Indian buildings by estimating the cooling capacity of the cooling system for each city. Secondly energy saving potential of the dew point cooling system w. r. t. to the conventional compression based air conditioning system for different cities of India is estimated.

Rin Yun, et.al [2] In His study the seasonal performance of a residential air conditioning system having either a fin-and-tube condenser or a microchannel condenser is experimentally investigated. For this investigation, a commercially available 7 kW capacity residential air conditioning system having a fin-and-tube condenser served as the base system. The test results show that the system with a microchannel heat exchanger has a reduced refrigerant charge amount of 10%, the coefficient of performance increased by 6% to 10%, and the SEER increased by 7% as compared with those of the base system.

Moien Farmahini Farahani, et.Al [3] In His study the results of an investigation on a two-stage cooling system have been studied. This system consists of a nocturnal radiative unit, a cooling coil, and an indirect evaporative cooler.

R.H. Turner [4] , In His study he focuses on potential applications of evaporative cooling (EC) and an associated survey of research requirements of EC as supplied in residential and small commercial buildings. To prepare this work, the literature in the field was reviewed and people active in the field were contacted. There are potential applications for EC systems and related research issues that are not fully understood by most government agencies, utility companies, engineers, industries, decision makers, and the consuming public. However, as energy costs rise there will be increasing demand for operationally inexpensive cooling systems. Thus, information on the potential of EC systems could benefit these parties. This paper focuses on residential and small commercial building applications of EC.

Nishant Dhanore [5], In his study he modified the evaporative cooler so that the moisture contents gets reduced. He supplied evaporator water to heat exchanger & performed forced convection over it. So that cooling effect can be achieved.

3. EXPERIMENTAL WORK

Evaporating unit will be used for evaporation. Evaporated water will be pumped and supplied to heat exchanger. Mostly pipe type heat exchanger will be used. Fans are provided at back of heat exchanger pipes, air will be supplied by fans on the pipes so that forced convection will occur. Cooled & moistureless air will be obtained. Again water is supplied to evaporating unit. This is for cooling effect.

In Winter, there is requirement of warm conditions , this can be achieved by switching ON the heating element. At back of heating element fan is provided so that after switching ON fan, the air will be warm. At a time One effect can be obtained. Either cooling or warm.

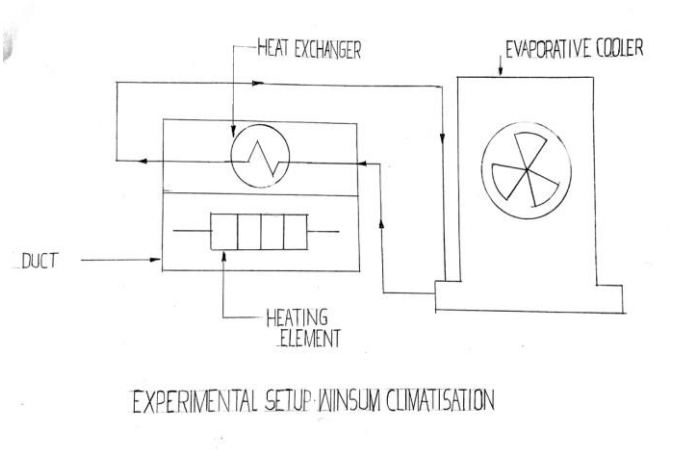


Fig: Experimental Setup WINSUM CLIMATISATION

4. CONCLUSION

This paper deals with solution over drawback of cost of Air conditioners & humidity of evaporative coolers. This setup consumes less power than air conditioners. It gives moisture less air cooled air in summer & warm air winter. From this paper we can conclude that this is the best option to replace air conditioners & it's operating cost is so less that everyone can afford.

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The Study of Reliability of X-type Bracing System to Avoid Progressive Collapse of Structure

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Abstract – *From past few years because of the demand of the customers building with soft storey are constructed, it is convenient for parking purpose. While parking any vehicle there are chances that any vehicle may collide with the column and column may fail which may leads to progressive collapse of structure. Also there is threat of terrorist attack if they damage the critical column then it trigger a chain reaction which then results in failure of entire structure. To avoid this bracing systems can be used. As bracing system contribute in resisting the impact of progressive collapse. Analysis and design of building is carried out using computer program ETABS.*

Key Words: Progressive collapse, critical column, soft storey

1. INTRODUCTION

Progressive collapse can be defined as the collapse of all or large part of a structure due to damage of relatively smaller part of a structure. It is also called as disproportionate collapse because as compare to first collapse the result is very large. To avoid progressive collapse due to failure of critical column in outer bays bracing systems can be used. As bracing systems significantly contribute in resisting lateral loads therefore it can also contribute in resisting the impact of progressive collapse due to removal of column in outer bays.

2.1 Analysis Procedure

The U.S. General Service Administration developed the progressive collapse analysis and design guideline for the Federal office building and major modernization projects to ensure that the potential of progressive collapse is addressed in design, planning and construction.

According to G.S.A. there are two methods of analysis of progressive collapse namely linear static analysis and linear dynamic analysis. Progressive collapse analysis is performed by instantly removing one or several columns here while analysis of any structure demand capacity ratio is key factor because progressive collapse phenomenon is based on depend on demand capacity ratio.

According to guidelines by G.S.A. the linear static analysis procedure can be applied upto 10 storey G.S.A. guideline have specified the following load case for static linear analysis procedure, load = 2(DL+0.25LL)

The performance of structure is evaluated by DCR, which should not exceed 2 for regular structure and 1.5 for irregular structures or else they are considered as severely damaged or failure. GSA has defined DCR as below,

DCR = QUC/QCE

QUD = Acting force (demand) determined in component (moment)

QCE = Expected unfactored moment carrying capacity of the component

3.1 Building Design (Normal Loading)

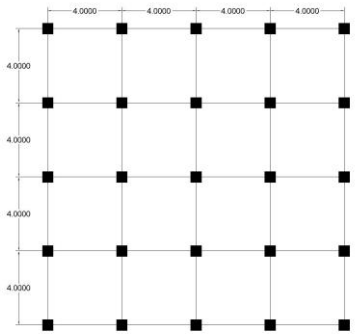


Fig -1: Building Plan

Building specifications are as follows,

Beam size – 300 X 600 mm

Slab – 130 mm

Columns for Ground, 1st, 2nd, 3rd floor – 600 X 600 mm

Columns for 4th and 5th floor – 400 X 400 mm

Columns for 6th and 7th floor – 300 X 300 mm

Seismic Zone – Zone II

Zone factor 0.1

From the building design in ETABS we get the reinforcement of each member from which the unfactored moment carrying capacities of beams can be calculated.

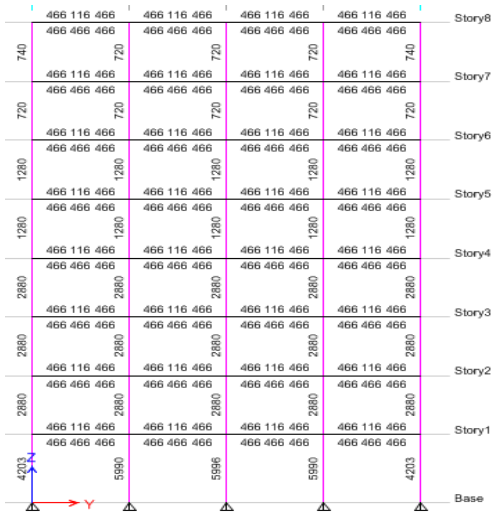


Fig -1: Reinforcement Details

From the reinforcement details ultimate moment carrying capacities are calculated.

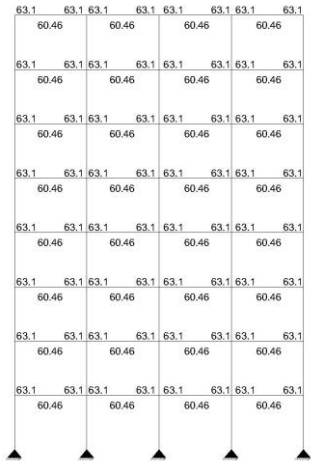


Fig -2: Moment Carrying Capacities

3.2 Column Removal Scenario

According to GSA guidelines following positions in the given building have the critical columns,

Case1) Middle column of each side
Case2) Corner column
Case3) Adjacent to corner column

The demand capacity ratio after each case is shown in following figures

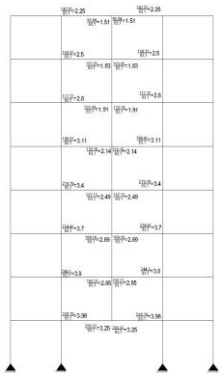


Fig -3: Case1) Middle column removal



Fig -4: Case2) Corner column removal



Fig -5: Case2) Adjacent to Corner column removal

3.3 Addition of Bracing System

To check the reliability of bracing system consider same building with bracing system and same column loss scenario is considered for all the cases. Bracing are of size 200 X 200 mm, HYSD 415 and M20. The demand capacity ratios for the same building with bracing system and column loss scenario are as follows.

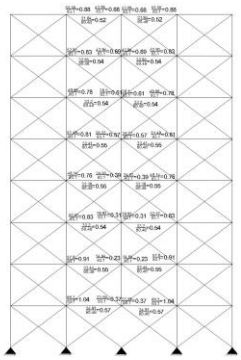


Fig -6: DCR for Case1with bracing system

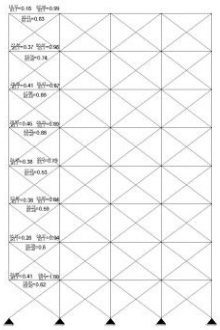


Fig -7: DCR for Case1with bracing system



Fig -8: DCR for Case1with bracing system

4. CONCLUSION

By considering all the cases it is found that when the column in building without bracing system is removed then the demand capacity ratio exceeds 2 which is sign of failure of column according to GSA guidelines but when the column in case of building with bracing system are removed then the demand capacity ratio is less than 2 which is safe. Hence it can be conclude that the X-type bracing system is reliable to avoid progressive collapse in case of sudden column loss scenario.

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Effect of Shear wall on Performance of Flat Slab

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ABSTRACT:
Flat slabs is innovative system for construction slab ,in which slab directly rest on columns.Flat slab structure have advantages over conventional structure such as economy in construction, its architectural appearance, flexibility and speed of the construction. However because of absence of beams in flat slab, lateral stiffness is considerably reduced hence flat slab structure more flexible to seismic loading as compare with conventional structure. This objective of this work is to study effect shear wall on seismic performance of flat slab structure.

Keywords: Flat slab RC structure, Seismic response, Static analysis, Dynamic analysis.

I. INTRODUCTION:

Flat slabs is system of construction is one in which the beams used in the conventional methods of constructions are done away with. The slab directly rests on the column and load from the slab is directly transferred to the columns and then to the foundation. To support heavy loads the thickness of slab near the support with the column is increased and these are called drops, or columns are generally provided with enlarged heads called column heads or capitals. These increasing thickness of flat slab in the region supporting columns provide adequate strength in shear and to increase the amount perimeter of the critical section, for shear and hence, increasing the capacity of the slab for resisting two-way shear and to reduce negative bending moment at the support. Flat slabs have been widely used in building construction due to their advantages in reducing storey height and construction period as compared with conventional structure, leading to a reduction of construction costs. Provision of the flat slab building in which slab is directly rested on columns, have been adopted in many buildings constructed recently due to the advantage of reduced floor to floor heights to meet the economical and architectural demands.

Because of absence of deep beam Flat slab building structures which are more significantly flexible than conventional concrete frame/wall or frame structures, thus becoming more vulnerable to seismic loading. Thus the seismic analysis of these structures is necessary to know the vulnerability of these structures to seismic loading.

The flat slab structure are more respond to seismic loading as compare with conventional structure hence additional measure are required to improve their seismic performance. Therefore, flat slab structure constructed in earthquake prone region additional measures should be taken such as provision of shear wall in order to reduce the seismic response of flat slab RC structure.

II. METHODS OF DESIGN OF FLAT SLAB

Following are the methods used for analysis of flat slab

1. The direct design method
2. The equivalent frame method

METHODS OF SEISMIC ANALYSIS

A. Linear static analysis

B. Linear dynamic analysis

III. PROBLEM FORMULATION, MODELLING AND ANALYSIS.

Following are the models used for analysis

Case 1)-

i. 8 storey Flat Slab RC structure having plan dimensions 30 m x36 m.
ii. 8 storey flat slab structure with shear wall having plan dimensions 30 m x36 m.

Case 2)-

i. 12 storey Flat Slab RC structure having plan dimensions30 m x36 m.
ii. 12 storey flat slab structure with shear wall having plan dimensions 30 m x36 m.

Case 3)-

i. 18 storey Flat Slab RC structure having plan dimensions 30 m x36 m.
ii. 18 storey flat slab structure with shear wall having plan dimensions 30 m x36 m.

All above model are analysed and comparison is made between these analysis. To know vulnerability of the structure to seismic loading.

Details of Modelling:

i. Storey height -3.2m
ii. Plinth level-0.8m
iii. Thickness of flat slab- 220mm
iv. Thickness of drop is -270mm.
v. Thickness of shear wall is- 150mm.
vi. Size of column -0.45m to 1.2m.
vii. Size of beam -300mm to 600mm.

Loading Details:

1 . Gravity loads-

i. Live load at typical floor-4 kN/m2
ii. Live load at top floor -2 kN/m2
iii. Floor finish load at typical floor -1.0 kN/m2
iv. Floor finish load at top floor -2.0 kN/m2

2. Detail of Earthquake loading-

1. Static analysis
   a. Location of zone- IV.
   b. The direction of excitation -X.
   c. Importance factor -1
   d. Response reduction factors- 5

2. Dynamic analysis-
   a. Location of zone- IV.
   b. The direction of excitation -X.
   c. Damping-5%.

IV. RESULTS

1. Base shear - Base shear is the total design lateral force (V_B) along any principal direction, which is determined by following expression

$$V_B = A_h W$$

Where
Ah = Design horizontal acceleration spectrum
W = Seismic weight of building.

TABLE I
BASE SHEAR COMPARISON of above models

Model	Linear static analysis	Response spectrum analysis
Case 1- 8 storey Structure		
Flat slab structure	1647.89	1523.60
Flat slab structure with shear wall	5392.65	4631.04
Case 2- 12 storey Structure		
Flat slab structure	2190.05	1845.76
Flat slab structure with shear wall	5618.61	4930.89
Case 3- 18 storey Structure		
Flat slab structure	3380.73	2647.29
Flat slab structure with shear wall	6397.51	5543.13

From above result shows that flat slab structure are more flexible. The flexibility of flat slab can be reduced by providing shear wall.

2. Storey drift-

Storey drift is the total lateral displacement that met in a single storey of a high-rise building. The drift in a storey is computed as a difference of deflections of the floors at the top and the bottom of the storey under consideration. It is one of the predominantly important engineering response quantity and indictor of structural performance, in particular for multi-storey buildings. Storey drift is considered as unique standard for structural behaviour conclusion.

According IS 1893 (Part 1): 2002 maximum allowable storey drift Should not be exceed shall 0.004 times the storey height under consideration. For all the analysis of the above model storey drift should not exceed 12.8mm.

Comparison of Storey Drift for different cases

Case 1- 8 storey structure

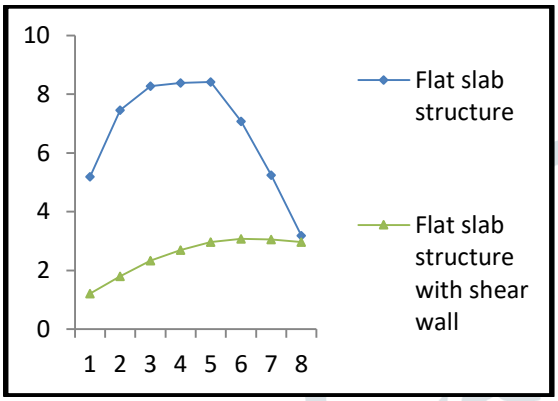


Figure 1. Linear Static Analysis

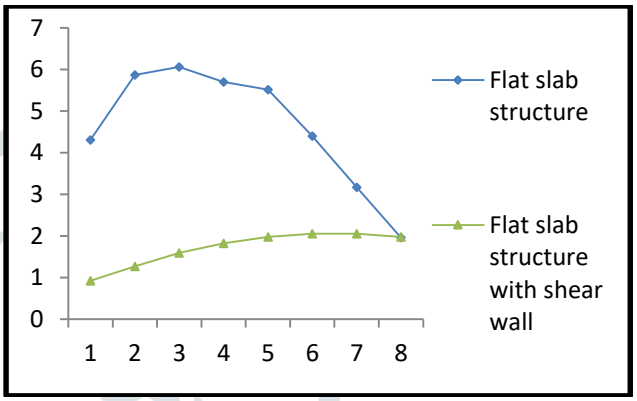


Figure 2. Linear Dynamic Analysis.

The plot of drift values shows that provision of shear wall imparts uniform stiffness to the flat slab structure and it reduces the drift values of mid-storey almost by 50%, thus proving the reliability of shear wall in case of multi-storey structures.

Case 2- 12 storey structure

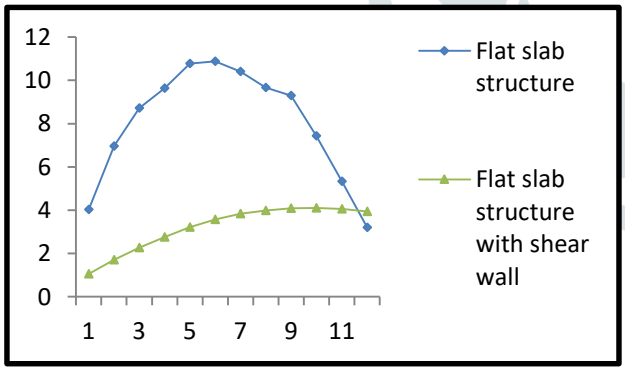


Figure 3.Linear Static Analysis.

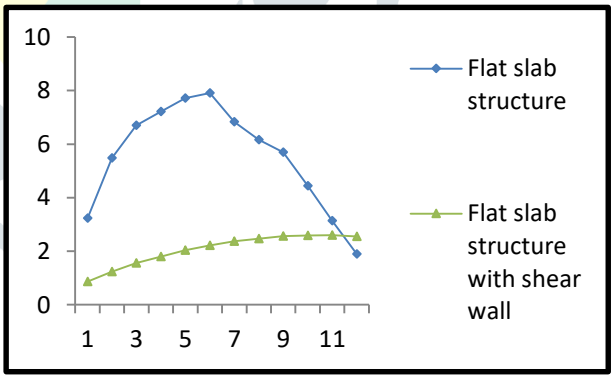


Figure 4.Linear Dynamic Analysis

The plot of drift values shows that provision of shear wall imparts uniform stiffness to the flat slab structure and it reduces the drift values of mid-storeys almost by 50%, thus proving the reliability of shear wall in case of multi-storey structures.

Case 3- 18 story structure

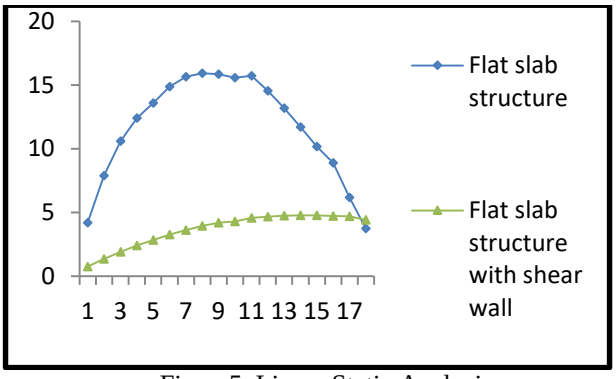


Figure5. Linear Static Analysis

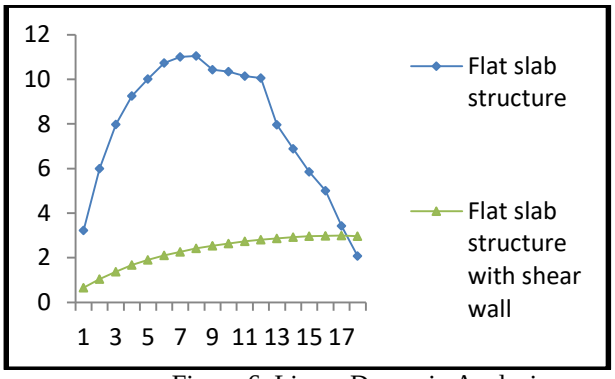


Figure 6. Linear Dynamic Analysis

In case of 18 storey structure in zone IV, Storey drift of flat slab structure differs very much from conventional RC framed structure and **exceed permissible values (storey drift being more than 12 mm)** when analyzed by linear static analysis. Thus, multi-storey flat slab structure essentially demand lateral load resisting system such as in-plane shear wall in order to bring storey drift values within permissible limits.

Comparison of Displacement for different cases

Case 1 -8 storey structure

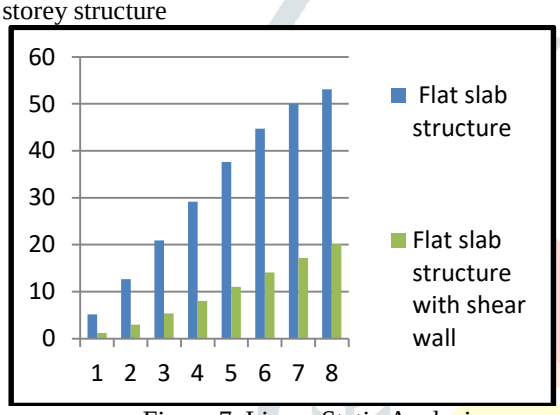


Figure 7. Linear Static Analysis.

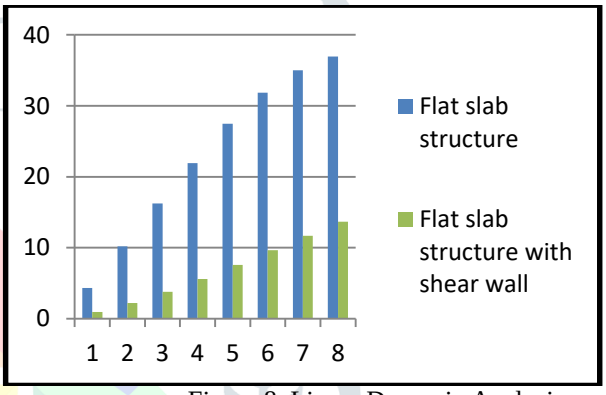


Figure 8. Linear Dynamic Analysis

Maximum displacement attained by flat slab structure with shear wall is much lesser than that in case of flat slab structure without shear wall. Both the analysis viz. linear static analysis and linear dynamic analysis emphasis that multi-storey flat slab structures are to be accompanied with the shear wall for better performance of flat slab structure during earthquake.

Case 2-12 storey structure

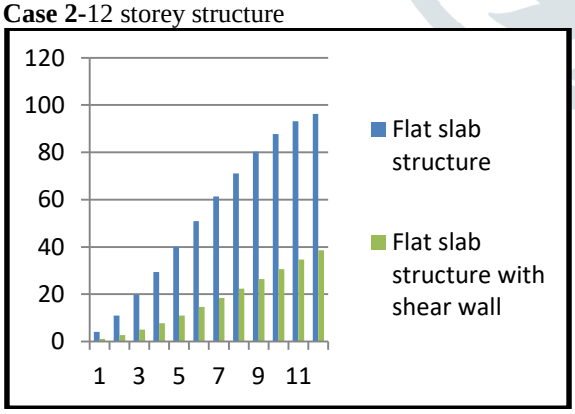


Figure 9. Linear Static Analysis

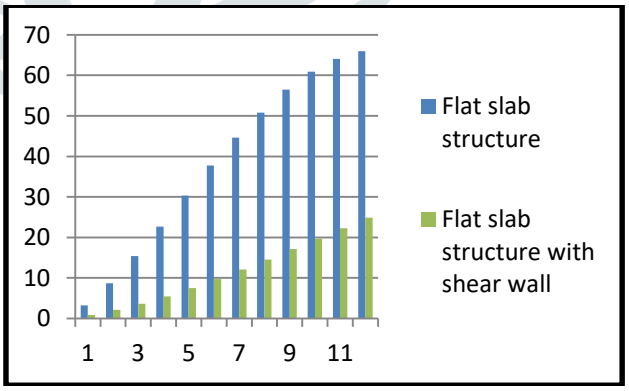


Figure10. Linear Static Analysis.

Figure 9 and figure 10 shows the significant reduction in maximum displacement of flat slab structure after the application of shear wall.

Case 3- 18 storey structure

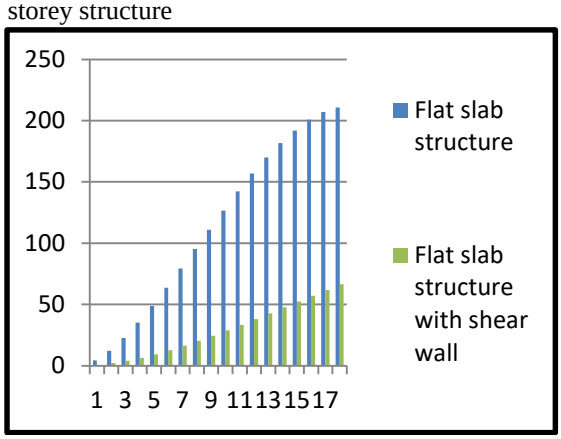


Figure11. Linear Static Analysis.

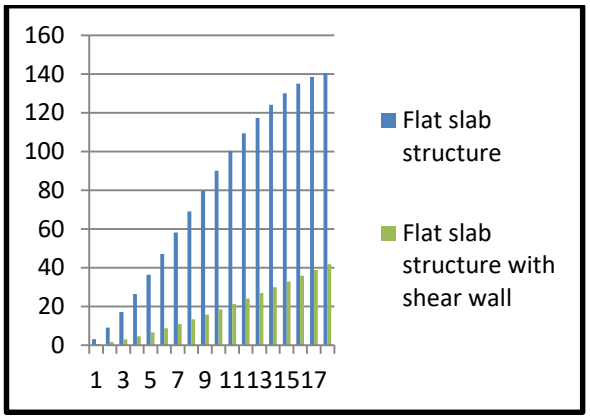


Figure12. Linear Dynamic Analysis

Maximum displacement attained by flat slab structure with shear wall found to be reduced by more than 60% than that in case of flat slab structure without shear wall. Hence such a multi-storey structure having 18 numbers of storeys must be accompanied with lateral load resisting element such as shear wall to bring the displacement values to the desired level as in this case.

V. CONCLUSION

1. For all case, flat slab structure without shear wall design base shear less as compare with conventional structure which is due to the flexibility of flat slab structure.
2. In case of flat slab storey drift is more and this storey drift can be reduced by provision of shear wall to flat slab structure.
3. The displacement of the flat slab structure considerably reduced by provision of shear wall.

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ORIGINAL ARTICLE

Turbidity removal by conventional and ballasted coagulation with natural coagulants

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Abstract

Kernel of *Moringa oleifera* and *Strychnos potatorum* (Nirmali) seeds has the potential for turbidity removal. However, potential of seed kernel naturally dried in trees and that of sun-dried and oven-dried seeds and other parts, such as coat and wing of *Moringa oleifera,* has not been explored. In the present study, various forms of kernel and parts of *Moringa oleifera* seed were used to assess the removal of turbidity aided with/without coagulant aid and ballasting agent. Low (< 12 NTU), medium (> 13 <= 24 NTU) and high turbidity (>= 25 <= 35 NTU) water samples were used in the present study. Micro-sand and powdered activated carbon (PAC) were used as ballasting agents along with *Aloe Vera* as a coagulant aid/natural polymer. The kernel from seeds naturally dried in *Moringa oleifera* tree was found to possess more coagulant property. The optimum dose of *Moringa oleifera* for medium and high turbidity was found to be 50 mg/L and 100 mg/L, respectively, with turbidity removal of 90.46% and 88.57%. The optimum dose of *Strychnos potatorum* was 0.2 mg/L, 0.6 mg/L, and 0.8 mg/L for low, medium and high turbidity, with turbidity removal as 71.42, 64.28 and 57.14%, respectively. *Aloe Vera* acts as a coagulant aid with the natural coagulants and increases turbidity removal. Ballasting agents micro-sand and PAC, with *Aloe Vera* and coagulants, increase turbidity removal and reduce the settling time.

Keywords *Aloe vera* · Ballasting · Micro sand · *Moringa oleifera* · *Strychnos potatorum* · *Turbidity*

Introduction

Surface water is the primary source of potable water supply systems in most of the cases. These sources are largely contaminated by surface runoff and wastewater. The turbidity imparted thereby necessitates treatment for its removal before supplied to consumers for potable use. Turbidity is a significant physical water quality parameter and largely contributed by non-settleable solids. Normally, municipal water supply and treatment systems have centralized water treatment system wherein the concept is to treat and supply. Typically, in such systems the raw water is treated with physical and chemical treatment viz. coagulation, flocculation, settling and filtration for turbidity removal. The centralized treat and supply systems have several limitations such as requirement of chemicals, sludge disposal problems, contamination/deterioration of water quality during distribution and requirement of energy-intensive mechanized systems. In this context, decentralized water treatment system (DWTS) based on the concept of supply and treat implemented through point of use (PoU) purifiers is a feasible option which caters to overcome the above limitations. PoU purifiers available in the market are more suitable for urban population in developing countries like India and are not cost-effective in terms of capital and recurring cost. However, there is a need to develop economically feasible technologies for turbidity removal in PoU purifiers which are more appropriate for rural population. The locally available plant materials, which have a potential to be used as a coagulant/coagulant aid, are useful to develop such technologies. The ballasted flocculation/coagulation which enhances turbidity removal efficiency can also be a part of PoU purifier. The plant-derived natural coagulants could create economic benefits, as cultivation of plants as a means of revenue

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generation would also provide new job opportunities for the local population.

Bhole and Shrivastava (1983), Raghuwanshi et al. (2002), and Swati and Govindan (2005) used *Strychnos potatorum* (Nirmali seed) as a coagulant/coagulant aid and reported their suitability for turbidity removal. Jahn (1986) studied the coagulant potential of different species of *Moringa oleifera* and reported that out of 14 species of *Moringacea*, only *Moringa oleifera* and *Moringa stenopetala* possess efficient coagulation properties. Muyibi and Evison (1995) carried out the optimization studies using *Moringa oleifera* for low, medium and high turbidity water and reported residual turbidity less than 10 NTU in all cases. Okuda et al. (2001) studied coagulation mechanism of salt solution-extracted active component in *Moringa oleifera* seeds. Narasiah et al. (2002) conducted a study on turbidity removal in synthetic turbid water under laboratory-controlled conditions using natural coagulant–flocculant *Moringa oleifera* seeds from Burandi, Central Africa, and from Mahajanga, Madagascar. The seeds from Burandi were found to be of superior quality than those of Madagascar. Other studies conducted to remove turbidity using *Moringa oleifera* include Raghuwanshi et al. (2002), Sudhirkumar et al. (2010) and Sarpong and Richerdson (2010). Montakhab and Gazali (2010) used *Moringa oleifera* seed powder extracted with $NaNO_3$. Dalen et al. (2011) studied the synergy between *Moringa oleifera* seed powder and alum in the purification of water. Gulmire and Munavalli (2017) used *Aloe Vera* as a coagulant/coagulant aid for turbidity removal and found 60–65% removal efficiency raw water turbidity of 20–30 NTU.

Shahnawaz et al. (2002) carried out the bench- and pilot-scale studies using sand-ballasted flocculation and conventional coagulation and reported the effectiveness of sand as ballasting agent. Other studies on ballasted flocculation include Young and Edwards (2003) (factors affecting ballasted flocculation), Blumenschein et al. (2004) (performance of sand-ballasted high-rate clarification), and Ghanem et al. (2007) mode of transport of ballasting agent from bulk liquid).

The literature review shows that the kernel extracts of *Moringa oleifera* and *Strychnos potatorum and* gel of *Aloe Vera* have potential for their usage as coagulant for turbidity removal. But the potential of various forms of kernel (naturally and artificially dried) and parts of (seed coat/wings/pod) of *Moringa oleifera* seed has not been assessed for turbidity removal. The use of *Aloe vera* as a coagulant aid along with *Moringa oleifera and Strychnos potatorum* is also not studied. It can also be seen from the literature review that sand-ballasted flocculation was used effectively along with Alum and synthetic polymer as a coagulant for turbidity removal. In this context, the present study contributes to existing knowledge on use of natural coagulants for turbidity removal in the following ways:

Coagulation study with various forms of kernel and parts of *Moringa oleifera* seed.

1. Sand-ballasted flocculation with natural plant-derived coagulants (*Moringa oleifera and Strychnos potatorum*) and *Aloe Vera* as a binder (polymer).
2. Use of powdered activated carbon as a ballasting agent in ballasted coagulation study.

Materials and methods

Preparation of turbid water

River water was used in the study. The composition of a typical raw water sample collected from river has: turbidity 5–50 NTU, hardness 120–140 mg/L as $CaCO_3$, pH 7–7.6, TDS 300–400 mg/L and alkalinity 200 mg/L as $CaCO_3$. The turbidity of settled raw water collected was less than 35 NTU. Low (< 12 NTU), medium (> 13 <= 24 NTU) and high turbidity (>=25 <=35 NTU) water samples were used in the present study. The water sample with required value of turbidity for the coagulation study was prepared by either remixing with alluvial soil (< 75 µm) or by diluting it with less turbid settled water. Series of such samples were prepared, and turbidity was ascertained through measurement by nephelo-turbidity meter. Thus, in the present study, the water samples used were contributed by suspended solids normally found in river water.

Moringa oleifera seeds

The pods of *Moringa oleifera* were collected from various locations in Sangli district, India (M.S.). These collected pods included matured green/partially dried and completely dried on the tree. The kernel of seed from completely dried pod collected from *Moringa oleifera* tree is referred as naturally dried seed kernel in the study. The coat of such seeds was also used in coagulation study. The matured green/partially dried pods were either sun-dried or oven-dried. One week period was used for sun drying. Temperature of 103 °C for 2 h was used for oven drying. The kernel of seed from pods which were sun-dried was referred as sun-dried seed kernel, and the kernel of *Moringa oleifera* seeds which were used oven-dried was referred as oven-dried seed kernel in the present study.

The kernel of seeds was used to prepare extract. The dried kernels were crushed and ground in domestic mixer to lowest possible size. One gram of pulverized kernel was mixed with 100 mL of distilled water, and the contents were

blended in the mixer at highest possible speed for 60 s. The suspension was filtered and used as 1% stock solution. The fresh stock solution was prepared as and when required fresh for use. An extract of coat of naturally dried *Moringa oleifera* seeds was also prepared similarly.

Strychnos potatorum (Nirmali)

Strychnos potatorum seeds were procured from the market. The coating of seed was removed, and kernel was pulverized to powder. A stock solution of 0.1% strength was prepared following same procedure as discussed previously for *Moringa oleifera* seed kernel.

Aloe Vera

The leaves of locally available *Aloe Vera* plant were collected. The outer skin of the leaves was removed, and pulp/gel was separated. The gel was blended in a mixer to get uniform liquefied paste. One gram of such fresh liquefied paste was mixed in 100 mL of distilled water and blended in mixer at more than 100 rpm to get 1% solution.

Ballasting agents

Standard sand (quality defined by Bureau of Indian Standards IS650, grade-III) was used in the study as a ballasting agent. The size of sand between 90 and 150 µm and specific gravity of 2.65 was used. Powdered activated carbon (PAC) manufactured by Thermo Fisher Scientific India Pvt. Ltd., having size 75–90 µm and density of 360 kg/m^3 was used as another ballasting agent alternative to sand.

Planning of experiments

The experiments were planned (1) to analyze raw and treated turbid water, (2) to carry out coagulation studies with *Moringa oleifera* and *Strychnos potatorum* as coagulant with and without *Aloe Vera* as coagulant aid, and (3) to conduct ballasted flocculation studies with clean standard sand and PAC. All the experiments of conventional and ballasted flocculation were performed with a standard jar test apparatus. The range of coagulant dose (10–100 mg/L for *Moringa oleifera* and 0.20–1 mg/L for *Strychnos potatorum*) and dose of coagulant aid *Aloe Vera* (10–100 mg/L) was used. These dosages were identified through trials and by referring the literature. The optimum pH was also determined for effective removal of turbidity. The coagulation studies were used as a reference to compare the results with that of ballasted flocculation. The maximum dosage of standard micro-sand and PAC used was 4 g/L and 0.50 g/L, respectively. In the ballasted flocculation study, optimum dose of *Aloe Vera* as a polymer was determined followed by determination of optimum dose of coagulant for particular ballasting agent dose. Therefore, series of experiments using *Aloe Vera* were planned. Five experiments were conducted for each dosage to assess the effectiveness of treatment, and average of these results was taken for discussions.

Experimental procedure

The jar test procedure was adopted to assess the effectiveness of *Moringa oleifera* and *Strychnos potatorum* with and without *Aloe Vera* as coagulant aid. The jar test procedure was referred to Bell-Ajy et al. (2000) and it consisted of rapid stirring at 120 rpm for 1 min, followed by a slow stirring at 40 rpm for 10 min and at 20 rpm for 10 min, consecutively; and finally settling for 30 min for a volume of 1 L synthetic sample.

The ballasted flocculation was carried out by initiating stirring, coagulating at 300 rpm for 2 min, injecting *Aloe Vera* (polymer) followed by 1 min stirring at 300 rpm, injecting appropriate dosage of ballasting agent, followed by stirring at 200 rpm for 2 min, and settling for 30 min. The settled sample was pipetted out a little (10 mm) below the surface of water for analysis in each of these jar test procedures. Raw and residual turbidity were measured.

All the procedures for analyzed parameters viz. pH, turbidity, alkalinity, and TDS were referred to Standard Methods for the Examinations of Water and Wastewater (1998). pH value of the samples was determined by pH meter. Turbidity was measured using a Hach 2100 series Nephelo-turbidity meter. The specific gravity of sand was determined by Pycnometer method.

Result and discussion

Effectiveness of kernel and coat of *Moringa oleifera* seeds for turbidity removal

Figure 1 shows the efficiency of turbidity removal by seed kernel (naturally dried, sun-dried and oven-dried) and coat of naturally dried seed. The results show that the coat of seed is relatively less efficient and naturally dried seed is more efficient in turbidity removal. Removal to an extent of 36% is possible with dosage of 10 mg coat of seed/L indicating that it has also some turbidity removal potential. This observation is significant as it can be used as coagulant aid due to its larger availability compared to kernel. However, naturally dried seeds can remove turbidity by 90% at a coagulant dosage of 50 mg/L. The comparison of turbidity

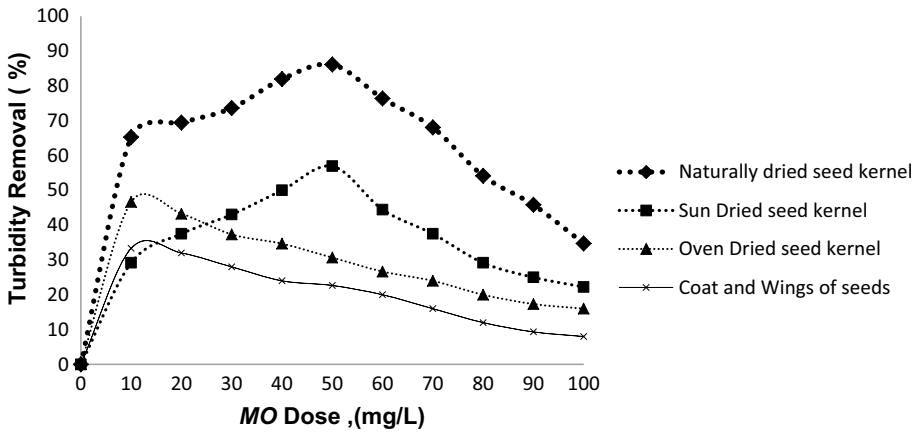


Fig. 1 Effect of coat and seed kernel of *Moringa oleifera* on turbidity removal

removal by sun-dried and oven-dried shows that sun-dried seeds are more efficient.

The predominant mechanism for coagulation is adsorption between coagulation active components in *Moringa oleifera* and particles of suspension to permit inter-particle bridging, and is not charge neutralization (Muyibi and Evison 1995; Ali et al. 2016). The efficiency of adsorption depends on the adsorbent surface area, surface morphology, pore size distribution, polarity and functional groups attached to the adsorbent surface (Ali et al. 2016). This indicates that naturally dried *Moringa oleifera* seed extract contains more active ingredients with more surface area available for adsorption and inter-particulate bridging (Joseane et al. 2013). The morphological characteristics of the powder of above materials used in the study were carried out through scanning electron microscope (SEM) with different levels of magnification to ascertain extent of porous nature of materials. Figure 2 shows the results of SEM study.

It can be seen that the naturally dried *Moringa oleifera* seed kernel is amorphous in nature with hips of fine particles which indicate availability of more surface area for adsorption. Sun-dried seed has agglomerated grains resulting in a flocculent structure. Oven-dried seed kernel is

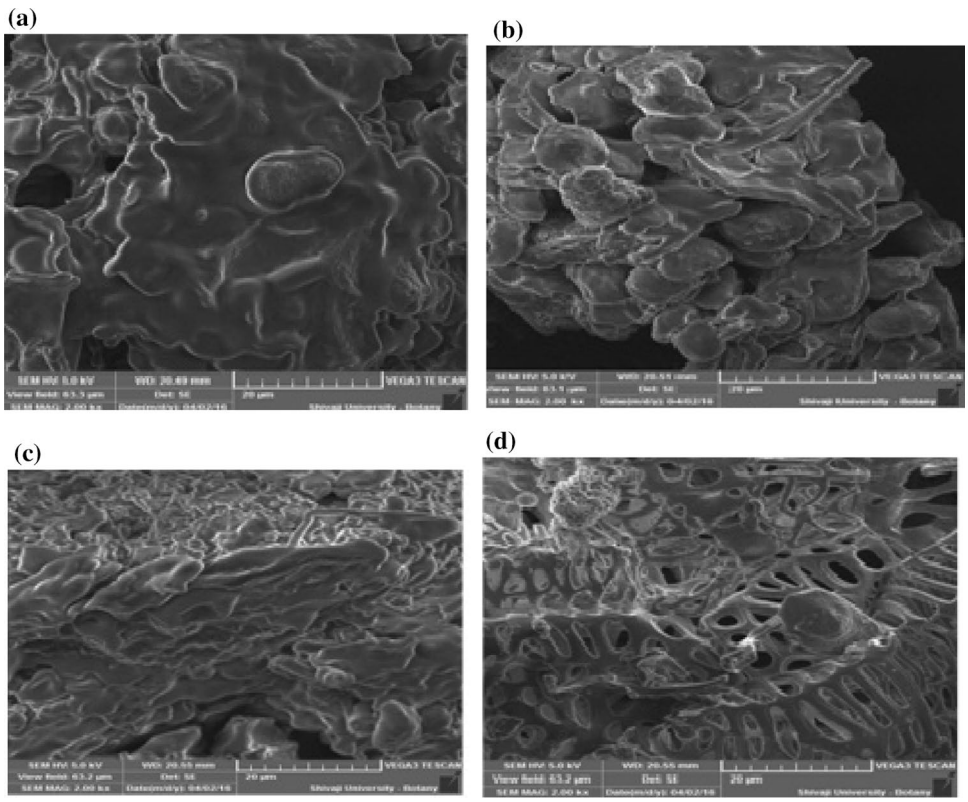


Fig. 2 Results of SEM study for **a** naturally dried; **b** sun-dried; **c** oven-dried; and **d** coat

relatively more porous compared to these two. Coat is highly porous with reticulated structure providing lesser sites for adsorption.

Further, the time required for drying of pods and its rate also plays a significant role in inducing quality ingredient (protein structure) and surface morphology of seed kernel. Sun-dried and oven-dried were subjected to 1 week and 2 h of drying time, respectively. Complete drying of pods in the tree naturally takes larger time and drying occurs gradually.

This surface morphology study and coagulation study reveal that naturally dried *Moringa oleifera* seed kernel has greater potential for turbidity removal. Hence, further study is carried out using naturally dried *Moringa oleifera* seed kernel.

Effect of Strength of *Moringa oleifera* and *Strychnos potatorum* extract on turbidity removal

The effect of varied strengths of *Moringa oleifera* extract was studied using 0.5, 1, 5, 10 and 15% extracts, for water sample of 26 NTU turbidity, and 100 mg/L dose of *Moringa oleifera*. Figure 3a shows the effect of *Moringa oleifera* strength on turbidity removal. It can be observed that although removal increases with increase in strength from 0.5 to 15%, the increase is not significant beyond 1%. Hence, 1% strength resulting in 88% removal was used for the further study. Figure 3b shows the turbidity removal with strength 1, 3, 5 and 8% of *Aloe Vera* for initial turbidity 32 NTU and *Aloe Vera* dose of 50 mg/L. It can be observed that *Aloe Vera* as a coagulant is not effective for turbidity removal. However, 1% strength is appropriate for *Aloe Vera* application as coagulant/coagulant aid. In case of *Strychnos potatorum* seeds, initial study for deciding dose range revealed that dose of 0.1–1 mg/L is sufficient for optimum turbidity removal. An extract of 0.1% was used considering the practical consideration of dose application. As lower dose application with higher strength extracts is not practicable, the strength effect study is not advisable for *Strychnos potatorum* seed extract.

Turbidity removal with *Moringa oleifera* and *Strychnos potatorum* seeds

Figure 4 shows the residual turbidity after applying varied dose of naturally dried seed kernel of *Moringa oleifera* for low, medium and high turbid water. It can be observed that for low turbidity water residual turbidity increases with added dose of *Moringa oleifera*. The colloidal and suspended solids concentration is less for low turbidity water, excess dose results in increase in residual turbidity due to uncombined coagulant, as sufficient particles are not available to combine with coagulant protein. The optimum dose

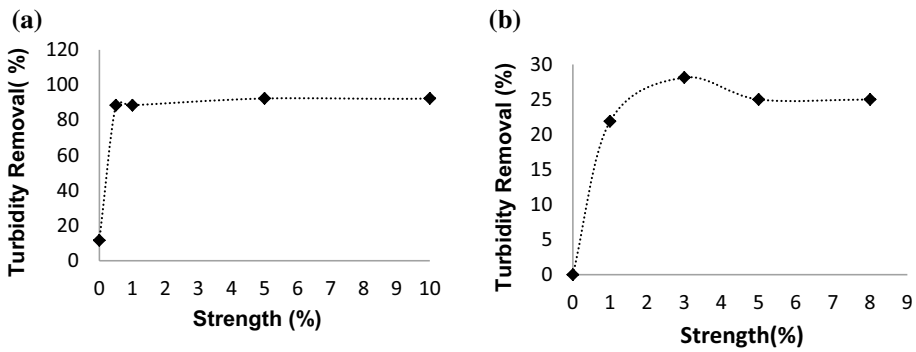


Fig. 3 Effect of strength of **a** *Moringa oleifera* extract and **b** *Aloe Vera* extract on turbidity removal

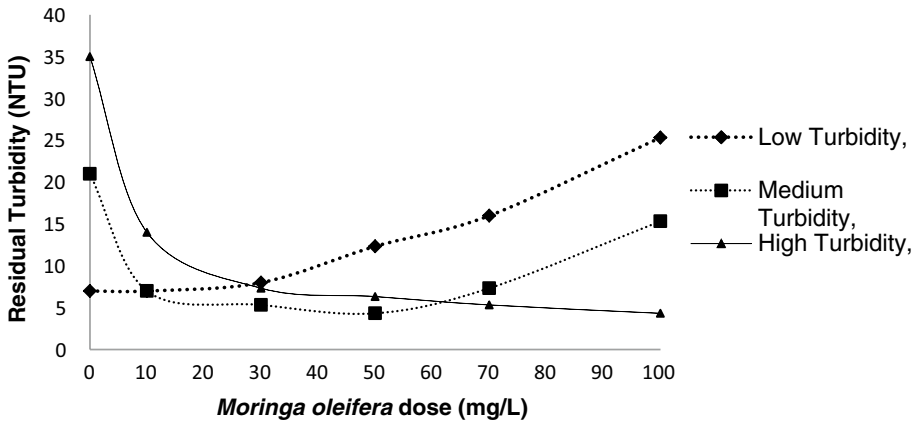


Fig. 4 Turbidity removal by naturally dried *Moringa oleifera* seed in (1) low, (2) medium and (3) high turbidity water

for medium and high turbidity samples was observed to be 50 and 100 mg/L, respectively, with turbidity removal efficiency of 80.95 and 88.57%. This indicates that coagulant dose required increases with initial turbidity for medium and high turbidity water, as more charged sites are necessary for adsorption and chemical bridging. After optimum dose the residual turbidity increases with added dose of coagulant, because of non-availability of sufficient number of particles for bridging with the charged sites of coagulant and turbidity increases due to suspended coagulant matter.

Figure 5 shows the effect of varied dose of *Strychnos potatorum* on turbidity removal for low, medium and high turbid water. The results show that the removal efficiency increases from high to low turbidity water and for maximum removal optimum dose was observed to be 0.8, 0.6 and 0.2 mg/L for high, medium and low turbidity water, respectively. Thereafter, residual turbidity increases insignificantly. The turbidity removal for low, medium and high turbidity samples was 71.42, 64.28 and 57.14%, respectively.

This study reveals that *Moringa oleifera* is not effective for low turbidity water, but *Strychnos potatorum* seeds show good results. For medium, *Moringa oleifera* is more effective coagulant for high turbidity water, as compared to *Strychnos potatorum.*

Effect of *Aloe Vera* as coagulant aid and as polymer with ballasting agents in turbidity removal

The efforts were taken to improve the efficiency of coagulation process by using *Aloe Vera* as a natural coagulant aid with *Moringa oleifera and Strychnos potatorum* as natural coagulants. Table 1 shows the comparison of optimum dosage of *Moringa oleifera*, when used with and without *Aloe Vera*. The results show that *Aloe Vera* is more effective as coagulant aid when used with *Moringa oleifera* for low turbidity water and relatively less effective for medium and high turbidity water. *Aloe Vera* acts as a polymer which possesses charged sites, to which micro-flocs formed with *Moringa oleifera* get attached, and large settleable flocs are formed.

This table also gives the optimum combination of *Moringa oleifera*, *Aloe Vera* and micro-sand for turbidity removal. It can be seen that the use of ballasting agent (micro-sand) with *Aloe Vera* has enhanced the turbidity removal. The dosage of *Moringa oleifera* is also reduced for medium and high turbidity water. This is due to improved settling conditions with increase in weight of flocs. Addition of polymer leads to branched floc formation and sand provides surface area for floc formation. The micro-flocs formed lead to the formation of macro-flocs by attaching with micro-sand. The physical attachment and enmeshment followed by fast settling macro-flocs are the causes of enhanced turbidity removal.

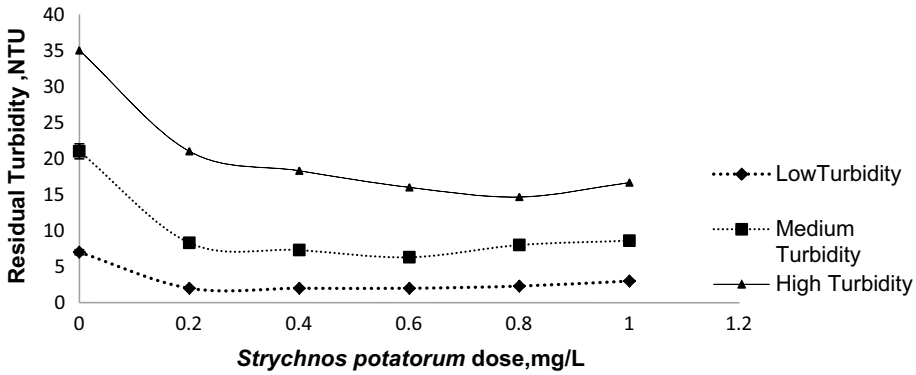


Fig. 5 Turbidity removal by *Strychnos potatorum* seed in (1) low, (2) medium and (3) high turbidity water

Table 1 Turbidity removal by *Moringa oleifera (MO)* with and without *Aloe Vera (AV)*; ballasted coagulation by *MO*, *AV*, and micro-sand

Initial turbidity	*MO*		*MO* + *AV*			*MO* + *AV* + micro-sand			
	Optimum dose (mg/L)	Res. turbidity (NTU)	Optimum dose (mg/L)		Residual turbidity (NTU)	Optimum dose			Residual turbidity (NTU)
			MO	AV		MO (mg/L)	AV (mg/L)	micro-sand (g/L)	
Low (7NTU)	10	7	10	10	4	10	10	0.5	3
Medium (21NTU)	50	4	50	10	3	30	10	1	2
High (35NTU)	100	4	100	10	3	70	10	1	2

Table 2 shows the comparison of optimum dosages of *Strychnos potatorum* with and without *AV*. The combination of *Strychnos potatorum* and *AV* did not give good results as compared with *MO* and *AV*. This may be due to *AV*, which bridges with some of the charged sites on coagulant protein, making them unavailable to the colloidal particles. At higher concentration of colloidal and suspended matter, the removal is more due to greater opportunity for contact to form large and readily settleable flocs. This table also shows that the use of micro-sand and *AV* as polymer with *Strychnos potatorum* improves turbidity removal for medium and high turbidity water, as compared with *Strychnos potatorum* alone. Although removal improves by this combination, post-treatment is necessary to reduce the turbidity below 1 NTU.

Table 3 shows the results of ballasted coagulation with *MO*, *AV* and powdered activated carbon (PAC). It can be seen that the use of PAC as ballasting agent with *MO and AV* has resulted in residual turbidity of 1 NTU or below 1 NTU for all types of turbid water. The larger surface area and surface texture of PAC particles, coating with *Aloe Vera*, formation of micro-flocs induced by *MO* with nucleus of PAC, and adsorption of colloidal particles contribute to improved turbidity removal. The results of ballasted coagulation by *SP*, *AV* and PAC given in Table 1 show enhanced turbidity removal but resulting residual turbidity is 2 NTU or below 2 NTU.

Table 2 Turbidity removal by *Strychnos potatorum (SP)* with and without *AV*; and ballasted coagulation by *SP*, *AV*, and micro-sand

Initial turbidity	*SP*		*SP* + *AV*			*SP* + *AV* + micro-sand			
	Optimum dose (mg/L)	Residual turbidity, NTU	Optimum dose (mg/L)		Residual turbidity, NTU	Optimum dose			Residual Turbidity, NTU
			SP	*AV*		*SP* (mg/L)	*AV* (mg/L)	Micro-sand (g/L)	
Low (7NTU)	0.2	2	0.2	10	5	0.4	40	1	3
Medium (21NTU)	0.6	6	0.6	10	11	1	50	0.8	3
High (35NTU)	0.8	15	0.8	20	7	0.6	10	0.6	2

Table 3 Turbidity removal by *MO*, *AV* and PAC; and *SP*, *AV* and PAC

Initial turbidity, NTU	*MO* + *AV* + *PAC*				*SP* + *AV* + *PAC*			
	Optimum dose			Res. turbidity, NTU	Optimum dose			Residual turbidity, NTU
	MO (mg/L)	*AV* (mg/L)	PAC (g/L)		*SP* (mg/L)	*AV* (mg/L)	PAC (g/L)	
Low (7NTU)	30	70	0.5	0	0.4	40	0.5	1
Medium (21NTU)	70	30	0.5	0	0.4	10	0.2	2
High (35NTU)	100	30	0.1	1	0.2	50	0.5	1

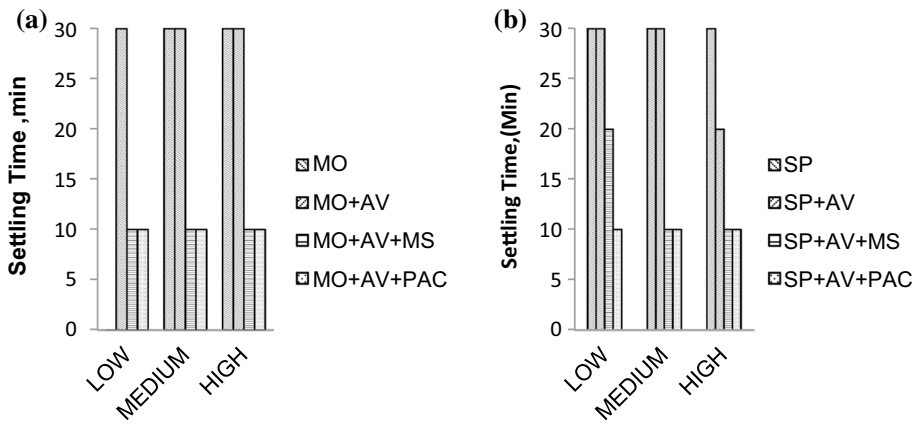


Fig. 6 Effect on settling time by use of **a** *MO*, **b** *SP* with and without micro-sand and PAC

Effect on settling time in ballasted coagulation

Figure 6 shows the effect on settling time in ballasted coagulation with micro-sand and PAC. The residual turbidity was measured after coagulation–flocculation for 10, 20 and 30 min of settling. It can be observed that the use of ballasting agents micro-sand or PAC reduces settling time from 30 to 10 min for obtaining residual turbidity below 4 NTU, as compared with *MO*, and *MO* + *AV* for all three categories of turbid water. Dose of *MO* increased the residual turbidity for low turbidity water, hence the effect on settling time was not considered.

Figure 6 also shows that the use of micro-sand and PAC reduces settling time to 20 min, and 10 min, respectively, for low turbidity water to reduce residual turbidity to 3 NTU. The settling time was reduced to 10 min for medium and high turbidity water by both micro-sand and PAC for obtaining residual turbidity of 6 NTU. Settling time was observed to be 30 min without the use of ballasting agents.

Addition of polymer in treatment leads to branched floc formation and addition of sand/PAC increases weight of the flocculated particles leading to faster settling of suspended solids. The polymer binds the sand/PAC to the floc, thereby avoiding dispersed floc. The reduction in settling time is significant as high-rate clarifiers such as tube/plate/lamella settlers can be used in separation.

Effect of Aloe Vera on dosages of *MO and SP* in ballasted coagulation

Figure 7a shows reduction in *MO* dose, with *AV* and ballasting agents. It can be seen that the dose of *MO* was reduced to 30 mg/L, 10 mg/L and 10 mg/L for high, medium and low turbidity water for obtaining residual turbidity of 4 NTU, respectively. The dose reduction is due to improved coagulation, flocculation and settling of particles, with the aid of polymer and ballasting agents.

Figure 7b shows reduction in *SP* dose, when used in combination with *AV* and ballasting agents to reduce the residual turbidity below 4 NTU. The ballasting agents are effective with coagulant and polymer, even for low turbidity water. The study shows that ballasting agents reduce the time and quantity of coagulant required for water treatment.

Conclusions

1. The coagulation study with various forms of kernel and parts of *Moringa oleifera* seed revealed that the naturally dried *Moringa oleifera* seed kernel has more potential for turbidity removal, with removal efficiency of 88.57%, when compared with sun-dried and oven-dried seed kernel and coat with removal efficiencies as 58, 48 and 36%, respectively.
2. The study on effect of naturally dried *Moringa oleifera* seed extract strength revealed that 1% extract gives 88% turbidity removal. Strength of 1% *Aloe Vera* leaf pulp solution was found to be more effective for turbidity removal; however, the study revealed that *Aloe Vera* is not an effective coagulant.
3. *Moringa oleifera* is not effective for low turbidity water, but it is effective for medium and high turbidity water. The optimum dose of *Moringa oleifera* for medium and high turbidity water was 50 and 100 mg/L, respectively, with turbidity removal of 80.95 and 88.57%.
4. *Strychnos potatorum* is effective for low, medium and high turbidity water, although the removal efficiency is less as compared with *Moringa oleifera* for medium and high turbidity water. The optimum dose of *Strychnos potatorum* for low, medium and high turbidity water was 0.2, 0.6, and 0.8 mg/L, respectively, with turbidity removal as 71.42, 64.28 and 57.14%.
5. *Aloe Vera* acts as a coagulant aid with *Moringa oleifera* and is effective for low turbidity water with removal up to 40%; however, its effect is lesser for medium and high turbidity water.
6. The ballasted coagulation with *Moringa oleifera/Strychnos potatorum*, micro-sand and *Aloe Vera* increases turbidity removal by 5–10% when compared to conventional coagulation with *Moringa oleifera.*

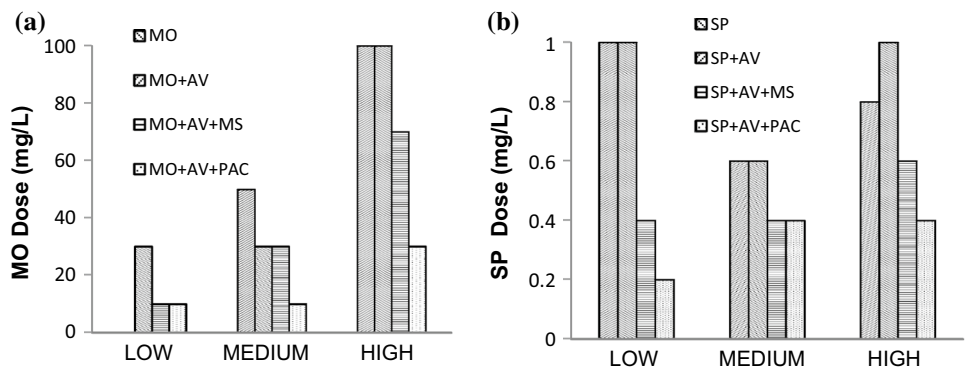


Fig. 7 Effect of *AV* and ballasting agents on dose of **a** *MO*, and **b** *SP*

7. The use of PAC as ballasting agent and *Aloe Vera* as natural polymer, with the coagulant *Moringa oleifera*, *or Strychnos potatorum* is most effective in reducing the turbidity of low, medium and high turbidity water samples below 1 NTU.
8. The use of ballasting agent as micro-sand or PAC reduces the settling time required for settling of flocs, by increasing the weight of flocs. The reduction in settling time is by 10–20 min. The ballasting agents reduce the coagulant dose by 20–70 mg/L with *Moringa oleifera* and 0.2–0.6 with *Strychnos potatorum.*
9. The study revealed that the coagulation with *Moringa oleifera* and *Strychnos potatorum* is a cost-effective alternative, particularly for rural area. The ballasting agents reduce the quantity of coagulant and time required for water treatment.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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