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Contents

Handwritten Digit Recognition using Convolutional Neural Network

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Abstract: ***Convolutional neural networks (CNNs) are multilayer neural networks with two or more hidden layers. Convolutional neural networks are widely used in image classification, content prediction, face identification, language classification, and recognition, among other applications. This research uses a convolutional neural network to offer a neural network technique for handwritten digit recognition. For handwritten digit recognition, the MNIST dataset is used. This collection comprises 70,000 photographs, each of which is 28x28 pixels in size. It includes 60,000 photographs of training and 10,000 photos of testing. Our objective is to observe the accuracy and loss at each step to classify handwritten digits and make comparison on the basis of epochs. We will also compare the accuracy of the model by using different optimizers.***

Keywords: **Convolutional neural network, Deep learning, Optimizers, Handwritten digit.**

I. INTRODUCTION

The capacity of computers to detect human handwritten digits is known as handwritten digit recognition. It is not an easy task for a machine to recognize different digits; machines are trained properly by going through various stages in order to provide results with accuracy. Handwritten digit recognition is broadly utilized in the automatic processing of bank cheques, postal addresses, cheque truncation system scanning, etc.

Convolutional neural networks (CNN), recurrent neural networks (RNN), artificial neural networks (ANN), and other forms of deep learning neural networks are essentially revolutionising the way humans interact with the outside world. Convolutional neural networks have an advantage over other types of neural networks in that they can learn filters without explicitly specifying them. These filters aid in the extraction of the most relevant and appropriate characteristics from the incoming data. The spatial characteristics of a picture are captured by CNN. These characteristics are the pixel arrangement and their interrelation within the picture. They help us to properly recognise an item, its area, and its connection to other things in the image.

MNIST is a dataset that includes 60,000 training pictures of the 10 digits (0-9) in 28x28 size, as well as 10,000 images constitute a test set. With the development of modern machine learning techniques, MNIST continues to be a trusted resource for researchers and learners. In this study, we use the MNIST dataset to train a CNN architecture with activation functions like Rectified Linear Unit and Softmax in order to detect handwritten digits.

II. LITERATURE REVIEW

A lot of techniques have been developed to deal with digit recognition. Different neural networks and machine learning approaches have made a difference to test a model's performance. Using neural networks, several researchers are attempting to enhance accuracy while reducing error. The Convolutional Neural Network (CNN) is widely used for image classification, video prediction and analysis, and other tasks.

CNN has demonstrated exceptional abilities in Chinese handwritten text recognition [5], handwritten character recognition in Indic scripts [4], handwritten Urdu content recognition and Telugu character recognition [3], handwritten Tamil character recognition [2], and offline handwritten Arabic character recognition [1].

In 1999, a novel sort of cascade neural network was used to combine segmentation and recognition methods [6]. The suggested technique has a stronger discrimination and generalisation capacity than earlier integrated segmentation and recognition methods, according to the experimental findings. Furthermore, the suggested method's network size is less than that of previous solutions.

M.Ghosh has compared three sorts of neural networks DNN, DBN and CNN [7]. The findings demonstrate that Deep Neural Network with the accuracy of 98.08% is the most accurate algorithm. But that it takes longer time to execute than Convolutional Neural Network. Because of the similarities in digit forms, each method, on the other hand, has a 1-2 percent error rate.

"Handwritten digit recognition using machine learning algorithms" by Mohammad Badrul Alam Miah, S M Shamim, Abdullah Al Jobair, Masud Rana and Angona Sarker reveals that Multilayer Perceptron achieves the highest accuracy of 90.37 percent when compared to other machine learning algorithms algorithms such as Random tree, Random Forest, Bayes Net, Naïve Bayes, and Support Vector Machine [8].

A.H. Jalbani and S.A. Awan offer Handwritten Sindhi Character Recognition Using Neural Networks as one of the first stages in identifying Sindhi handwritten characters [9]. The subjects' isolated characters written in Sindhi script were identified. Vertical projection was used to segment the characters. A neural network has been used to classify the data. The suggested method's experimental findings demonstrate that using a neural network, an accuracy of 85 percent may be reached.

III. RESEARCH METHODOLOGY

A. Convolutional Neural Network

A neural network which includes two or more layers and are used basically for processing, classification and segmentation of images is called Convolutional Neural Network. Basically, there are three layers in CNN those are convolutional and pooling (part of Feature Extraction) and fully connected layers (part of classification).

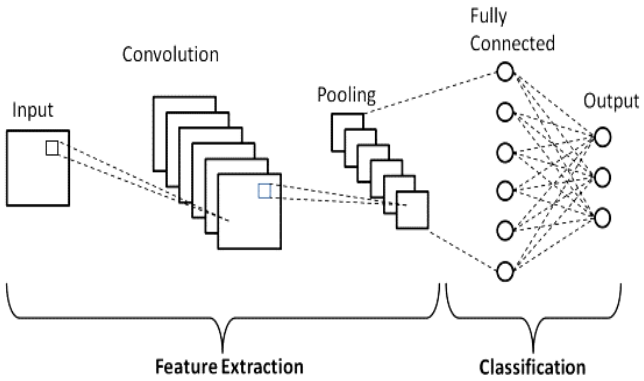

Fig. 1. Basic CNN Architecture

B. Convolutional Layer

This is the first layer, which aids in the extraction of several characteristics from the input images. A convolution operation is performed between the input picture and a filter of a specific size, such as NxN. With reference to filter size (NxN), the dot product between the filter and the sections of the input picture is taken. To get information about image edges and corners, a feature map is present which is fed to other layers to get information about other input image features.

C. Pooling Layer

It is the second layer, which decrease the feature map size and reduce computational costs. Different forms of pooling operations exist. The operations of maximum pooling and average pooling are commonly employed. Average pooling takes the average of the components in a predetermined sized picture area, whereas max pooling takes the largest element from the feature map. Sum pooling computes the total sum of the components inside a designated segment. Between convolutional and fully connected layers, a pooling layer acts as a link.

D. Fully Connected Layer

This layer serves as a link between two separate layers of neurons. The previous layers' input images are flattened and delivered to the fully connected layer. The classification process begins at this point.

E. Activation Functions

It is a very important feature in neural networks. An activation function decides whether the neurons needs to be activated or not if no need to do so. A lot of activation function are used such as ReLU, Softmax, sigmoid functions, etc. Each activation function has specific usage. Softmax is mostly utilized for multi-class classification.

F. Optimizers

Optimizers are used to alter the attributes of the neural network such as weights and learning rate in order to decrease the losses. Optimization tactics aid in the reduction of losses and the provision of the most precise outcomes feasible.

- ADAM – Adam is a deep neural network training technique that uses adaptive learning rate optimization. It has high performance in terms of training speed [10]. This strategy is exceptionally effective in managing while working with large issues including a lot of data or parameters. It requires less memory and is efficient.
- ADAGRAD – Adagrad is an adaptive optimizer that changes learning rates based on the frequency of parameter updates during training. We make bigger updates for parameters that are only used once in a while and smaller updates for values that are used often. Adagrad eliminates the need to adjust the learning rate manually.
- ADADELTA – Adadelta is an Adagrad modification that aims to lessen Adagrad's aggressiveness by monotonically decreasing the learning rate [11]. We don't need to set the default learning rate in Adadelta since we use the ratio of the previous time steps' running average to the current gradient.
- RMSPROP – It's an adaptive learning rate optimization approach called Root Mean Square Prop. For each weight, RMSprop takes the moving average of the squared gradients and divides the gradient by the square root of the mean square. This is why it's referred to as RMSprop. It also trains neural networks at fast speed.
- SGD – A kind of gradient descent is stochastic gradient descent. SGD only works with a small subset or a random sample of data instances. When the learning rate is modest, SGD delivers the same results as normal gradient descent. On large datasets [12], SGD can converge faster

than batch training because it performs updates more frequently.

IV. DATASET

MNIST Dataset is a collection of images having 28x28 pixel sizes. This collection has a total of 70,000 photos. There are 60,000 photos in the training set and 10,000 images in the testing set. This dataset is often used to recognise handwritten digits.

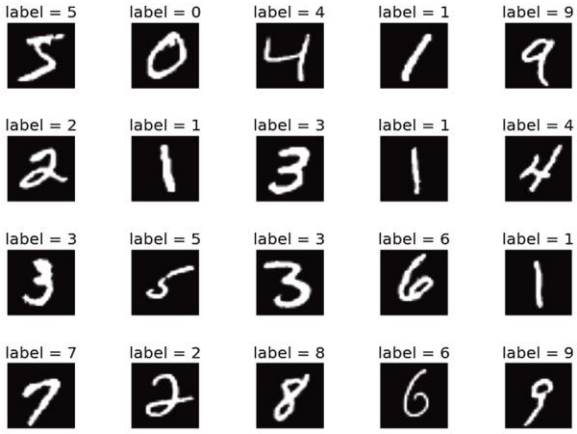

Fig. 2. MNIST Dataset Sample Images

V. RESULTS

Using MNIST dataset and applying convolutional neural network to the model, we have found the test losses and accuracy by using different optimizers in the model. A total of five different optimizers namely Adam, Adadelta, Adagrad, SGD and RMSProp have been compared on the basis of loss and accuracy. Test loss and accuracy have been observed by using five different optimizers for 11 epochs.

Table 1 shows test loss at first and eleventh epoch as well as accuracy percentage at first and eleventh epoch for recognizing handwritten digits.

First case shows adam optimizer where minimum test loss at epoch 1 is 0.2619 which improved after 11 epochs to 0.0136 and achieved maximum accuracy of 99.51% after 11 epochs. Refer to [Figure 3]. In second case, adadelta optimizer is used where accuracy after 11 epochs is about 75% which is comparatively less as shown in [Figure 4]. Next case shows that adagrad optimizer is used as shown in [Figure 5], test loss has decreased from 1.9139 to 0.3528 while the accuracy after 11 epochs is 90.27%. After that we have used SGD optimizer in the next case and achieved exactly 95% accuracy and test loss is decreased to 0.1740. Refer to [Figure 6] for SGD optimizer.

In the last case, RMSProp optimizer is used where the test loss is decreased from 0.2652 to 0.0212 while the accuracy has improved from 92.22% to 99.41% after 11 epochs as shown in [Figure 7].

To achieve the performance, optimizers such as Adam, Adadelta, Adagrad, SGD, and RMSProp were employed. As can be seen, Adam optimizer achieves the maximum accuracy of 99.51 percent. RMSProp optimizer worked admirably as well, coming in second place in terms of accuracy after Adam. In all situations, it can be shown that training using the optimizer improves the classifier's accuracy.

TABLE 1: COMPARISON OF DIFFERENT OPTIMIZERS ON THE BASIS OF LOSS AND ACCURACY

S. No	Optimizer Used	Test Loss (Epoch = 1)	Test Loss (Epoch = 11)	Accuracy (%) (Epoch = 1)	Accuracy (%) (Epoch = 11)
1.	Adam	0.2619	0.0136	92.45	99.51
2.	AdaDelta	2.2928	1.5516	13.24	75.49
3.	AdaGrad	1.9139	0.3528	54.04	90.27
4.	SGD	1.0630	0.1740	74.80	95.00
5.	RMSProp	0.2652	0.0212	92.22	99.41

VI. CONCLUSION

In this paper, different optimizers were compared on the basis of loss and accuracy to recognize handwritten digits. The variations were observed for 11 epochs to determine the maximum accuracy. The minimum and maximum test loss and accuracy was observed for different optimizers. All the five cases give different results for accuracy. Finally, the maximum accuracy of 99.51% was achieved by using Adam optimizer. Also the least loss was detected by using Adam optimizer as compared to other optimizers. Because of the reduced loss, CNN will be able to achieve higher image resolution. Adam optimizer gave the maximum accuracy after 11 epochs for the

MNIST dataset while other optimizers were not able to overcome by giving more accuracy.

VII. FUTURE SCOPE

In future, a model can be developed which not only recognize hand written digit but also it would predict the hand written alphabets and after that we can extend the model for paragraph too.

We will test our model with different hidden layers and try to increase its accuracy by increasing or decreasing its different layers of convolution neural networks which are highly responsible for accuracy. By using different convolution neural network architectures such as CNN-RNN, CNN-HMM and hybrid CNN models, we will test each model individually on kernel size, learning rate and batch size.

```
model = tf.keras.models.Sequential()
model.add(tf.keras.layers.Flatten())
model.add(tf.keras.layers.Dense(128,activation=tf.nn.relu))
model.add(tf.keras.layers.Dense(128,activation=tf.nn.relu))
model.add(tf.keras.layers.Dense(10,activation=tf.nn.softmax)) # softmax for probability distribution
model.compile(optimizer = "adam" , loss = 'sparse_categorical_crossentropy' , metrics = ['accuracy'] )
model.fit(x_train,y_train,epochs = 11 )
predictions = model.predict([x_test])
```

```
Epoch 1/11
1875/1875 [==============================] - 4s 2ms/step - loss: 0.2619 - accuracy: 0.9245
Epoch 2/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.1081 - accuracy: 0.9674
Epoch 3/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.0739 - accuracy: 0.9768
Epoch 4/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.0540 - accuracy: 0.9824
Epoch 5/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.0406 - accuracy: 0.9872
Epoch 6/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.0320 - accuracy: 0.9892
Epoch 7/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.0253 - accuracy: 0.9917
Epoch 8/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.0218 - accuracy: 0.9930
Epoch 9/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.0194 - accuracy: 0.9934
Epoch 10/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.0157 - accuracy: 0.9944
Epoch 11/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.0136 - accuracy: 0.9951
```

Fig. 3. Loss and Accuracy using Adam Optimizer

```
model = tf.keras.models.Sequential()
model.add(tf.keras.layers.Flatten())
model.add(tf.keras.layers.Dense(128,activation=tf.nn.relu))
model.add(tf.keras.layers.Dense(128,activation=tf.nn.relu))
model.add(tf.keras.layers.Dense(10,activation=tf.nn.softmax)) # softmax for probability distribution
model.compile(optimizer = "Adadelta" , loss = 'sparse_categorical_crossentropy' , metrics = ['accuracy'] )
model.fit(x_train,y_train,epochs = 11 )
predictions = model.predict([x_test])
```

```
Epoch 1/11
1875/1875 [==============================] - 4s 2ms/step - loss: 2.2928 - accuracy: 0.1324
Epoch 2/11
1875/1875 [==============================] - 3s 2ms/step - loss: 2.2402 - accuracy: 0.2266
Epoch 3/11
1875/1875 [==============================] - 3s 2ms/step - loss: 2.1865 - accuracy: 0.3592
Epoch 4/11
1875/1875 [==============================] - 3s 2ms/step - loss: 2.1283 - accuracy: 0.4908
Epoch 5/11
1875/1875 [==============================] - 3s 2ms/step - loss: 2.0639 - accuracy: 0.5794
Epoch 6/11
1875/1875 [==============================] - 3s 2ms/step - loss: 1.9925 - accuracy: 0.6382
Epoch 7/11
1875/1875 [==============================] - 3s 2ms/step - loss: 1.9140 - accuracy: 0.6762
Epoch 8/11
1875/1875 [==============================] - 3s 2ms/step - loss: 1.8288 - accuracy: 0.7046
Epoch 9/11
1875/1875 [==============================] - 3s 2ms/step - loss: 1.7390 - accuracy: 0.7244
Epoch 10/11
1875/1875 [==============================] - 3s 2ms/step - loss: 1.6459 - accuracy: 0.7406
Epoch 11/11
1875/1875 [==============================] - 3s 2ms/step - loss: 1.5516 - accuracy: 0.7549
```

Fig. 4. Loss and Accuracy using Adadelta Optimizer

```
model = tf.keras.models.Sequential()
model.add(tf.keras.layers.Flatten())
model.add(tf.keras.layers.Dense(128,activation=tf.nn.relu))
model.add(tf.keras.layers.Dense(128,activation=tf.nn.relu))
model.add(tf.keras.layers.Dense(10,activation=tf.nn.softmax)) # softmax for probability distribution
model.compile(optimizer = "Adagrad" , loss = 'sparse_categorical_crossentropy' , metrics = ['accuracy'] )
model.fit(x_train,y_train,epochs = 11 )
predictions = model.predict([x_test])
```

```
Epoch 1/11
1875/1875 [==============================] - 3s 2ms/step - loss: 1.9139 - accuracy: 0.5404
Epoch 2/11
1875/1875 [==============================] - 3s 2ms/step - loss: 1.0459 - accuracy: 0.7904
Epoch 3/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.6866 - accuracy: 0.8369
Epoch 4/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.5540 - accuracy: 0.8587
Epoch 5/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.4856 - accuracy: 0.8725
Epoch 6/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.4435 - accuracy: 0.8817
Epoch 7/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.4146 - accuracy: 0.8887
Epoch 8/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.3935 - accuracy: 0.8932
Epoch 9/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.3771 - accuracy: 0.8965
Epoch 10/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.3639 - accuracy: 0.9003
Epoch 11/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.3528 - accuracy: 0.9027
```

Fig. 5. Loss and Accuracy using Adagrad Optimizer

```
model = tf.keras.models.Sequential()
model.add(tf.keras.layers.Flatten())
model.add(tf.keras.layers.Dense(128,activation=tf.nn.relu))
model.add(tf.keras.layers.Dense(128,activation=tf.nn.relu))
model.add(tf.keras.layers.Dense(10,activation=tf.nn.softmax)) # softmax for probability distribution
model.compile(optimizer = "SGD" , loss = 'sparse_categorical_crossentropy' , metrics = ['accuracy'] )
model.fit(x_train,y_train,epochs = 11 )
predictions = model.predict([x_test])
```

```
Epoch 1/11
1875/1875 [==============================] - 3s 2ms/step - loss: 1.0630 - accuracy: 0.7480
Epoch 2/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.3948 - accuracy: 0.8890
Epoch 3/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.3225 - accuracy: 0.9076
Epoch 4/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.2867 - accuracy: 0.9173
Epoch 5/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.2613 - accuracy: 0.9252
Epoch 6/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.2412 - accuracy: 0.9304
Epoch 7/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.2243 - accuracy: 0.9355
Epoch 8/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.2091 - accuracy: 0.9397
Epoch 9/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.1960 - accuracy: 0.9436
Epoch 10/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.1846 - accuracy: 0.9467
Epoch 11/11
1875/1875 [==============================] - 3s 2ms/step - loss: 0.1740 - accuracy: 0.9500
```

Fig. 6. Loss and Accuracy using SGD Optimizer

```
model = tf.keras.models.Sequential()
model.add(tf.keras.layers.Flatten())
model.add(tf.keras.layers.Dense(128,activation=tf.nn.relu))
model.add(tf.keras.layers.Dense(128,activation=tf.nn.relu))
model.add(tf.keras.layers.Dense(10,activation=tf.nn.softmax)) # softmax for probability distribution
model.compile(optimizer = "RMSprop" , loss = 'sparse_categorical_crossentropy' , metrics = ['accuracy'] )
model.fit(x_train,y_train,epochs = 11 )
predictions = model.predict([x_test])
```

```
Epoch 1/11
1875/1875 [==============================] - 4s 2ms/step - loss: 0.2652 - accuracy: 0.9222
Epoch 2/11
1875/1875 [==============================] - 4s 2ms/step - loss: 0.1159 - accuracy: 0.9657
Epoch 3/11
1875/1875 [==============================] - 4s 2ms/step - loss: 0.0852 - accuracy: 0.9749
Epoch 4/11
1875/1875 [==============================] - 4s 2ms/step - loss: 0.0684 - accuracy: 0.9806
Epoch 5/11
1875/1875 [==============================] - 4s 2ms/step - loss: 0.0563 - accuracy: 0.9836
Epoch 6/11
1875/1875 [==============================] - 4s 2ms/step - loss: 0.0473 - accuracy: 0.9863
Epoch 7/11
1875/1875 [==============================] - 4s 2ms/step - loss: 0.0406 - accuracy: 0.9886
Epoch 8/11
1875/1875 [==============================] - 4s 2ms/step - loss: 0.0359 - accuracy: 0.9896
Epoch 9/11
1875/1875 [==============================] - 4s 2ms/step - loss: 0.0299 - accuracy: 0.9921
Epoch 10/11
1875/1875 [==============================] - 4s 2ms/step - loss: 0.0259 - accuracy: 0.9926
Epoch 11/11
1875/1875 [==============================] - 4s 2ms/step - loss: 0.0212 - accuracy: 0.9941
```

Fig. 7. Loss and Accuracy using RMSProp Optimizer

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E-Bike Speed Controller and Battery Management System

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Abstract: ***With rapid growth in the carbon emissions from continuously increasing number of conventional vehicles running on petrol and diesel, there has been a requirement of an alternative which can help reduce the carbon emissions given its also economical. Electrical vehicles come out to be the first option, running on rechargeable batteries, which when used with a number of cells in a battery pack and battery management system can prove not only reliable but also economical in the long run. The other important part of the electrical vehicle is the motor, a BLDC motor is used in this project which runs on 24 volts with a power rating of 250 watts. The E-bike controller circuit acts as an interface between the motor and battery pack, it helps to control the speed of the BLDC motor and also for the braking. The system cannot only be used to make reliable and economical e-bikes but can also be used as a conversion kit to make bicycles to e-bikes.***

Keywords: electrical vehicles, battery pack, battery management system, BLDC motor, E-bike controller, e-bike.

I. INTRODUCTION

The project explains a purposed electric bike system that runs on li-ion batteries to power the BLDC motor. The designed system is the basic block of an electric vehicle[1] which are same for every electrical vehicle, it varies depending on the required application. The circuits and layouts of e-bike is designed. It provides a reliable and unique way of battery management system. Its design also integrates BLDC motor control circuit which is responsible for controlling and braking of the brushless DC motor. The controller and motor in the system will be powered using a rechargeable battery pack and battery pack is charged with the help of a battery management system[2], which ensures equal voltage level across all the cells of the battery pack. This product will cater to vast number of people who use conventional automobile vehicles and are ready to switch to more economical and immaculate ways of commuting.

II. BACKGROUND

A. BLDC motor

Brushless DC motor are compact yet powerful system, can be controlled by high performance drivers to offer excellent power savings and speed stability as well as wide speed control range.[3] BLDC motor can make systems more compact and still providing high power due to the strong permanent magnets being used in the rotor. This makes it most suitable type of motor for light weight e- bikes. The only down sight of these motors is that they aren't able to provide high amount of torques.

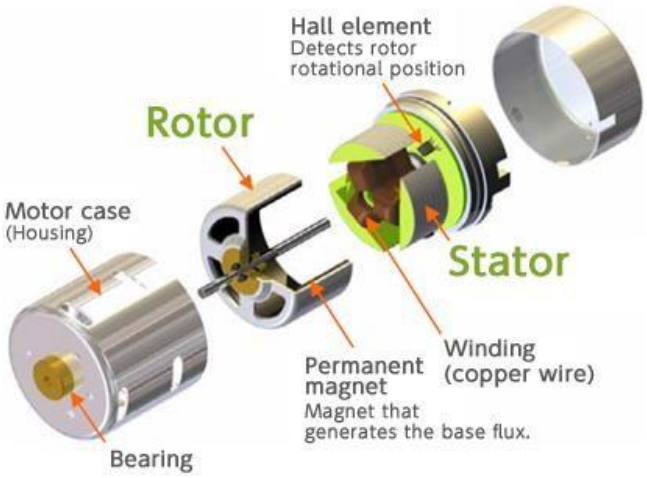

Fig. 1. A detailed diagram of outer rotot type BLDC motor

B. Power MOSFET

Advanced processing techniques are used in Power MOSFETS to obtain extraordinarily low on-resistance per silicon area. This advantage, combined with the quick switching and ruggedized device architecture of HEXFET power MOSFETs, offers the designer with an incredibly efficient and dependable device for usage in a wide range of applications. Power MOSFETs are a kind of metal oxide semiconductor field effect transistor. It has been specifically created to deal with high-level powers. Power MOSFETs are built in a V configuration. As a result, it is also known as a V-MOSFET or VFET. The V configuration of power MOSFET's is shown in the fig.2.

In this project IRF2807 power MOSFET is deployed for the operation of three phase bridge used in controlling the e-bike.

It is a N-channel MOSFET, N-channel MOSFET find use in circuit applications where high- power switching is required. Unlike transistors which require high current drive signals to turn fully on, MOSFET's can be turned on with drive signals above the gate threshold voltage of the MOSFET which is usually around 4 volts. A voltage of up to 10V is normally required to turn a MOSFET completely on. Because the gate terminal of a MOSFET behaves like a capacitor, the driving signal must have enough current to charge and discharge the gate capacitor quickly in order to switch on and off the MOSFET at high speeds.

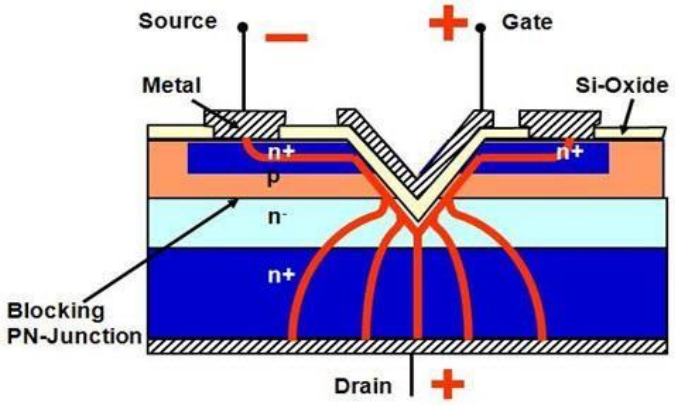

Fig. 2. Cross sectional diagram showing V configuration of power MOSFET

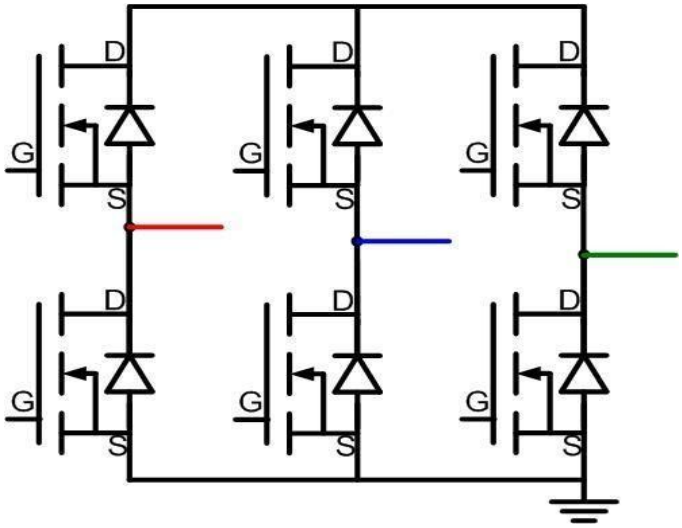

Fig. 3. Three phase MOSFET bridge used to drive BLDC motor

C. Microcontroller

In an embedded system, a microcontroller is a small integrated circuit that governs a certain operation. On a single chip, a typical microcontroller contains a processor, memory, and input/output peripherals. In this project Arduino Mega 2560 microcontroller module is used.

The ATmega2560 microcontroller is at the heart of the Arduino Mega 2560 Rev3 microcontroller board. On the board, there are a total of 54 digital I/O pins, 15 of which are used as PWM pins. The board is equipped with 15 analogue pins. The board has four serial ports, one SPI port, and one I2C communication port.

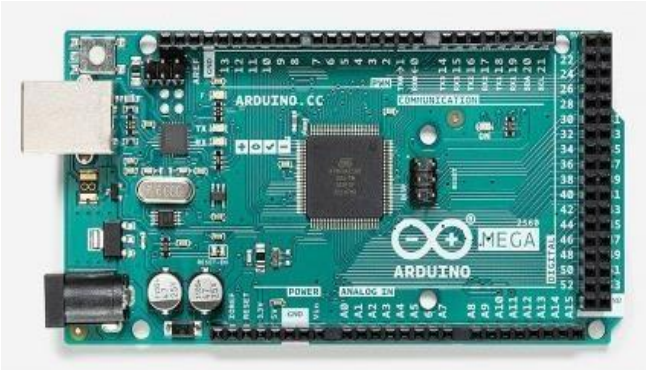

Fig. 4. Arduino Mega 2560

The project also uses Arduino Pro Mini in the battery management system, it takes voltage measurement across cells as input and helps balancing it across all the cells. The ATmega328 is the basis for the Arduino Pro Mini, a microcontroller board.

It has 14 digital input/output ports (six of which are PWM outputs), six analogue inputs, an installed resonator, a reset button, and pin header mounting holes. To give USB power and communication to the board, a six-pin header can be linked to an FTDI cable or a Spark fun breakout board. The Arduino Pro Mini is designed to be installed in objects or exhibitions on a semi-permanent basis. The board comes without pre-installed headers, allowing for a wide range of connections or direct wire soldering. The pin layout is Arduino Mini compliant. The Pro Mini is available in two variants. One operates at 3.3V and 8 MHz, while the other operates at 5V and 16 Mhz.

Fig. 5. Arduino Mega 2560

III. PROPOSED SYSTEM

A. E-Bike Controller

E-bike controller is the main power electronic that acts as a controlling interface between the motor and the battery. It is responsible for the speed control of the motor and it's braking too. In this system the controller can be operated by two means either by throttle control or pedal assist. In case of throttle control, the operation is similar as it's there in a conventional two-wheeler, when the throttle is engaged it powers and propels the bike forward. The throttle engagement can be adjusted by user to adjust speed in the same ways as it's done the conventional two- wheeler. In case of pedal assist your electric bike that provides power from the motor to help you pedal easier motor to help you pedal easier and move faster. When you activate pedal assist and select your level of assistance, the motor will deliver a specific amount of power while you pedal. As you bike, you may sense a tiny push. Pedal assist differs from throttle mode in that it requires riders to pedal in addition to receiving engine power. The throttle mode eliminates the need to peddle and instead relies entirely on the motor to propel the bike ahead.

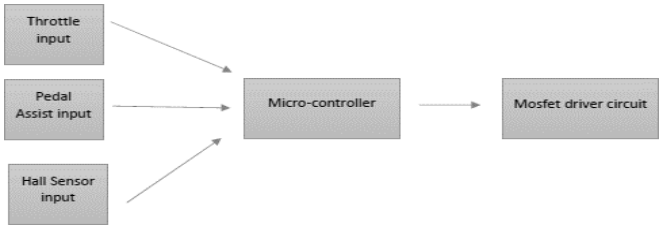

Fig. 6. E-Bike controller block diagram

B. Battery Management System

Battery management system (BMS)[4] is the power input to the system it takes the AC power supply and helps charging the battery ensuring cell balancing i.e., equalizing voltages across the cells and state of charge among the cells when they fully charged.

No two cells are identical. There are always slight differences in the state of charge, self-discharge rate, capacity, impedance, and temperature characteristics[5]. An LCD is used to display the real-time current and voltage values. SMS also provides over-voltage and over- current protection.

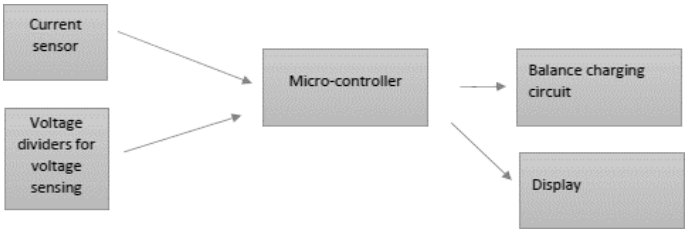

Fig. 7. Battery management system circuit diagram

C. BLDC motor control with Arduino

In this paper, there will be discussion about the programming that has been used in this project to program Arduino Mega.

There are two types of BLDC motors: sensor-based and sensor less. Hall effect sensors are used in sensor-based BLDC motors to determine rotor position, whereas BEMF (back electromotive force) is used in sensor-less BLDC motors. This topic shows how to drive a sensor-based BLDC motor using an Arduino MEGA board[6]. This project's BLDC motor is simply a PC CD-ROM motor (spindle motor).

The BLDC motor (sensor-based or sensor-less) is a three-phase DC motor with three stator core windings. A spinning electric field is created by energizing two coils at the same time. This system is simple to implement, but the excitation on the stator must be sequenced in a certain manner while knowing the exact position of the rotor magnets to prevent the permanent magnet rotor from locking with the stator.

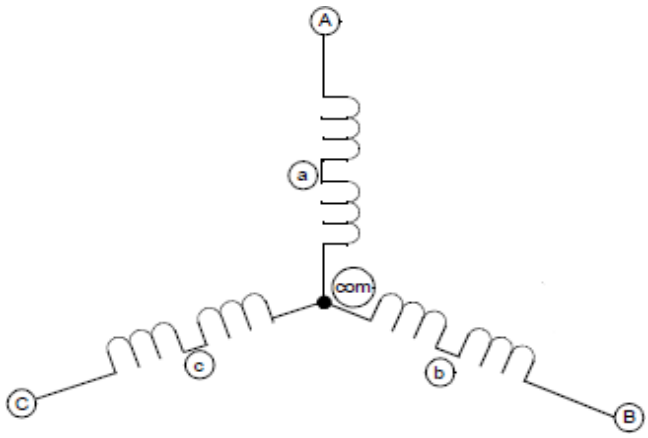

Fig. 8. Three phase winding in BLDC Motor

We will need a 3-phase bridge to drive this motor, and the 6 MOSFETs are the key components. The 3-phase bridge's general circuit schematic is depicted below:

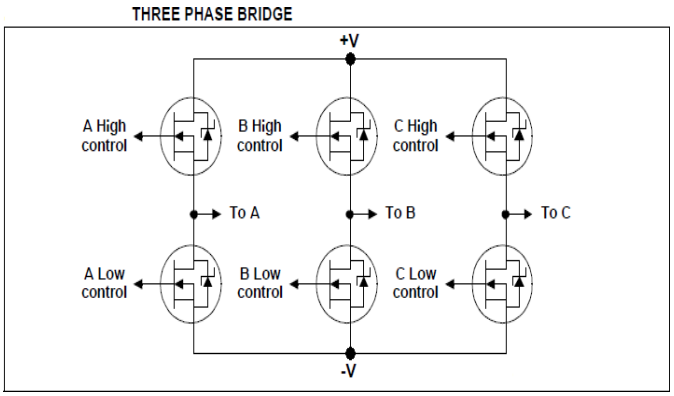

Fig. 9. Schematic diagram of three phase bridge

To sense rotor position, the sensor-based BLDC motor contains three hall effect sensors (A, B, and C), which are positioned as illustrated in the diagram below. Each hall effect sensor in the motor has four pins: VCC (H+), GND (H-), and two outputs (some sensors come with 3 pins: VCC, GND and output).

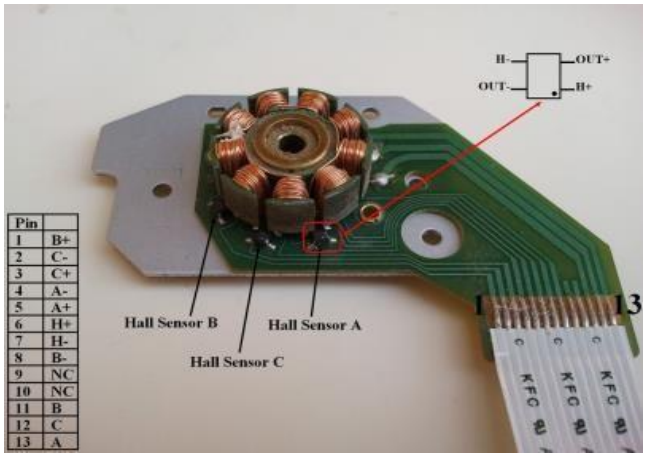

Fig. 10. Hall sensors placed in BLDC motor

For 180 electrical degrees, each sensor outputs a digital high, and for the other 180 electrical degrees, it outputs a digital low. The following figure shows the relationship between the sensor's outputs and the required motor drive voltages for phases A, B and C.

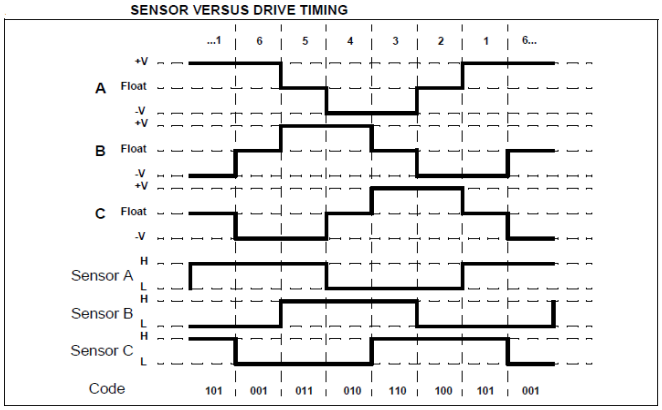

Fig. 11. Sensor's outputs and requisite motor drive voltages

IV. HARDWARE REQUIREMENTS

Hardware requirements are listed below

Sr. No.	Components	Name
1	Microcontroller	Arduino Mega2560, (Atmega 2560) Arduino Pro Mini (Atmega 328)
2	Power MOSFET	IRF2807
3	Programmable precision refence	TL431
4	Current Sensor	ACS712
5	MOSFET driver circuit	IR2104
6	Schottky diode	1N5819
7	Zener diode	1N4148
8	Rectifier diode	1N4007W
9	BLDC motor	24 volts, 250 watts
10	Transistor	2N3906, 2N2222
11	Display	I2C 16x2 LED, 0.96 inch OLED
12	Voltage regulator	7805

V. WORKING

A. Speed controller:

The controller drives the BLDC motor using a three phase MOSFET bridge which is controlled by three half bridge driver IC's (IR2104). These driver ICs are driven by Arduino mega microcontroller which generate a PWM signal and a commutation signal.

The commutation signal is generated based on the input from hall sensors and duty cycle of PWM signal decides the speed of the motor. The microcontroller calculates the duty cycle of PWM signal based on the input of throttle and pedal assist.

Speed controller has two modes throttle and pedal assist

B. Throttle mode: -

In throttle mode the microcontroller takes input from throttle and according to the value of throttle input it decides the duty cycle for the PWM signal which will then be fed to half bridge driver circuit. The pedal assist has no role in this mode.

C. Pedal assist mode: -

In PAS mode the microcontroller decides the duty cycle of PWM signal based on the pedal assist level user can select the pedal assist level (1-3). with pedal assist level is 1, the effect of pedaling will be less on the speed of motor while at highest pedal assist level that is 3, the effect of pedaling will be high on motor speed[7].

The selected assistance level and mode of operation is displayed on the OLED display.

D. Battery management system (BMS): -

It manages the voltage of the lithium-ion cell by continuously monitoring their voltage level and while charging if the voltage goes above the max voltage which in this case is set to 4.2volts, it switches on the balance circuit for that particular cell by switching on a MOSFET switch which connects a 10ohm resistor in parallel to that cell, this results in discharging of extra voltage through that resistor at a rate of 420mA which is safe discharge current for most of the cell. This method of cell balancing is called active balancing[8].

The BMS also monitors the input charging current and if the charging current exceeds the set limit it stops charging.

VI. RESULTS

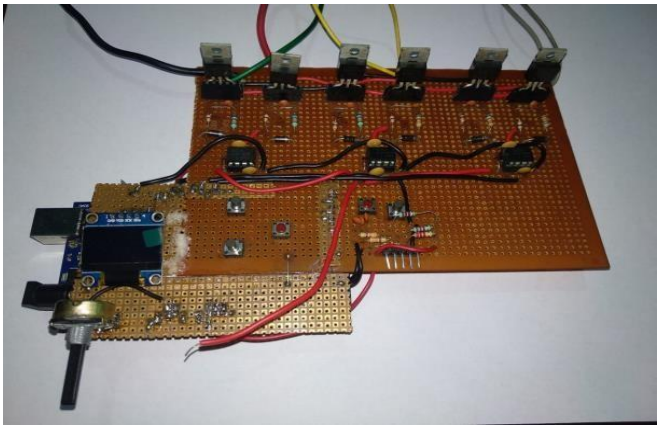

Fig. 12. E-Bike controller circuit after assembling

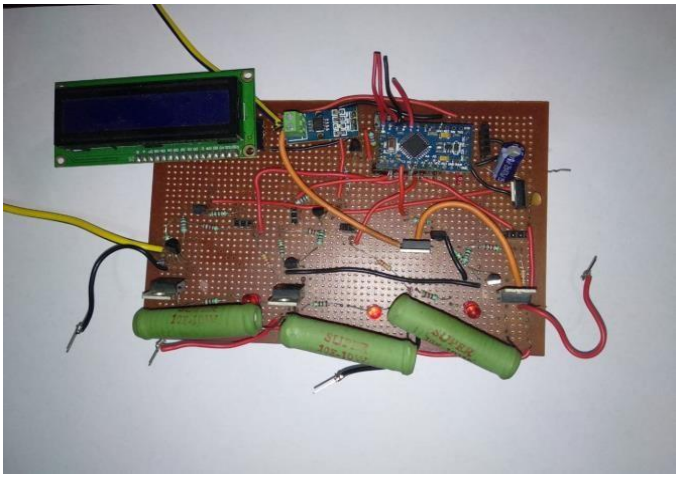

Fig. 13. Battery management system circuit after assembling

All the components are assembled and tested successfully. The system is designed to operate with 24-volt, 250 watts BLDC motor and tested successfully, both throttle control and pedal assist mode of the E-Bike controller are working perfectly as expected.

VII. CONCLUSION

E-Bikes are an effective alternative to our conventional vehicles as it's not only immaculate but also economical in the long run, helps reduce carbon emissions and subsequently improving air quality index of our major cities.

E-bike motor controller helps in wide speed motor control application of the BLDC motor and also helps in braking. Battery Management System ensures equal voltage across all the cells of the battery pack, displays real parameters like voltage and current values and also helps in over voltage and over current protection of the Li-ion cells, it also helps increasing reliability and durability of the battery pack making the system more economical in the long run. The designed system can not only be used to make new E-Bikes but can also be deployed to convert conventional bicycles to E-bikes.

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Named Entity Recognition for Names of Indian Origin using BERT

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Abstract: News generates huge amounts of online content on a day to day basis and managing them correctly is very critical to get the full benefit of each feature or article. Tools are needed to automatically extract useful information from the ever-growing corpus of news texts. An essential condition is the ability to recognize names mentioned in text, a special case of named entity recognition (NER). In this work, we train BERT- NER model and explore fine-tuning strategy for the BERT model to detect names of Indian origin in a given unannotated block of English text. Our fine tuning approach obtains state –of- art results on own built dataset comprising of English language documents from news domain, obtaining a F1 score of 96.64% (on 5NE) using BERT-Base model. FastAPI framework is used to deploy the model. FastAPI is a modern, high-performance web framework. It is used for building APIs with Python 3.6+.

Keywords: BERT, Named Entity Recognition, Natural Language Processing.

I. INTRODUCTION

Named entity recognition (NER) is an important step towards information extraction. Its aim is to identify the named entities that occur in the text and classify them into different pre-defined categories. NER can be deployed in many fields for answering many real-world questions, relation-extraction, topic modelling, information retrieval etc [1]. Named Entity Recognition (NER) can automatically explore the full articles/features and display which are the prime people, organizations and places discussed therein.

The paper focuses on first task of information extraction, called NER, more specifically, to detect the mention of names of Indian origin in English textual documents. The idea is to cover cross-linguistic aspects of text while performing NER on Indian names.

Formally, given a sequence of tokens s, s = <w1, w2, ..., w_NN. i, NER is to output a list of tuples <Is, Ie, ti>, each of which is a named entity mentioned in s. Here, Is ∈ [1, N] and Ie ∈ [1, N] are the start and the end indexes of a named entity mention; t is the entity type from a predefined category set. Figure 1 shows an example where a NER system recognizes three named entities from the given sentence [2].

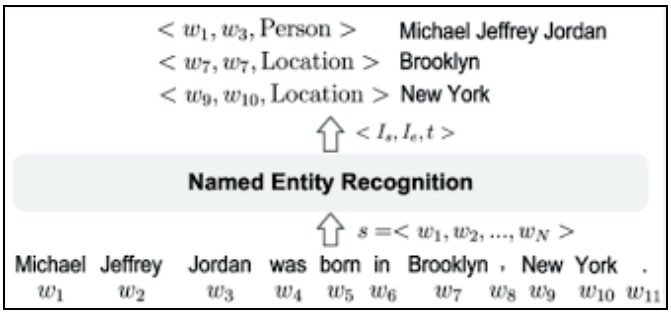


Fig. 1. An illustration of the named entity recognition task

In order to obtain high performance, deep learning-based NLP models require much larger amounts of annotated dataset or knowledge. As the annotated training data size increases (in billions), the performance improves significantly. However, preparation of such a huge corpus manually is tedious, time consuming and an expensive process. The lack of sufficient labelled data is still the major challenges for creating high quality NLP models.

To address this issue, we rely on existing pre-trained DNN models using transfer learning [3]. The process or technique of training general purpose language representation models on enormous piles of un-annotated corpora on the web/online refers to pre-training. This general purpose pre-trained model can then be fine-tuned for many tasks that may not be related to the task for which the model was trained on. This approach gives close to state-of-the-art results and is highly useful when the training data is inadequate. (BERT) is one of the latest techniques for NLP pre-training. In this paper, we explore BERT technique (Bidirectional Encoder Representations from Transformers) that uses deep neural networks to recognize the named entities of Indian origin in the news literature. Identifying Indian origin names in English text documents is a challenging task. They have to cope up with the diversity of person naming practices (such as acronyms, salutations, and other abbreviations) and ambiguity arising from the use of same common name refers to different class

This work majorly distinguishes 4 entities of Indian origin namely persons, organizations, location, others an English

news document. The approach adopted is majorly unsupervised learning based on the fine tuning.

II. CHOICE OF BERT OVER ELMO

In this section, the features of BERT and ELMo are presented. We discuss what are the features that makes BERT superior to its predecessor, ELMo .

A. Features of BERT and ELMo

ELMo(Embeddings from Language Model) , is a word embedding technique developed at Allen Institute for Artificial Intelligence. It looks at sequence of words and represents them as a vectors sequence [4]. A bi-directional LSTM is fed with character-level tokens. This bi-directional LSTM then outputs word-level embeddings.

However, unlike BERT, ELMo is not truly bi-directional. BERT uses a Masked LM technique which makes it deeply bi-directional whereas ELMo uses right-to-left and left-to-right LSTMs instead. Thus, the accuracy of BERT is way higher than ELMo.

The time taken by BERT to train a model is significantly less than the time taken by ELMo. This is because BERT uses transformers whereas ELMos has an LSTM based approach [5].

Both BERT and ELMo feed a different type of input to the model. BERT inputs in tokenized words whereas ELMo has a character-based input. It has been alleged that word-based models perform better than character-based models [6]. Hence, BERT is better than ELMo.

III. LITERATURE SURVEY

The first NER task was formulated by Grishman and Sundhiem (1996) at the sixth Message Understanding Conference (MUC-6). In respect of the problem definition, Petasis et al. [7] confined the definition of named entities: “A NE is a proper noun, serving as a name for something or someone” Early NER systems were based on handcrafted rules, lexicons, orthographic features and ontology [8][9][10][11]. These systems were followed by NER systems based on feature-engineering and machine learning [12].

Agerri and Rigau (2016)[13] developed a semi-supervised system by presenting NER classifiers with features including orthography, character n-grams, lexicons, prefixes, suffixes, bigrams, trigrams, and unsupervised cluster features from the Brown corpus, Clark corpus and k-means clustering of open text using word embeddings [14]. They were able to achieve almost state of the art performance on CoNLL datasets: 84.16%, 85.04%, 91.36%, and 76.42% on English, Dutch, Spanish, and German, respectively.

The state-of-the-art results were achieved In DrugNER [9], [15] by using a CRF with features using lexicon resources from Food and Drug Administration (FDA), DrugBank, [16] and word embeddings which were trained using MedLine corpus. For the identical task, [17] used a CRF with features derived from dictionaries (e.g., [16]), ontologism (ChEBI ontologism), prefixes-suffixes from chemical entities, etc.

In [18], early NER neural network architectures were proposed. Here, the feature vectors were extracted from orthographic features such as word breaks, capitalization, punctuation etc, dictionaries and lexicons. Subsequent work work in place of these manually constructed feature vectors word embeddings [19] stepped in. Word embeddings represents words in n-dimensional space, typically learned over huge amount of unlabeled data through based on unsupervised process like the skip-gram model [14]. Studies have depicted the significance of such pre-trained word embeddings for NER systems based on neural network [20] and also for pre-trained character embeddings in character-based languages like Japanese, Korean and Chinese [21].

Starting with [19], neural network NER systems with minimal feature engineering have become popular. These kinds of models are preferred as they generally do not need domain specific resources like lexicons or ontologies, which are expensive and hence are more domains independent. Various neural architectures have been proposed, mostly based on some form of recurrent neural networks (RNN) over characters, sub-words and/or word embeddings.

There are various NER tools available online with pre- trained models. Table 2 shows frequently used English NER by academia and Industry [2].

TABLE 1: Few Off-the-shelf POPULAR NER tools provided by academia and industry projects

NER System	URL
Academia	
Stanford Core NLP	https://stanfordnlp.github.io/CoreNLP/
Illinois NLP	https://github.com/aritter/twitter_nlp
NeuroNER	http://cogcomp.org/page/software/
NERsuite	https://polyglot.readthedocs.io
NERsuite	https://polyglot.readthedocs.io
Gimli	http://bioinformatics.ua.pt/gimli
Industry	
spaCy	https://spacy.io/api/entityrecognizer
NLTK	https://www.nltk.org
OpenNLP	https://opennlp.apache.org/

LingPipe	http://alias-i.com/lingpipe-3.9.3/
AllenNLP	https://demo.allennlp.org/
IBM Watson	https://natural-language-understandingdemo.ng.bluemix.net

IV. DATASET AND MODEL

In this section of the paper, the dataset used for training the model and the model have been described in detail.

A. Dataset

In this study, we have trained our model on a dataset of 6910 sentences, each containing at least one name of Indian origin. We created this dataset by ourselves using web-scraping techniques with the help of python libraries such as BeautifulSoup4 and Spacy.

TABLE 2: BERT dataset format

Sentence #1	Word	POS	Tag
	pm	NN	O
	modi	NNP	B-per
	may	MD	O
	light	VB	O
	first	JJ	O
	lamp	NN	O
	on	IN	O
	deepawali	NNP	O
	In	IN	O
	varanasi	NNP	O

The sentences which form our dataset have been extracted from news centric APIs (Google News API and NewsAPI) containing Indian news from various sources. The API provided us the below listed features in which Topic/Short Headlines were used:

i. Topic Headlines
ii. Top Headlines
iii. Search
iv. Search by Source
v. Geographic Headlines

Then a list of common Indian names was created to make sure that every sentence contains a name of Indian origin. The filtered sentences were then converted into a comma-separated values format, the format required by BERT for training. Each name was tagged as "B-per". All the other words were tagged as "O".

TABLE 3. A Few Examples of sentences in the dataset and names of indian origin tagged as "b-per"

Sentence	Name(s) of Indian origin in the sentence
Trump says he spoke to PM Modi , govt. denies it.	Modi
I try to find faults in myself even if there aren't many: Arjun Kapoor	Arjun Kapoor
Sanjay Singh uses official tickets to fly 33 migrants home.	Sanjay Singh

BERT requires that each word is assigned its detailed part-of-speech tag. Using the natural language processing library spacy, all the words were tagged with their detailed part-of-speech tag.

The model was trained on 90% of the data. The rest 10% of data in the dataset was used as the testing and validation data by the model. .

B. BERT(Language Model)

Bidirectional Encoder Representations from Transformers (BERT) is a machine learning technique based on Transformers. It is used for natural language processing (NLP) pre-training. BERT was created by Google employee Jacob Devlin and his colleagues in 2018 [22]. It was pre- trained on *Book Corpus*, a dataset consisting of 11,038 unpublished books and English Wikipedia (excluding lists, tables and headers) [23],[24].

BERT is bidirectional trained and thus it has a deeper understanding of the context and flow of language as compared to the language models which are only single-direction.

BERT uses a technique called Masked LM (MLM) in order to predict the next word in a sequence. Words in a sentence are randomly masked and the BERT tries to predict them. Thus, BERT takes the previous as well as next word into context at the same time [25].

C. The BERT-Base Model

In this study, we have used the BERT-Base model. This model has 12 layers, 768 hidden nodes, 12 attention heads and 110 million parameters. It was trained on 4 cloud TPUs for 1 million steps. The batch size was set at 256. For 90% of the steps, the sequence length was limited to 128 tokens. For the remaining 10% of the steps, the sequence length was 512 tokens [26].

TABLE 4: BERT-Base Model parameters

Parameters	Count
Number of hidden layers	12
Hidden Unit Size	568
Number of Attention heads	12
Feed forward filter size	4*768
Max. sequence length	512
Parameters	110Million

D. Spacy

Spacy is a python library which has industrial level natural language processing capabilities for processing raw text [27]. We have used Spacy for two different tasks.

First, we used spacy in the creation of our dataset. Spacy's part-of-speech tagging feature is used to tag each word in our training data with its detailed part-of-speech tag.

Later, we used Spacy to give a more detailed output. Our model only detects names on Indian origin. Therefore, we have used Spacy's named entity recognition feature to assign labels to various other entities such as organizations, companies and names of cities and countries

E. FastAPI

FastAPI framework has been used to deploy the model. FastAPI is a modern, high-performance web framework. It is used for building APIs with Python 3.6+.We are using its Swagger UI to create an interface for the user. A window is provided to enter desired text. The output is generated in the form of dictionary, with each word having a corresponding named entity

F. Training of Model

The model has been trained on unique sentences, with each sentence having at least one name of Indian origin. The model was then evaluated on different set of unique sentences. Just like the training data, every sentence in the validation data has at least one name of Indian origin in it. Basic model configurations are listed below:

a. Training data size: 6219 sentences
b. Testing data size: 691 sentences
c. Optimizer: AdamW (Adam with weight decay)….
d. Batch size: 32.

V. NER EVALUATION METRICS AND RESULTS

NER systems are usually evaluated by comparing their outputs against human annotations. The comparison can be quantified by either exact-match or relaxed match.

NER essentially involves two subtasks: boundary detection and type identification. In "exact-match evaluation" [28], [29], [30], a correctly recognized instance requires a system to correctly identify its boundary and type, simultaneously. More specifically, the numbers of False positives (FP), False negatives (FN) and True positives (TP) are used to compute Precision, Recall, and F-score.

False Positive (FP): entity that is returned by a NER system but does not appear in the ground truth.

False Negative (FN): entity that is not returned by a NER system but appears in the ground truth

True Positive (TP): entity that is returned by a NER system and also appears in the ground truth.
Precision refers to the percentage of your system results which are correctly recognized. Recall refers to the percentage of total entities correctly recognized by your system.

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

$$Recall = \frac{\neq TP}{\neq (TP+FN)} \quad (2)$$

$$F - Score = 2 \times \frac{Precision \times Recall}{Precision + Recall} \quad (3)$$

In addition, the macro-averaged F-score and micro averaged F-score both consider the performance across multiple entity types. Macro-averaged F-score independently calculates the F-score on different entity types, and then takes the average of the F-scores. Micro-averaged F-score sums up the individual false negatives, false positives and true positives across all entity types then applies them to get the statistics. The latter can be heavily affected by the quality of recognizing entities in large classes in the corpus.

1. F1 score= 2 * (Precision * Recall) / (Precision + Recall)

   = 2 * (0.962 * 0.971) / (0.962 + 0.971)

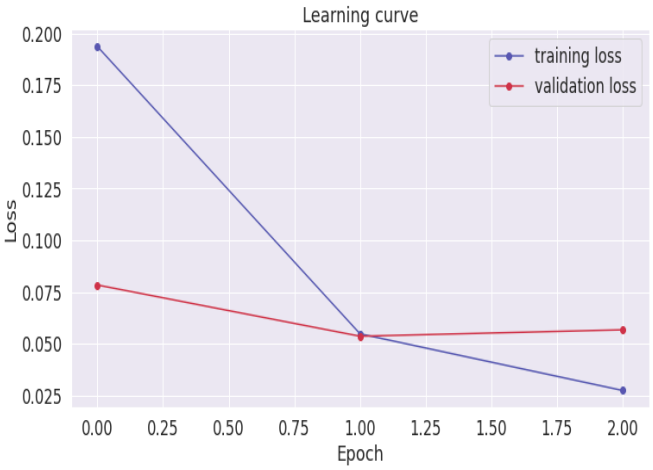
   =0.9664

The results obtained after training the model are as shown in Table 4 below.

TABLE 4. Results obtained BERT dataset format

Evaluation Metrics	Name(s) of Indian origin in the sentence
Validation Accuracy	98.65%
Precision	0.962
Recall	0.971
F1 score	0.9664

The F1 score combines the precision and recall of our model by defining the harmonic mean between them and indicates how accurate the model is performing on the dataset. As the range of F1 score in between 0 (least accurate) and 1 (most accurate) and we got 0.96 (96.64%) indicating low levels of false positives and false negatives.



The loss graph is shown in fig. 1 tells us how good our model is performing with the training and validation set of data. The fact that training loss and validation loss are almost equal indicates that the model was not over fitted or under fitted in this process.

The output shown in Fig. 2 contains an output dictionary which clearly identifies the names of Indian Origin as "INDIAN NAME".

Fig. 2. The output dictionary

VI. CONCLUSION

In this research, the state-of-art named entity recognition results in the detection of names of Indian origin using BERT are achieved. We have achieved an accuracy of 98.65% and F1 score of 0.96. This result has been achieved with a relatively small dataset of just 6910 sentences. Thus, it can be accepted that with the help of BERT, one can train an extremely accurate custom named entity recognition model even if the amount of training data available is very low.

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Robotic Process Automation – A Review of Benefits, Applications & Limitations

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Abstract: In today's time, human beings have become more dependent on technology. They search and develop such kinds of technologies that complete the work very quickly and more efficiently. This problem is solved with the implementation of Robotic Process Automation. It is the new future technology in the domain of computer science, Electronic and Communication, Mechanical Engineering, and Information Technology. It is the combination of hardware, software, networking, and automation for making the work simple and easy. Manpower has been depleted in the era of Robotics and Artificial Intelligence (AI). It is a fast implemented process automation approach that uses software robots to replace human beings from the workplace. This paper discusses RPA in detail. It becomes a compulsory part to complete the business operations in the organization across the world. The main motive to write this paper is to define Robotic Process Automation, its benefits for the organization, its disadvantages, and also highlight some domains where it can be implemented.

Keywords: Robots, Automation, Sensors, Artificial Intelligence, RPA

I. INTRODUCTION

When we hear the term "Robotic Process Automation (RPA)", a tiny robot walking in the building in which performing some task comes to our mind. In reality, it's just software the follows human commands and completed various tasks at business. It is a combination of hardware and software, networking, and automation for reducing the complexity of things [1]. Various studies and researches have proven that Robots and Robotic Process Automation have become compulsory technologies to perform various business operations in organizations across the globe. RPA is implemented in the core business process like payroll of employees, processing on the voice, inventory management, and many more.

Besides this, Robotic Process Automation has various applications in healthcare and pharmaceuticals, finances, outsourcing, retail, real estate, telecommunication, and many other sectors. The year "2018" is known as the year of the "Robotic Process Automation". The implementation of RPA in day to day activities of business becomes a necessity. RPA is an emerging form of business process automation with the usage of robots or artificial intelligence (AI). The lifestyles of human beings are changing with the advancement of new technologies and the introduction of RPA technology in the business world [2].

Among the existing technologies like – Big Data, Artificial Intelligence, Machine Learning, Deep Learning, Internet of Things, the emergence of RPA technology has become noteworthy and powerful. The organization can computerize daily work with quick execution and in a cost-effective manner. RPA is easily integrated with the process, decision automation, and data collection process. RPA help in reducing processing time with less human error and also increase throughput [3]. The main aim of the organization is to increase operational efficiency with the usage of RPA. In RPA, 'Robots' or 'Bots' in short, represent the software agents that interact with the software system that minimizes the workload of the human being [4]

II. UNDERSTANDING ROBOTIC PROCESS AUTOMATION

The term "Robotic Process Automation" tells about physical robots wandering around the organization performing human tasks, but, it is a software-based solution for all the business process operations. In terms of business, it refers to configuring the software 'robot' to do the tasks that were being performed by humans previously. RPA technology includes:

A. Robots

Robots are electromagnetically designed machines that are programmable by computers and are capable of performing various complex human tasks. These robots are much intelligent to understand human commands. Artificial Intelligence (AI) plays a vital role in robotics to make them more intelligent and to make work easier.

They are frequently used artificial intelligence machines used in manufacturing units that use Big Data, Wireless Networking, Cloud Computing, Open-Source, and other shared resources to improve the working of the robots. In the upcoming years, robots are going to be part of human society [2]. The robotics industry has been booming in recent years. Robots are using wireless networking, big data, statistical machine learning, and other shared resources in various application areas like driving, warehouse logistics, package delivery, housekeeping, and surgery to improve performance [5].

B. Process

A 'process' is the most common and mostly-heard term by everyone. It is an essential part of any system and is defined as a task that is to be completed. It can be finished by the people or things or by both. A process takes input from the different sources and provides you with the output according to the rules of the process that is to be executed. The process is a conversion of input into output by going through some steps of execution. In today's era of technologies, every organization has adopted an advanced method for its operations and tasks to be performed [2].

C. Automation

The word automation means something that works by itself or automatically. 'Automation' basically refers to the working of a process or a system automatically without any manual touch and provides output according to the rules of the process. It includes the processing capability of a system. Automation has emerged so well in today's era that it has made household chores easier too. Some of the home automated devices include – Amazon Echo Device Alexa, Philips Hue Smart Light Bulbs, Belkin WeMo Switch, and automated smart devices. These smart devices perform the task themselves with the usage of embedded software and hardware. The best part of smart devices is that they bring the quality of human being's life, efficiency to perform the task, and easily handle any situations which are not possible for human beings [6]. The automation process has made things or tasks easier, faster, and better and has made human beings free from labor. Some of the automation technologies include – machine vision, AI for driverless cars, cognitive computing in IoT-connected cars, and collaborative robots.

III. BENEFITS OF ROBOTIC PROCESS AUTOMATION

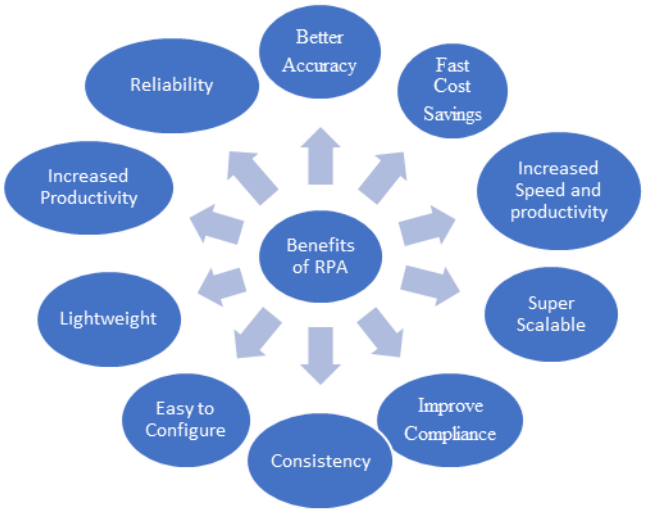

Fig. 1. Benefits of Robotic Process Automation

A. Better Accuracy

Robotic Process Automation software robots are programmed to follow rules. They never make mistakes and their results are accurate and reliable. [2]

B. Improved Compliance

RPA robots work according to the instructions or commands were given to them. They are much more reliable and thus reduce risk. Everything that an RPA robot does is monitored and controlled according to the existing rules and regulations.

C. Fast Cost Savings

Processing costs reduce up to 80% by the usage of RPA. Enterprises have a positive return on the investment on RPA in less time.

D. Increased speed and productivity

RPA robots are automated and thus it eliminates the role of manual power. It even removes non-value-add activities and reduces the pressure of the work.

E. Super Scalable

RPA robots perform massive complex activities in less time and with minimum cost. Thus, they can be expanded and engaged on a wider scale in minimum time and less cost according to the work rules and flexibility.

F. Consistency

Each task is performed the same way each time. Since the RPA robots are programmed and are automated so they need not be programmed again and again. Every time the same task is performed, it is performed similarly.

G. Easy to configure

RPA technology is easier to configure and one does not need any programming skills to use RPA technology. It simply involves dragging and linking the icons together while using. It can be used for business processes even with zero knowledge of programming. When a user drags and drops an icon the code of that icon is generated automatically, so he does not need to have programming knowledge before working with the RPA technology [7].

H. Lightweight

RPA is a lightweight technology. Using RPA would not disturb any functioning of the computer system and it even does not need much support. It even does not need to create,

replace, or develop many expensive platforms for installing. It works with the computer system in the way a human works, just by using a login id and password. It even does not store any data so it does not require any extra internal space.[2]

I. Increased Productivity

With the implementation of RPA, the process cycle of production is can be completed in a small amount of time as compared to the manual process of production.

J. Reliability

RPA robots work tirelessly without any interruption. It works 24*7 without fail.

IV. ROBOTIC PROCESS AUTOMATION APPLICATIONS

Robotic Process Automation (RPA) comes forward as the software-based resolution to automate rules-based business processes that engage routine tasks, structured data, and deterministic outcomes. It is the most powerful technology that provides various operational advantages and also provides with various applications explained as follows:

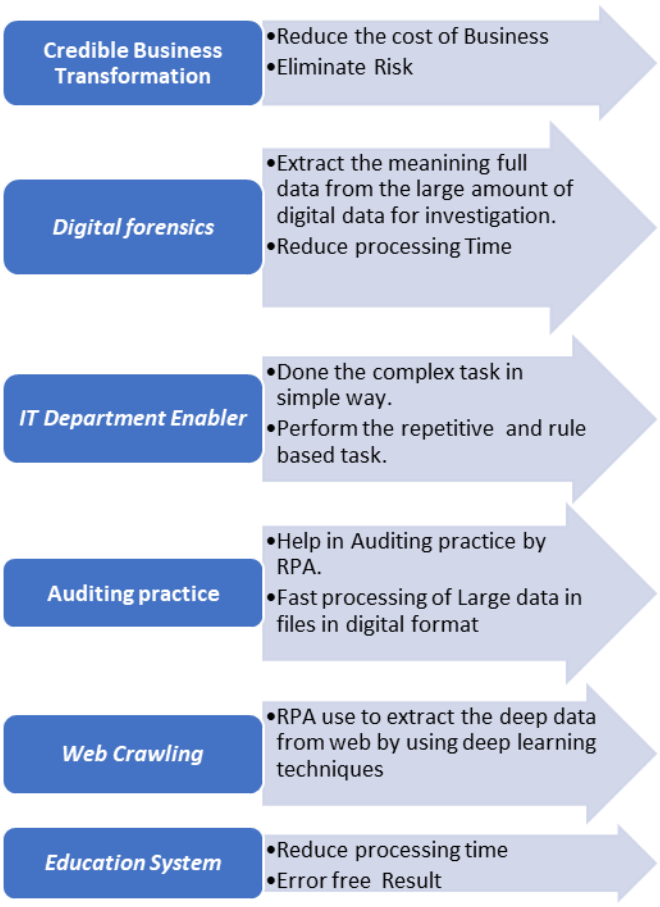

Fig. 2. Application Domain of RPA

A. Credible Business Transformation

With the introduction of RPA technology, business operations are to be changed drastically. This will even affect the profit and growth of a business. Since the RPA robots are efficient and require low-cost digital labor, thus the cost of business reduces and eliminates risk.

B. Education System

With the implementation of RPA in the education domain, the result analysis of student's examination results is error-free with 94.44% less time is taken to prepare the result as compared to a manual analysis by human beings. RPA process takes input in pdf format and for automation on this pdf file is using the Automation anywhere tool. With this tool, all the entries are converted into excel from pdf automatically without the intervention of human beings. Now on excel sheets, proper analysis can be done for each subject of the student [8]

C. Auditing practice

RPA also plays an important role in auditing practice. For the implementation of RPA, audit industries have 4 stages framework to help auditors like the selection of appropriate audit procedure, modify the current procedure, implementation and evaluation of performance [9]

D. Web Crawling

Robotic Process Automation technology uses a wide range of artificial intelligence and deep learning techniques to evaluate the data. It can capture the data in any format like – text, audio, video, pictures, etc. It can extract deep data from the web using deep learning techniques.

E. IT Department Enabler

Robotic Process Automation uses 'Robots' that copy and follows what a human does. It performs tasks that are repetitive and rules-based. These robots are programmed to perform complex tasks in a much simpler way and in less time.

F. Digital forensics

In the field of digital forensic, data in digital forms is increasing day by day. Now digital evidence is provided for investigative support in many criminal investigations. To handle a large amount of data, require the implementation of RPA to extract the process and provide the report based on given digital evidence. At that time, RPA plays an important role ti investigating the crime on digital data[10]

V. DISADVANTAGES OF ROBOTIC PROCESS AUTOMATION

A. Expensive

Businesses have many monetary restrictions due to which they need to analyze, think, and take a collective decision to make

any kind of expense. RPA technology requires a good budget before being purchased. So this lacks a business from using RPA technology.

B. Lack of technical knowledge

People believe that for using any technology, the end-users require a lot of technical knowledge. Even in the case of RPA, it's believed that the users must have the technical knowledge to use and implement RPA in organizations. This holds back some businesses from using RPA for their processes.

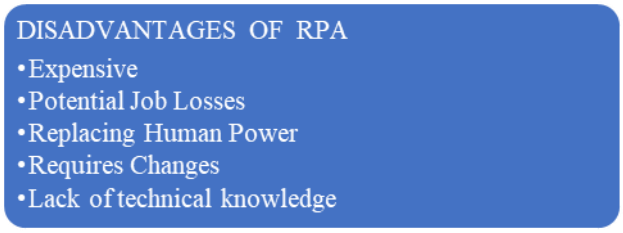

Fig. 3. Disadvantages of Robotic Process Automation

C. Requires Changes

Implementing new technology involves a lot of changes in the system as well as proper tools for implementation. These modifications make the businesses hold back from switching to RPA technology. Due to this, the RPA technology lags from being implemented in various fields.

D. Replacing Human Power

The introduction of robots in the world has made people fear being replaced by machines. Since the robots now work just like a human, perform every task like them, RPA has a major drawback among people that fear being replaced by machines in their fields, thus leading to unemployment.

The main purpose of RPA robots is to support human work and not replace them in their fields. Hence forcing people to think before implementing RPA technology.

E. Potential Job Losses

The biggest concern on the implementation of RPA is the impact on jobs for employees. If a robot can execute the task very fast and at a more consistent rate then the fear that employees may not be required at all.

VI. DEVELOPING PROCESS FOR ROBOTIC PROCESS AUTOMATION

The developing RPA has contained four phases [11].

In assess phase of RPA, processes that are automated are investigated. This phase provides the assessment report that includes the detail of the project and also contains the feasibility report of the RPA.

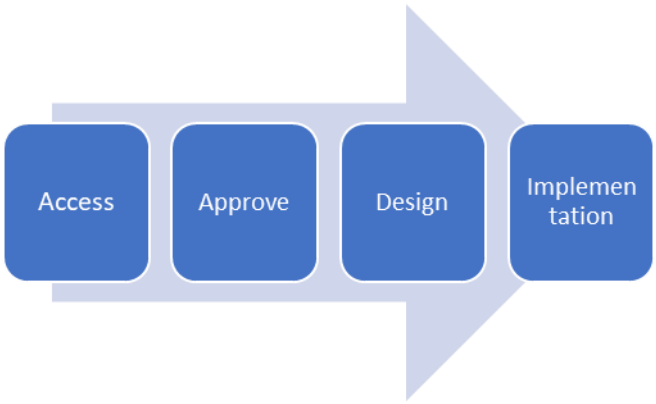

Fig. 4. Developing process of RPA

Approve is the second phase of RPA. Before the implementation of the process improved by RPA, the whole documentation of the AS-IS process (performed by humans), and analysis and documentation of the TO-BE process (now performed by the robot), needs to be done using Business Process Model and Notation (BPMN).

The third phase of RPA is design. In this phase, the developer chooses the developing tool, and after that robot will be developed based on the requirement Development team uses the iterative process for the development of the robot. This phase ends with the user acceptance testing of the robot

Implementation is the last phase of RPA. In this phase robot is working in the real environment, behave like an employee's, and its performance is also monitored

VII. CONCLUSION

In this era of advanced and powerful technologies, Robotic Process Automation will soon take up the market and will emerge as the most powerful technology of Information Technology and the Computer Science world. Robots and Robotic Process Automation technologies are becoming compulsory. Soon they will completely replace the manpower. They are going to perform the entire complex task and perform every task that a human being can do. Every business organization requires some technology to grow. Powerful technology and efficient techniques are the need of the hour.

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Biot Number Effect on MHD Double Diffusive Flow of Nanofluid Past a Linear Stretching Vertical Plate

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Abstract: ***Present work shows the analysis of steady two-dimensional laminar flow of fluid containing nanoparticles (Nanofluid) over a stretching sheet with convective boundary condition. The effect of Dofour effect and Soret effect has been considered in the non-homogenous model for transport phenomenon given by Buongiorno [1]. Firstly the transport equations has been converted to the non-dimensional form using similarity transformation and then these transformed equations are solved using shooting method. Effect of Biot number is illustrated graphically on dimensionless velocity profile, temperature profile, solute concentration and nanoparticles volume fraction.***

Keyword - Nanofluids, MHD, Double Diffusive, Mixed Convection.

Nomenclature

a	Constant
B	Strength of magnetic field applied
$\emptyset_1$	Solutal concentration of salt
$\emptyset_{1\infty}$	Ambient solutal concentration of salt
$\emptyset_{1w}$	Solutal concentration of salt at the wall
$\emptyset_2$	Nanoparticles volume fraction
$\emptyset_{2\infty}$	Ambient nanoparticles volume fraction
$\emptyset_{2w}$	Nanoparticles volume fraction at the wall
T	Nanofluid temperature
T_w	Nanofluid temperature at sheet
T_∞	Ambient temperature of the fluid
u, v	Velocity components along *x*- axis and *y*-axis respectively
u_w	Velocity of the sheet
x, y	Cartesian coordinates
P	Dimensionless stream function
k	Thermal conductivity
M	Dimensionless Magnetic field
Nu_x	Local Nusselt number
Ra_x	Local Rayleigh number
R	Rescaled nanoparticles volume fraction
Bi	Biot number
D_{CT}	Soret diffusivity
D_{TC}	Dufour diffusivity
Pr	Prandtl number
D_B	Brownian diffusion coefficient
D_T	Thermophoretic diffusion coefficient
D_S	Solutal diffusivity of porous medium
Gt	Thermal Grashof number
Gr	Buoyancy force owed by temperature difference
Bc	Solutal Grashof number
g	Acceleration due to gravity
Ln	Nanofluid Lewis number
Ld	Dufour-solutal Lewis number of salt
Le	Regular Lewis number of the salt
Nr	Nanofluid buoyancy ratio
Nd	Modified Dufour parameter
Nb	Brownian motion parameter
Nt	Thermophoresis parameter
Nc	Regular buoyancy ratio of the salt
Nur	Reduced Nusselt number
Q	Dimensionless solute volume concentration

Greek symbol

$(\rho c)_f$	Heat capacity of base fluid
$(\rho c)_p$	Heat capacity of nanoparticles
β_T	Volumetric thermal expansion coefficient of the fluid

τ	Shear stress at surface
σ	Electric conductivity of base fluid
η	Similarity variable
μ	Dynamic viscosity of the base fluid
β_C	Volumetric solutal expansion coefficient of the fluid
ρ_p	Nanoparticles mass density
ρ_f	Base fluid density
θ	Dimensionless temperature
	Subscript
f	Fluid
∞	Ambient condition
w	Condition on surface

I. INTRODUCTION

Nanofluid is an efficient heat transfer fluid having various engineering applications. Firstly Choi [2] gave the name nanofluids to the heat transfer fluids containing nanosized $(1-100\ nm)$ solid particles. These heat transfer fluids have various applications like nuclear system cooling, engine cooling, in car radiators, geothermal energy sources, micro channels, domestic refrigerator [3]–[5] etc. Fluid flow due to stretching/shrinking surfaces has a variety of applications like fibre creation, paper formation, manufacturing of plastic sheets, crystal developing, wire drawing, tinning of copper wires, plasma studies etc. Crane [6] firstly analyzed this problem and found an analytic solution. Khan and Pop [7] numerically explored the stretching sheet problem considering nanofluid. In the current study, we have endeavored to investigate numerically double diffusive mixed convective boundary layer flow of nanofluid past a stretching sheet with convective boundary conditions considering Buongiorno model [1]. We have used the revised model in which nanoparticles volume ratio at the plate is controlled passively [8].

II. MATHEMATICAL FORMULATION

The model considered assumes steady, two dimensional, laminar flow of incompressible, homogenous, electrically conducting binary nanofluid along a vertical stretching sheet (see Fig. 1) which is stretched by giving a velocity $u = ax$ (a is constant). The base fluid is a dual fluid such as salty water. x-axis is taken along the sheet and y-axis is taken perpendicular to it. The fluid is flowing in the region $y > 0$. An invariable magnetic field B is applied along y -axis. The nanoparticles volume ratio at the surface is controlled passively. The denotations of physical quantities involved are given in the nomenclature. The time independent conservation of mass, momentum, energy, nanoparticles volume ratio and solutal concentration equations after applying boundary layer approximation are given as

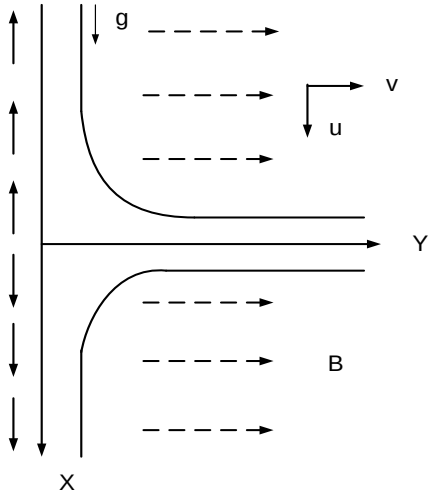

Fig. 1. Physical Model

1. Mass Equation

$$\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}=0, \tag{1}$$

2. Momentum Equation

$$\frac{\partial P}{\partial x}=-\rho_f\left(u\frac{\partial u}{\partial x}+v\frac{\partial u}{\partial y}\right)+\mu\frac{\partial^2 u}{\partial y^2} \tag{2}$$
$$-\sigma B^2 u+\left[(\emptyset_2-\emptyset_{2\infty})(\rho_p-\rho_f)\right.$$
$$\left.+(1-\emptyset_{2\infty})\{\rho_f(1-\beta_T(T-T_\infty)-\beta_{C_1}(\emptyset_1-\emptyset_{1\infty})\}\right]g,$$

$$\frac{\partial P}{\partial y}=0, \tag{3}$$

3. Energy Equation

$$u\frac{\partial T}{\partial x}+v\frac{\partial T}{\partial y}=\alpha\frac{\partial^2 T}{\partial y^2}+\tau\left[D_B\frac{\partial T}{\partial y}\frac{\partial \emptyset_2}{\partial y}+\left(\frac{D_T}{T_\infty}\right)\left(\frac{\partial T}{\partial y}\right)^2\right] \tag{4}$$
$$+D_{TC}\frac{\partial^2 \emptyset_1}{\partial y^2},$$

Solute Concentration Equation

$$u\frac{\partial \emptyset_1}{\partial x}+v\frac{\partial \emptyset_1}{\partial y}=D_{CT}\frac{\partial^2 T}{\partial y^2}+D_S\frac{\partial^2 \emptyset_1}{\partial y^2}, \tag{5}$$

Nanoparticles Volume Concentration Equation

$$u\frac{\partial \emptyset_2}{\partial x}+v\frac{\partial \emptyset_2}{\partial y}=\left(\frac{D_T}{T_\infty}\right)\frac{\partial^2 T}{\partial y^2}+D_B\frac{\partial^2 \emptyset_1}{\partial y^2}, \quad (6)$$

subject to the conditions at the boundary
at $y=0$,

$$u=ax, v=0,$$
$$-k\frac{\partial T}{\partial y}=h\left(T_f-T\right),$$
$$\emptyset_1=\emptyset_{1w},$$
$$D_B\nabla^2\emptyset_{2w}+\left(\frac{D_T}{T_\infty}\right)\nabla^2 T=0,$$

as $y\to\infty$

$$u\to 0, v\to 0, T\to T_\infty, \quad \emptyset_1\to\emptyset_{1\infty}, \emptyset_2\to\emptyset_{2\infty}. \quad (7)$$

where

$$\alpha=\frac{k}{(\rho C)_p}, \tau=(\rho C)_p/(\rho C)_f. \quad (8)$$

Removing P and applying the similarity transformations given as:

$$u=axP'(\eta), v=-\sqrt{a\nu}P(\eta),$$
$$\eta=\sqrt{\frac{a}{\nu}}y, \theta(\eta)=\frac{T-T_\infty}{T_w-T_\infty}, \quad (9)$$
$$Q(\eta)=\frac{\emptyset_1-\emptyset_{1\infty}}{\emptyset_{1w}-\emptyset_{1\infty}}, R(\eta)=\frac{\emptyset_2-\emptyset_{2\infty}}{\emptyset_{2w}-\emptyset_{2\infty}},$$

we get the subsequent coupled equations

$$P'''+PP''-(P')^2-M^2P' +Gr(\theta+NcQ-NrR)=0, \quad (10)$$
$$\theta''+Pr(P\theta'+Nb\theta'R'+Nt(\theta')^2+NdR'')=0, \quad (11)$$
$$Q''+PrLePQ'+LdPr\theta''=0, \quad (12)$$
$$R''+PrLnPR'+\frac{Nt}{Nb}\theta''=0, \quad (13)$$

subject to the conditions at the boundary

$$P(0)=0, P'(0)=1,$$
$$\theta'(0)=-Bi\left(1-\theta(0)\right),$$
$$Q(0)=1, NbR'+Nt\theta'=0,$$
$$P'(\infty)=0, \theta(\infty)=0, Q(\infty)=0, \quad (14)$$
$$R(\infty)=0,$$

where

$$Pr=\frac{\nu}{\alpha}, Ra_x=\frac{u_w(x)x}{\nu}, Le=\frac{\alpha}{D_s},$$
$$Ld=\frac{\alpha D_{CT}(T-T_\infty)}{D_S(\emptyset_1-\emptyset_{1\infty})}, Ln=\frac{\alpha}{D_B},$$
$$Nd=\frac{D_{CT}(\emptyset_{2w}-\emptyset_{2\infty})}{\nu(T_w-T_\infty)}, M=\frac{\sigma B^2}{a\rho_f}, \quad (15)$$
$$Gt=\frac{(1-\emptyset_{2\infty})\rho_{f\infty}gx^3\beta_T(T-T_\infty)}{\nu^2},$$
$$Gr=\frac{Gt}{{Ra_x}^2}, Nb=\frac{(\emptyset_{2w}-\emptyset_{2\infty})D_B\tau}{\nu},$$
$$Nt=\frac{(T-T_\infty)D_T\tau}{\nu T_\infty},$$
$$Nr=\frac{(\emptyset_{2w}-\emptyset_{2\infty})(\rho_p-\rho_f)}{\rho_f(\emptyset_2-\emptyset_{2\infty})\beta_T(T-T_\infty)},$$
$$Bc=\frac{(1-\emptyset_{2\infty})\rho_{f\infty}gx^3\beta_T(\emptyset_1-\emptyset_{1\infty})}{\nu^2},$$
$$Nc=\frac{Bc}{Gt}=\frac{Br}{Gr}=\frac{\beta_C(\emptyset_1-\emptyset_{1\infty})}{\beta_T(T-T_\infty)},$$
$$Br=\frac{Bc}{{Ra_x}^2}, Bi=\sqrt{\frac{\vartheta}{a}\frac{h}{k}}.$$

III. NUMERICAL SOLUTION AND JUSTIFICATION

The equations (10)-(13) along with boundary conditions (14) are firstly converted into initial value problem (IVP) by assuming

$$(P,P',P'',\theta,\theta',Q,Q',R,R')=$$
$$\left(Z(1),Z(2),Z(3),Z(4),Z(5),Z(6),Z(7),Z(8),Z(9)\right).$$

$$Z(1)' = [Z(2)]$$

$$Z(2)' = [Z(3)] \quad (16)$$

$$Z(3)' = \begin{matrix} Z(2)^2 - Z(1)Z(3) - Gr(Z(4) \\ +NcZ(6) - NrZ(8) + M^2Z(2) \end{matrix}$$

$$Z(4)' = [Z(5)]$$

$$Z(5)' = \left(\frac{1}{NdLdPr^2}\right)\begin{pmatrix} PrZ(1)Z(5) \\ +NbZ(5)Z(9) \\ +NtZ(5)^2 \\ -NdPr^2LeZ(1)Z(9) \end{pmatrix}$$

$$Z(6)' = [Z(7)]$$

$$Z(7)' = -\left(\frac{LdPr}{LdNdPr^2}\right)\begin{pmatrix} PrZ(1)Z(5) \\ -NdPr^2LeZ(1)Z(9) + \\ NbZ(5)Z(9) + NtZ(5)^2 \\ -PrLeZ(1)Z(7) \end{pmatrix}[\ \ ]$$

$$Z(8)' = [Z(9)]$$

$$Z(9)' = \begin{pmatrix} -\left(\frac{Nt}{LdNdNbPr^2 - Nb}\right) \\ PrZ(1)Z(5) \\ -NdPr^2LeZ(1)Z(9) + NbZ(5)Z(9) + \\ NtZ(5)^2 \\ -PrLnZ(1)Z(9) \end{pmatrix}$$

with the initial conditions

$$Z^T = \begin{pmatrix} 0,1, x_1, 1, x_2, x_3, -Bi(1 - x_3), \\ x_4, (-Nt/Nb)x_2 \end{pmatrix}^T \quad (17)$$

Initial conditions (17), doesn't have the values of unknown $Z(3), Z(4), Z(7)$ and $Z(8)$ i.e. $P''(0), \theta(0), Q'(0)$ and $R(0)$. For this, we estimate their values so the distant conditions i.e. $P'(\infty) = 0, \theta(\infty) = 0, Q(\infty) = 0, R(\infty) = 0,$ are satisfied. Here we have taken $\eta_\infty = 6$. RKF45 method is used to discover the solution using coding in MATLAB.

IV. RESULTS ACHIEVED

We have endeavored to investigate the impact of Biot number Bi on dimensionless velocity P', temperature profile θ, dimensionless solute concentration $\emptyset_1$ and dimensionless nanoparticles volume fraction $\emptyset_2$ which are described in Fig. 2,3. Default values of other parameters involved are taken as \

$$Pr = 6.2, Le = 1, Ln = 10, Ld = 0.1, Nr = 0.5, Nt = 0.3, Nb = 0.1, Nc = 2, Nd = 0.1, M = 1, Gr = 1$$

To validate the results found, we have compared the results with the results obtained by Khan and Pop [7] and results are found to be in the good agreement. Therefore we are confident that the results obtained in the present problem are correct.

TABLE 1: Comparison of *Nur* with the result obtained by Khan and Pop [7]

Nb	***Nt***	***Nur*** **(Khan and Pop [7])**	***Nur*** **(Present)**
0.1	0.1	0.9524	0.9523
	0.3	0.5201	0.5203
	0.5	0.3211	0.3211
0.3	0.1	0.2522	0.2512
	0.3	0.1355	0.1356
	0.5	0.0833	0.0833
0.5	0.1	0.0543	0.0543
	0.3	0.0291	0.0292
	0.5	0.0179	0.0178

Fig. 2 depicts that as Bi increases both dimensionless velocity profile $P'(\eta)$ and temperature profile $\theta(\eta)$ rise. Increase in Bi gives stronger convective heating of the surface, which results in increase in the surface temperature and hence the temperature profile.

Fig. 3 shows that with the increase in Bi, $\emptyset_1$increases and hence the thickness of boundary layer increases. Also this figure shows that $\emptyset_2$ firstly decreases and then increases with increase in Bi. Also it is depicted from the figure that there is negative value of $\emptyset_2$ near the surface as due to higher temperature at the surface than the ambient temperature, the thermophoretic force results in depression of their concentration near the surface.

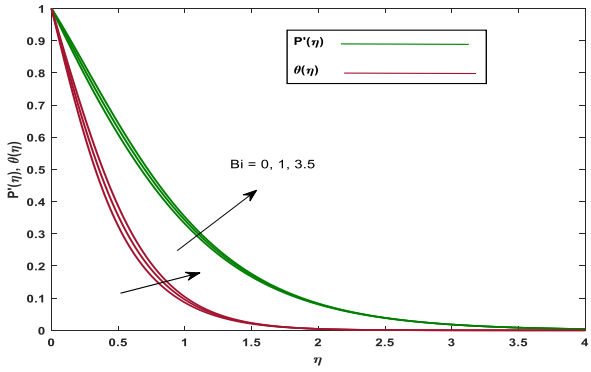

Fig. 2. Variation of dimensionless velocity P' and temperature profile θ with Biot number Bi

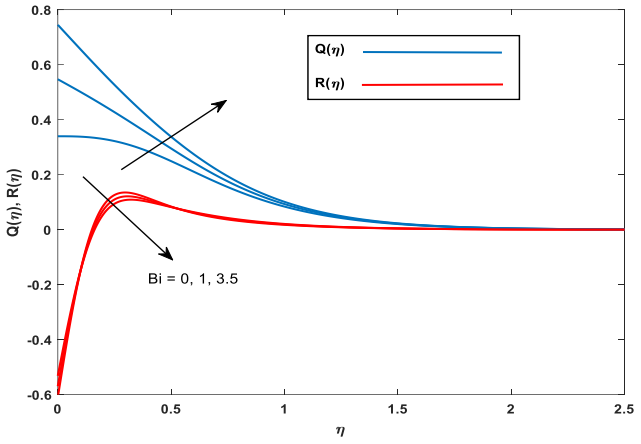

Fig. 3. Variation of solutal concentration $\emptyset_1$ and nanopaticles volume fraction $\emptyset_2$ with Biot number Bi

V. CONCLUSIONS

Double diffusive mixed convective boundary layer flow of MHD nanofluids past a stretching sheet is investigated. Dimensionless velocity, temperature profile, solute concentration are increasing with enhanced Biot number Bi, Also there is negative nanopaticles volume concentration near the surface due to depression effect of thermophoretic force near the surface.

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Direct Theorem for L_p- Norm by Linear Combination for Baskakov Durrmeyer Operators

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Abstract: In recent past I studied basic results for Lp-Norm by linear linear combination for certain Baskakov-Durrmeyer type operators. I extended the study to prove direct theorem for Lp-norm for linear combinations for certain Baskakov-Durrmeyer operators.

Keywords: Linear positive operators, Baskakov-Durrmeyer operators component; formatting; style; styling; insert (key words)

I. INTRODUCTION

Gupta et al [5] introducing the following Baskakovakov-Durrmeyer operators as

For $f \in C_\alpha[0,\infty) \equiv f \in C[0,\infty); |f(t)| \leq M(1+t)^\alpha$, for some $M > M > 0, \alpha > 0$, [5] are defined as

$$B_n(f(t),x) = \sum_{v=1}^{\infty} p_{n,v}(x) \int_0^\infty b_{n,v}(t) f(t)dt + p_{n,0}(x)f(0)$$

$$= \int_0^\infty W_n(x,t)f(t)dt \text{ where}$$

$$p_{n,v}(x) = \binom{n+v-1}{v} \frac{x^v}{(1+x)^{n+v}},\ b_{n,v} = \frac{1}{B(n+1,v)} \frac{y^{v-1}}{(1+t)^{n+v+1}}$$

and

$W_n(x,t) = \sum_{v=1}^{\infty} p_{n,v}(x) b_{n,v}(t) + p_{n,0}(x)\delta(t)$, and $\delta(t)$ being the Dirac-delta function. The space $C_\alpha[0,\infty)$ is normed by $\|f\|_{C_\alpha} = \underbrace{sup}_{0\leq t<\infty} |f(t)(1+t)^{-\alpha}|$.

Let $d_0, d_1, d_2, \ldots, d_k$ be $k+1$ arbitrary but fixed distinct positive integers. Then, the linear combination $B_n(f,k,x)$ of $B_{d_j n}(f,x), j = 0, 1, 2, \ldots, k$ is given by

$$B_n(f,k,x) = \sum_{j=0}^{k} C(j,k) B_{d_j n}(f,x),$$

where $C(j,k) = \prod_{\substack{i=0 \\ i\neq j}}^{k} \frac{d_j}{d_j - d_k}, k \neq 0$ and $C(0,0) = 1$.

These linear combinations were first used by May [2]

And later by Kasana [3] so exponential operators.

II. DIRECT THEOREM

Theorem 2.1 Let $f \in L_p[0,\infty), p > 1$. If f has $2k+2$ derivatives on I_1 with

$f^{(2k+1)} \in A.C.(I_1)$ and $f^{(2k+2)} \in L_p(I_1)$, then for all n sufficiently large

$$\|B_n(f,k,\cdot) - f\|_{L_p(I_1)} \leq Mn^{-(k+1)} \left\{ \left\| f^{(2k+2)} \right\|_{L_p(I_1)} + \|f\|_{L_p[0,\infty)} \right\}$$

, where constant M is independent of f and n.

Proof. By Taylor's expansion of f, we have [3], for $x \in I_2$ and $t \in I_1$ [4]

$$f(t) = \sum_{j=0}^{2k+1} \frac{(t-x)^j}{j!} f^{(j)}(x) + \frac{1}{(2k+1)!} \int_x^t (t-w)^{2k+1} f^{(2k+2)}(w)dw + F(t,x)(1-\varphi(t))$$

, (1)

where $\varphi(t)$ denotes the characteristic function of I_1 and

$F(t,x) = f(t) - \sum_{j=0}^{2k+1} \frac{(t-x)^j}{j!} f^{(j)}(x)$, for all $t \in [0,\infty)$ and $x \in I_2$.

Operating on this equality (1) by $B_n(\cdot,k,x)$ and breaking the right hand side into three parts E_1, E_2 and E_3, say, corresponding to the three terms on the right hand side of (1), we have

$$\|E_1\|_{L_p(I_2)} \leq Mn^{-(k+1)} \left(\sum_{j=1}^{2k+1} \left\| f^{(j)} \right\|_{L_p(I_2)} \right) \leq Mn^{-(k+1)} \left(\|f\|_{L_p(I_2)} + \left\| f^{(2k+2)} \right\|_{L_p(I_2)} \right)$$

in view of Lemma 2.3 [4] and [6].

Suppose h_f be the Hardy-Littlewood majorant of $f^{(2k+2)}$ on I_1, so we can define

$h_f = \sup_{t \neq x} \frac{1}{t-x} \int_x^\infty |f^{(2k+2)}(t)| dt, a_1 \leq t \leq b_1.$

To estimate E_2, Using Holder's inequality and (4.3) and remark of [4], we get

$J_1 \equiv \left| B_n\left(\varphi(t) \int_x^t (t-w)^{2k+1} f^{(2k+2)}(w) dw, x\right)\right| \leq$
$B_n\left(\varphi(t)|t-x|^{2k+1} \left|\int_x^t |f^{(2k+2)}(w)| dw\right|, x\right)$

$\leq \{B_n(|t-x|^{(2k+2)q} \varphi(t), x)\}^{\frac{1}{q}} \{B_n(|h_f(t)|^p \varphi(t), x)\}^{\frac{1}{p}}$

$\leq Mn^{-(k+1)} \left(\int_{a_1}^{b_1} W_n(x,t) |h_f(t)|^p dt\right)^{1/p}.$

Hence, by theorem of Fubini's and [1], we have

$\|J_1\|_{L_p(I_2)}^p \leq Mn^{-(k+1)p} \int_{a_1}^{b_1} \left(\int_{a_2}^{b_2} W_n(x,t) dt\right) |h_f(t)|^p dt \leq$
$Mn^{-(k+1)p} \|h_f\|_{L_p(I_1)}^p$
.

Consequently,

$\|J_1\|_{L_p(I_2)} \leq Mn^{-(k+1)} \|f^{(2k+2)}\|_{L_p(I_1)}.$

Thus, we are led to

$\|E_2\|_{L_p(I_2)} \leq Mn^{-(k+1)} \|f^{(2k+2)}\|_{L_p(I_1)}.$

For $t \in [0,\infty)[a_1,b_1], x \in I_2$ there exist a $\delta > 0$ such that $|t-x| \geq \delta$ which leads us to what follows,

$|b_n(F(t,x)(1-\varphi(t)), x)|$

$\leq \delta^{-(2k+2)} \left[B_n(|f(t)|(t-x)^{2k+2}, x) + \sum_{j=0}^{2k+1} \frac{|f^{(j)}(x)|}{j!} B_n(|t-x|^{2k+j+2}, x)\right]$

$=: J_2 + J_3$

Using Holder's inequality and (4.4) Lemma 2.4[4], we get

$|J_2| \leq Mn^{-(k+1)} \left(B_n(|f(t)|^p, x)\right)^{1/p}.$

Now, applying Fubini's theorem as earlier, we obtain

$\|J_2\|_{L_p(I_2)} \leq Mn^{-(k+1)} \|f\|_{L_p[0,\infty)}.$

Moreover, use of (4.4) [4] and [6], gets us to

$\|J_3\|_{L_p(I_2)} \leq Mn^{-(k+1)} \left(\|f\|_{L_p(I_2)} + \|f^{(2k+2)}\|_{L_p(I_2)}\right).$

Therefore,

$\|E_3\|_{L_p(I_2)} \leq Mn^{-(k+1)} \left(\|f\|_{L_p[0,\infty)} + \|f^{(2k+2)}\|_{L_p(I_2)}\right).$

On combining the estimates of E_1, E_2 and E_3, the result is obtained.

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A Velocity Level path Planning Approach for Mobile Robot for Following a Visually Detected Object in the Cluttered Environment

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Abstract— In this paper, a velocity level path planning approach is proposed for the mobile robot for following a visually detected object. The path planning of the mobile robot to track a moving object is a local path planning problem as the mobile robot does not have a-priori information about its environment. Therefore, the instantaneous reading of the sonar devices, ranging limits, opening angles of beams and their physical placement on the robot, are considered while commanding the robot to detect collision and avoid obstacle during tracking. As the object is detected visually, coordinates transformation schemes are developed to convert the image coordinates to the global frame coordinates. The object tracking is tested in the player stage simulator to justify its application in the real world. The Path planning algorithm and the coordination transformation schemes are successfully implemented in real time on Pioneer P3-DX mobile robot from Activ Media Robotics.

Keywords:object detection,object tracking,velocity level path planning

I. INTRODUCTION

Mobile robot is suitable in various fields such as surveillance [1], hospitals [2], museums [3], offices [4] etc. All these fields require some sort of tracking of rigid and non-rigid objects in any random environment Great deal of research in this field is done and lot is under research. Ramesh et.al. in [5] came out with an algorithm dealing with static distribution of images , it uses Mean shift algorithm. Bradski [6] used Continuously Adaptive Mean Shift Algorithm (CAMShift) tracker where it records the head and face movement. Later hybrid CAMShift algorithm was proposed in [7] that limited the use of single hue. While using any of these algorithm for the mobile robot, a path planning algorithm is required to follow the object without hitting the obstacles.

Path planning involves identifying one or more trajectories that a mobile robot should follow to reach the object from its initial location. There are two types of path planning with respect to the knowledge of navigation environment one is global and other is local. In global path planning [8], a mobile robot has all environmental information and it can plan its motion a priori. But, in local path planning [9], a mobile robot has limited information about the navigational environment. It has to decide its motion as it explores the environment using the instantaneous sensors readings. It should endow with some obstacle detection and avoidance module, so that it can reach the object without hitting any obstacles. So, the path it takes to reach its object location from its initial location may not be optimal one. Obstacle avoidance involves planning and modifications of the mobile robot trajectory in order to avoid any collision with obstacles. A mobile robot relies on its sensor readings to understand surrounding environment and presence of obstacles. A sonar based navigation scheme is proposed in [10], having level control of position. In position level control of the mobile robot, the trajectory generated by the robot is not smooth. The present work is a modification of the work done in [10] and does the velocity level control of the mobile robot.

The paper has been organized in eight sections. Section II describes the coordinate systems, transformation and system modeling of the robot which is required for the path planning. Section III elaborates the proposed method on path planning for the mobile robot in dynamic environment. Section IV and V elaborates the experimental results and conclusions respectively.

II. COORDINATE SYSTEMS, TRANSFORMATION AND SYSTEM MODELLING FOR THE ROBOT

1. Coordinate systems and transformation

Global and local frame of coordinate systems for the robot and coordinate transformation: Global and local frame of coordinate systems are needed to make proper velocity decision for avoiding the obstacles and for tracking the object. The first local robot frame, when the robot was static is defined as global frame of coordinate. As the robot moves, its local frame of coordinate changes while the global frame of coordinate remains unchanged. If the coordinates of a point is known in the local frame of robot then its coordinates in global frame can be calculated by using the odometry data of the robot, the coordinate of robot gravity center in global frame ($^{g}x_r$, $^{g}y_r$) and angle (θ) by which the local frame of the robot is rotated with respect to the global frame about the *z*-axis.

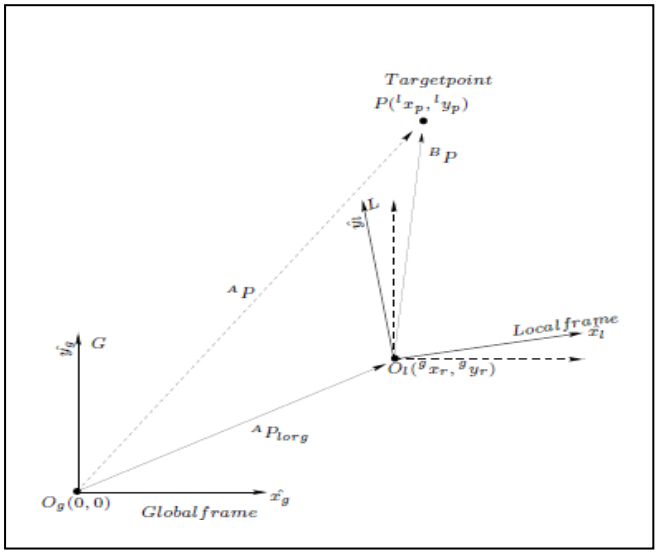

Fig. 1. Robot's global and local frame of coordinate systems

As shown in figure 1, a target center point *P* having coordinates ($^{l}x_p$, $^{l}y_p$) in the local frame, its coordinates in global frame can be calculated as

$$\begin{bmatrix} {}^{g}x_p \\ {}^{g}y_p \end{bmatrix} = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} X \begin{bmatrix} {}^{l}x_p \\ {}^{l}y_p \end{bmatrix} + \begin{bmatrix} {}^{g}x_r \\ {}^{g}y_r \end{bmatrix} \quad (1)$$

where, ($^{g}x_p$, $^{g}y_p$) are the coordinate of target centre point the in global frame of coordinate. This matrix equation can be rewritten as:

$${}^{g}P = {}^{g}R_{l}\,{}^{l}P + {}^{g}P_{lorg} \quad (2)$$

where, ^{g} P is the description of point P relative to G, ^{l}P is the description of point P relative to L, ^{g}R is the rotation matrix describes L relative to G and ^{g} P_{lorg} is the vector that locates the origin of L relative to G.

2. Transformation of the object coordinates from image frame to local robot frame: Transformation of object coordinates is important to design any robot motion controller. The angle of object is given by

$$\psi = -\frac{\phi}{2} + \frac{x}{x_{\max}}\phi \quad (3)$$

where, Ψ is the angle of the object with respect to the robot, x is the x-coordinate of the object in image frame, x_{max} is the width of the image and φis the view angle of the camera. Once the angle of the object with respect to the robot is known, sonar data measures the object distance the sonar for which the condition $\psi \in \left[\beta^{j}_{sy\min}, \beta^{j}_{sy\max}\right]$ is satisfied, its reading (s_j) gives the distance of the object with respect to the robot. So, the Cartesian coordinate of the object in the local robot frame is given by:

$$\begin{bmatrix} {}^{l}x_p \\ {}^{l}y_p \end{bmatrix} = \begin{bmatrix} s_j x \cos\psi \\ s_j x \sin\psi \end{bmatrix} \quad (4)$$

It is to be noted that transformation technique uses information from sonar sensors, which is a cheap sensor and can be easily placed over the robot.

3. System modelling

i) Robot safety clearance ϵ_r: It is the desired safety of the robot in any anonymous environment given by :

$$\varepsilon_r = \begin{cases} S_{\min}; if S_{\min} > R_{\max} - R \\ R_{\max} - R; otherwise \end{cases} \quad (5)$$

where,

R-radius of the mobile robot

R_{max} - distance from the robot center to the furthest point on it S_{min} is the minimum distance, that sonar can detect.

ii) Essential clearance angles of robot: The desired robot angles are as follows

$$\eta^{j} = \gamma j$$

$$\beta^{j}_{normal} = \eta^{j}$$

$$\beta^{j}_{sy\min} = \begin{cases} \eta^{j} - \frac{\alpha}{2}; if\ \beta^{j}_{\min} < \frac{pi}{2} \\ \eta^{j} + \frac{\alpha}{2}; if\ \beta^{j}_{\min} > \frac{pi}{2} \end{cases}$$

$$\beta^{j}_{sy\max} = \begin{cases} \eta^{j} + \frac{\alpha}{2}; if\ \beta^{j}_{\min} < \frac{pi}{2} \\ \eta^{j} - \frac{\alpha}{2}; if\ \beta^{j}_{\min} > \frac{pi}{2} \end{cases} \quad (6)$$

j = 0, 1, 2, ..., n number of sonars.

γ-angle between two consecutive sonars.

η^{j} is the placement angle of jth physical sonar with respect to the local robot frame.

$\beta^{j}, \beta_j \in \left(\beta^{j}_{normal}, \beta^{j}_{sy\min}, \beta^{j}_{sy\max}\right)$ represents the angle of sonar beam with respect to the x_R – axis.

iii) Forward safe path limit: In this section, we have defined a forward safe path limit for sonar sensors placed over the mobile robot to detect the presence of the obstacles in their forward path. The forward safe path limit is defined as:

$$s^{j}_{fd-path} = \frac{\varepsilon_s (R + \varepsilon_r) - \left| R \cos \eta^{j} \right|}{\left| \cos \beta^{j}_{normal} \right|} \quad (7)$$

$$S^{j}_{\lim it} = \min\{s^{j}_{\max}, s^{j}_{fd-path}\} \quad (8)$$

Where, s_{jmax} is the maxi um range of the j^{th} sonar and S_{jlimit} is the forward safe path limit of the j^{th} sonar for a safety scaling ϵ_s ($\epsilon_s \geq 1$). If the reading of any sonar goes below its forward safe limit, it means that the obstacle is detected in the forward path of the robot.

III. PATH PLANNING

The path planning of the mobile robot to track a moving object is a local path planning problem. In local path planning, the mobile robot does not have a-priori information about its environment. It has to decide its motion as it explores the environment. So, the trajectory it generates for tracking the object may not be an optimal one. However, in this work, we have tried to make the robot movement as optimize as possible. The path planning problem has been decomposed into two parts namely (1) Obstacle avoidance task (2) object tracking task.

1. Obstacle avoidance task

Obstacle avoidance is an integral part of planning algorithm of motion implemented on robots navigation in an anonymous environment. Obstacle avoidance task may be further subdivided into two parts (1) Obstacle detection (2) Obstacle avoidance.

i).Obstacle detection: In this work, obstacles are detected using the forward safe path limit, as discussed in section IIB.iii. If any sonar reading (s_j) goes below from its forward safe path limit (S_{jlimit}), then there will be an obstacle in the forward path of the robot.. In this criteria, the robot will first attend the obstacle which is having minimum ordinate in local robot frame. This criteria minimizes the value of turning angle required to avoid an obstacle. The minimum ordinate $y^{\min}_{ordinate}$ is found out as:

$$y^{\min}_{ordinate} = \min(R \sin \eta^{k} + s_j \sin \beta_{sy\min}) \quad (9)$$

where, k ∈ (positional number of sonars which detect obstacles). When the obstacles lies on both side of the robot, the minimum ordinate criteria cannot be applied..

ii). Obstacle avoidance: If there is a single obstacle detected, find out the position number (k) of the sonar which is detecting obstacle and ordinate of the obstacle. In case of multiple obstacles, first check the location of the obstacles (left/right) using the position number of the sonars. If the multiple obstacle lies either in left or right side of the robot, find out the position number (k) of the sonar which is having minimum ordinate among all the sonars those detected obstacle. (ax, ay) are the coordinates of the clearance point on the new forward path and calculated as:

$$\begin{bmatrix} ax \\ ay \end{bmatrix} = R * \begin{bmatrix} \cos \eta^{k} \\ \sin \eta^{k} \end{bmatrix} + S_k * \begin{bmatrix} \cos \beta^{k}_{sy\max} \\ \sin \beta^{k}_{sy\max} \end{bmatrix} \quad (10)$$

The required turning angle is calculated as:

$$ca = bxl - |ax|$$

$$ab = \sqrt{ca^2 + ay^2}$$

$$\zeta = \begin{cases} \cos^{-1}\left(\dfrac{ab^2 + ay^2 - ca^2}{2ab.ay} \right) for - left - turn \\ -\cos^{-1}\left(\dfrac{ab^2 + ay^2 - ca^2}{2ab.ay} \right) for - right - turn \end{cases} \quad (11)$$

where, ζ is the required turning angle and $bxl = \epsilon_s(R + \epsilon_r)$ To avoid any possible collision with the obstacle, the velocity of the robot is restricted as:

$$V_r = \begin{cases} \varepsilon_r ; if --y^{\min}_{ordinate} - \varepsilon_r > \varepsilon_r \\ 0 --otherwise \end{cases} \quad (12)$$

In the case, when multiple obstacles are detected and lies on both sides of the robot, then multiple obstacles are treated as a single big obstacle.

Algorithm 1

1: n Number of sonar those detecting obstacles

2: s[n] Array of sonar's reading those detecting obstacles

3: i[n] Array of corresponding sonar index

4: k is the index of sonar on which clearance point depends

5: MP is the major portion of the obstacle

6: imin = i[0]; imax = i[n];

7: Calculate a = 4 − imin = i[0]; b = imax = i[n] − 3;

8: **if** a = b **then**

9: **if** s[0] < s[n] **then**

10: MP lies in left side of the robot

11: k = imax
12: **else**
13: MP lies in right side of the robot
14: k = imin
15: **end if**
16: **else if** a > b **then**
17: MP lies in left side of the robot
18: k = imax
19: **else**
20: MP lies in right side of the robot
21: k = imin
22: **end if**

The required turning angle is calculated using equation 14 but the value of ca is now calculated as *ca = bxl + |ax|*.The velocity of the robot is governed by equation 12.

2. Object tracking task

For tracking the object, its gravity center coordinates needs to be transformed from image frame to local robot frame.The velocityof the robot is then governed by a linear controller as:

$$V_{pt} = k_{pe} + k_{de}\dot{} \qquad (13)$$

where,k_{pe} and k_{de} are the proportional and derivative constant respectively and e = $s_j - \epsilon_r$ is the distance, robot is supposed to move to reach the object. The maximum velocity, which the robot can attain depends on the local environment sensed by the sonars and is calculated as:

$$V_{\max} = \min\left(\frac{s_1}{S^1_{\lim it}}, \frac{s_2}{S^2_{\lim it}}, ..., \frac{s_6}{S^6_{\lim it}}\right) * S^i_{\lim it} - \varepsilon_r \qquad (14)$$

where, i is the index of the sonar for which ratio s_i /$S_{i\ limit}$ is minimum. If any obstacle comes in the forward path of the robot, then obstacle avoidance action is executed. After the execution of obstacle avoidance action, the robot gets deflected from its target directional line. So, it is required to know the location of the object with respect to the robot, to resume its path. As the object gravity center coordinates $({}^g x_p, {}^g y_p)$ and the robot pose $({}^g x_r, {}^g y_r, \theta)$ are known in global frame of coordinate, the location of the object with respect to the robot can be easily found.

$$\theta_d = \tan^{-1}\left(\frac{{}^g y_p - {}^g y_r}{{}^g x_p - {}^g x_r}\right)$$

$$\theta_{diff} = \theta_d - \theta$$

where, θ_d is the desired heading of the robot to have the object in the center of its view. If θ_{diff} is negative, then the object is in right side of the robot and there is a need to search opening towards the right side of the robot. If θ_{diff} is positive, then the object is in left side of the robot and there is a need to search opening towards the left side of the robot.

3. Path planning algorithm

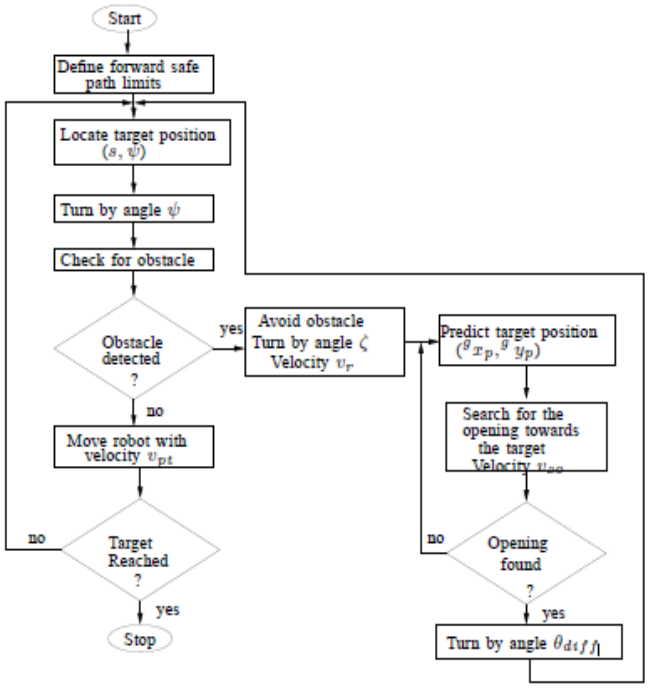

Fig. 1. Flowchart of the path planning algorithm

IV. SIMULATION AND EXPERIMENTAL RESULTS

To test the validity of the proposed algorithms, simulation and real time experiments has been conducted. For simulation, a model of Pioneer robot P3-DX (red color) is considered in stage robot simulator. The moving object is taken as another robot (blue color). Following data has been taken from the P3-DX: R = 200mm, _ $\alpha=15^0$, $\gamma=20^0$, number of sonars =8, sonar limit =1000mm, S_{lim} =100mm, R_{max} =240mm.

The workspace is 16m × 16m, ϵ_r= 0.15 and ϵ_s=1. Figure 3-8 shows the different navigation conditions for the mobile robot in anonymous environment. The moving object and the robot starts from the different initial points. The moving object moves with a constant translational velocity and stops at the point where it met the obstacle. The tracking robot check the position of the moving object and plans its path accordingly and avoids all the obstacles met on its way.

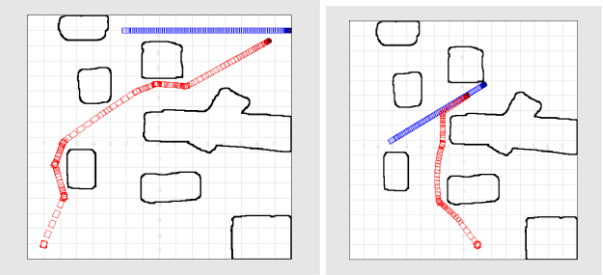

Fig. 3.Navigation of mobile robot in anonymous environment

Fig. 4. Navigation of mobile robot in anonymous environment

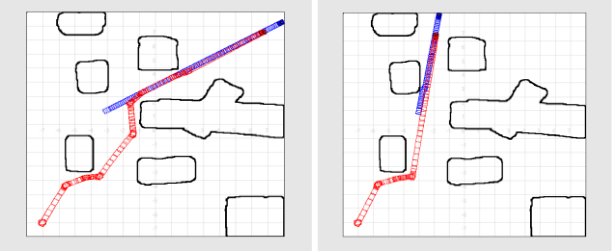

Fig. 5.Navigation of mobile robot in anonymous environment

Fig. 6. Navigation of mobile robot in anonymous environment

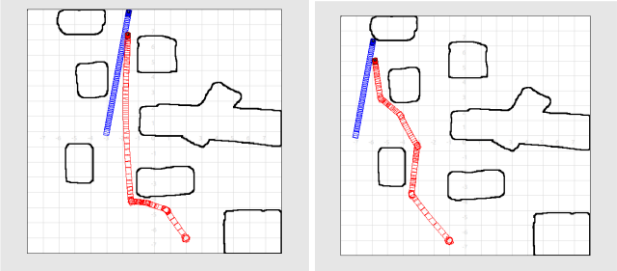

Fig. 7.Navigation of mobile robot in anonymous environment
Fig. 8. Navigation of mobile robot in anonymous environment

V. CONCLUSIONS

A geometry based system modelling is done for local path planning of the robot. Velocity level path planning approach is successfully implemented on the mobile robot for following a visually detected object. Simulation results justify the validity of algorithm in real time. Although, the odometry data is not accurate, the algorithm works fine in real time as the error introduce in global coordinates of object and robot gets cancel out.

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Placement Administration System using MERN

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Abstract: the project named "Placement Administration System" is a web-based student and company information management system. This project is developed based on the information and services provided by the Campus Placement Cell for storing and retrieving the information of students and companies who visit the campus for the recruitment drives. The system maintains an extensive database of students wherein all the information of students, including their personal records like their Phone Number, Address, Email ID, etc. and the academic performance in terms of both CGPA and percentage are maintained. The company information, including the profile of the company, eligibility criteria, the role it is offering and facilities it provides, etc. The software retrieves and operates on this data and displays various opportunities as per the student's eligibility and company requirements. The system takes complete care of the authorization and authentication when a user logs into the system. To achieve this functionality, we have designed separate portals for all the students, student placement coordinators, teacher placement coordinators and placement officers with different roles assigned to them. It is a user-friendly system designed for the particular need of the college to carry out placements smoothly and effectively as it is supported to eliminate the hardships faced in the existing manual system.

I. INTRODUCTION

Every institution comprises of several people working together. Each member of the institution aims for the same vision and mission for the betterment of their institute. They give their best for the improvement of the institute. But still, many obstacles arise in the institute due to less use of technology and more of the previous working procedures. Everyone wants to make his workload less and diminish ultimately with the use of technology, but they don't get the right platform, and so.

Placement Management System brings you the best of both worlds. Placement Management is a web platform for the students and the college placement cell where they can get their entire placement process automated and are also free from maintaining the manual records ultimately. Placement management gives the users the comfort of checking each of their detail related to their placement by themselves, and there is no need to search through a long list of emails and WhatsApp groups every day. Thereby saving their time as well as reducing the workload on the placement coordinators who keep all the placement related record of their institute's students. The Placement Officer and teacher coordinators keep their students updated whenever there is any opportunity is available regarding their placements or internships. Placement Management facilitates the user in every aspect with the proper use of technology.

This project aims to develop a complete solution where final year and 3rd-year students can see full details about which company is visiting next in their campus for internships and placement drives. A student is required to register for the website and then provide his academic as well as personal information only for the first time. Then whenever a new opportunity is available, they can apply to it just by a single click, hence avoiding any typing mistakes made during manual filling of forms.

However, a student can edit their academic information like semester marks, aggregate percentage, CGPA whenever result for any semester is declared. Whenever a new opportunity is available students are notified over their email provided to us during their registration. In this way, they are notified timely and the chances of responding to any opportunity increases. They don't have to take care of their details while applying for any campus drive. They have to keep their personal and academic information updated as the same is pulled from the database while applying for any on- campus opportunity.

They can also filter the jobs based upon their interest and domains they are suitable. They don't have to scroll down unnecessarily see the posts, not of their field. They can apply a filter on the job in the profile they fit and want to apply. Along with this, they can also review the applications for which they have registered successfully. Students will only be notified of the opportunities they are eligible.

This website mainly focuses on reducing the workload of student placement coordinators as they have to make google forms and maintain excel sheets for every new opportunity or placement drive. Any slip-up or fault in student database results in multiplying their work. They have to check several times the academic details of each student, and this turns out to be an overhead for them. Even sending the reminders regarding any opportunity and registration deadlines are to be handled by them.

This web-platform reduces the workload of student placement coordinators. Whenever a teacher coordinator adds any new opportunity, the new database automatically gets created for

that opportunity and students registering for the same are marked with an entry in the same database. So, the workload of maintaining excel sheets diminishes. Also, student coordinators will be provided with same options as of a student appearing for a drive on their dashboard like registering for a new event, editing their personal as well as academic details, to review their previously applied applications.

Automatic conversion of database to excel sheets is possible now whenever it is required to forward details of an event. Student coordinators can keep the attendance of any activity on this platform. They can also monitor how many students of their respective class have applied for an event and don't have to take care of manually notifying those who have still not involved.

Student coordinators also have the authorization to edit the details previously entered by the Teacher coordinators for any event, in case they find any discrepancy or improvement in the description. They just now need to monitor the registrants, and the hassle of maintaining large data sets reduces.

Now, coming to the role of Teacher coordinators, they have complete authorization of any work done by the student coordinators. They have to take care of adding any new campus drives or internship opportunities by making an entry via the interface provided on their dashboard. They have to add necessary details when posting a new job like name of the company, job description, roles for which the company is hiring. The other detailed information like attached PDF, documents, images can also be shared, and their links get appended with the read more section appearing on company's description for students who are qualified and viewing it over their dashboard. Teacher Coordinators can edit the information once added or delete the posts if required. They can add new student coordinators and even deactivate their accounts at the beginning of the new academic year. They can also generate the excel sheets regarding the complete details of students who have applied for a specific job.

Training and Placement Officer (TPO) also have the functionality of having an overall overview of the number of applicants for a particular campus drive or internship interview and can maintain the status of the placed students in various campus drives. They can generate final reports for the overall participation for a campus drive, and also the yearly placement drives records to share with the college administration.

II. AIMS AND OBJECTIVES

The problems in the existing manual system point to the need for a fully dedicated and automated placement administration system to carry out placements smoothly and effectively. The main objectives of the proposed method are:-

1. It aims to provide a common platform for the students of Maharaja Surajmal Institute of Technology (MSIT) for easy management of their information regarding placement activities.
2. The aim is to minimise the manual workload of creating forms and managing data of students for each campus placement drive over excel sheets and providing the campus placement team with a platform to automate this process and have more meticulous administration of student data.
3. It helps in making the entire process fast and reliable.
4. It also aims at providing information about various on-campus events over a single platform to prevent any mismanagement of data by students due to their negligence.
5. It reduces the chances of errors as no student can apply to a job for which he/she is not eligible which makes the sending the data of qualified students to the company easy and less time-consuming.
6. It aims to minimise the verbosity in postings for eligibility to students as the later will be able to filter out postings according to their domain and field of interest.
7. We also intend to provide students with a platform where they can not only apply for an incoming opportunity but can also track and review the status of their application and can thus prepare accordingly.
8. The placement cell can also harness the platform as a medium for generating reports of each drive or the yearly placement records for college administration.
9. It also provides the facility of converting the database information to the excel sheets.
10. It reduces the complete dependency of students on their respective student placement coordinators.

III. PROBLEM STATEMENT

Maharaja Surajmal Institute of Technology doesn't have a web platform to manage the placement activities. All the information related to placement and internship opportunities available on campus is circulated through email and Whatsapp groups. All the records are kept manually, and this, in turn, leads to a very complicated procedure that can be error-prone many times. Training and Placement Officer, Teacher Placement Coordinators, and Student Placement Coordinators must keep a check so that every opportunity is communicated to each student taking part in placement drives. Along with this Student Placement Coordinators need to look over the student's details filled by them, manually which is a very tedious process. They need to check that all the eligible students must have timely registered for an event and need to give reminders

to them. All the excel sheets of student data of an event are to maintained over local storage which is even not a favourable option when viewed from the perspective of security. All this procedure is to be performed manually by the Student Placement Coordinators. It is a very time-consuming job when it comes to maintaining data for the whole final year students. There are innumerable curbs in the existing systems. In the current scenario, all the tasks are being taken care of manually. There comes the need for a dedicated system that will overcome all the downsides.

IV. SCOPE

The proposed web platform has a large scope when it comes to comparing it with the existing system. Students can fill and update their academic and personal details on their own.

Notifications regarding the latest opportunities available are directly sent to them. They can view the application status of all the events previously applied. This platform is very easy to use and the following are the main functionalities which is provided through this web application:

1. User Profile.
2. Data update and edit, i.e. academic as well as personal data.
3. Change Password.
4. Add jobs and update existing job applications.
5. See Various Jobs Posted.
6. Apply to Jobs if Eligible.
7. Check Application Status for jobs applied
8. Generate excel sheets for the company's application received.
9. Forget Password
10. Teacher PC's can add Student Placement Coordinators.
11. The Placement Officer can assign Teacher PC's

V. PROPOSED SYSTEM

Traditionally the registration of students for a particular company implied a manual process of creating forms by student coordinators which were very time consuming and error-prone process. So, a significant need is to provide a digital medium for registration of students and to maintain their data for reusability in other companies. Since handling this data by concerned authority is necessary, so there is a need for security for supporting restrictive access to student's data. After a new company application is live students do not have any access to be informed. Hence, there was a need for a notification system probably solved by implying mails functionality at every stage of the application. For keeping track of the application status of a student, the application status is maintained in a central repository. To achieve all the requirements mentioned above, and to reduce the time required to process this information, there is a need for maintaining a centralised repository of student data as well as that of the recruiters digitally. The intention is to develop a system that could accomplish and:

1. Reduce the time and labour in the data collection process.
2. Improve the integrity of the data provided to the company.
3. Manage the resources carefully.
4. User-friendly interface for managing as well as showcasing information.
5. Security check-in, check-outs as well as maintaining the student profile.
6. Easy scalability of the system with the growing requirements.
7. Notification System for informing about the new opportunities.

VI. LITERATURE SURVEY

TABLE 1. Literature Survey

S.NO	Title	Features	Advantages
1.	Training and Placement Web Portal, International Journal on Recent and Innovation Trends in Computing and Communication.	Showing names of companies, Apply option	Fast registration, Reduce manual works
2.	ADVANCED TRAINING AND PLACEMENT WEB PORTAL	Applying to the companies, Internships	Security, TPO forum section
3.	Placement Cell, IOSR Journal of Computer Engineering	Automation, Notifications via email.	Fast registration, Reduce manual works
4.	Web Based Placement Management System, International Journal of Computer Science and Information Technologies	Notification of placement to students through email and messages	Used for maintaining college details
5.	College Collaboration Portal with Training and Placement, IOSR Journal of Computer Engineering (IOSR-JCE)	Automation, Optimization, Security, Information, software and placement	Fast registration, Reduce manual works
6.	TRAINING AND PLACEMENT CELL, International Journal on Recent and Innovation Trends in Computing and Information Technologies	Automation, uploading Internships	Fast registration, Reduce manual works
7.	Placement Cell, IOSR Journal of Computer Engineering	Automation, Notifications via email and messages	Fast registration
8.	Online College Portal, International Journal of Current Engineering and Technology	Automation, Resume uploading, Notification	Fast Registration, Reduce manual works, Involvement of staffs.
9.	Student Placement Management System (SPMS), International Journal of Advanced Research in Computer and Communication Engineering	Notification, Uploading Internships	Fast registration, Less time of retrieving data

VII. WORKFLOW

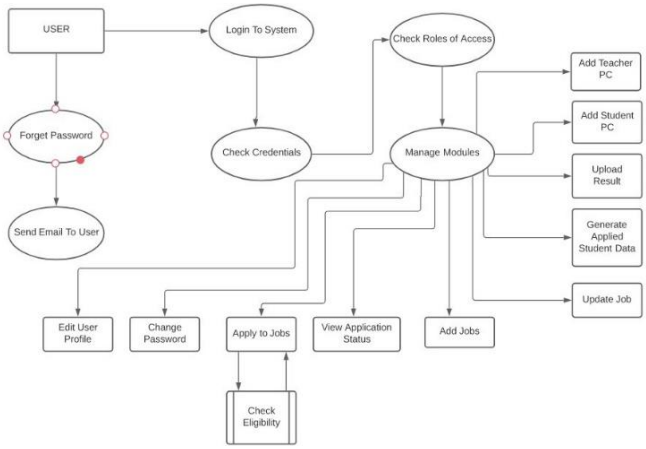

Fig. 1. Workflow Diagram

Once a user login to his/her account firstly the credentials are verified from database, then the role of the user is accessed and depending upon whether the user is Student,

Student PC, Teacher PC, TPO dynamic dashboard is rendered. Depending upon rights given to a particular user which depends upon role, he / she can have different functionalities visible. If he/she doesn‘t remembers credentials, user can use forget password functionality and thus get OTP over the email provided to get new password.

VIII. DATABASE DESIGN

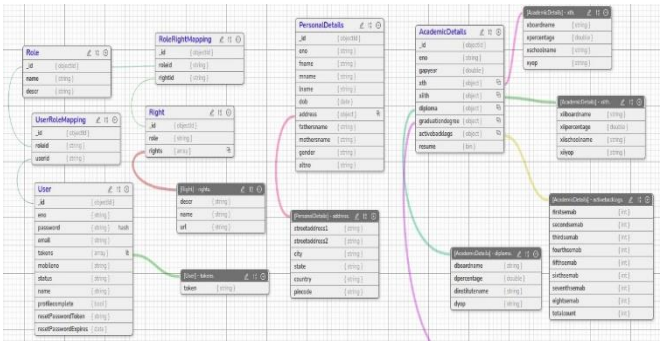

Fig. 2. Database Design

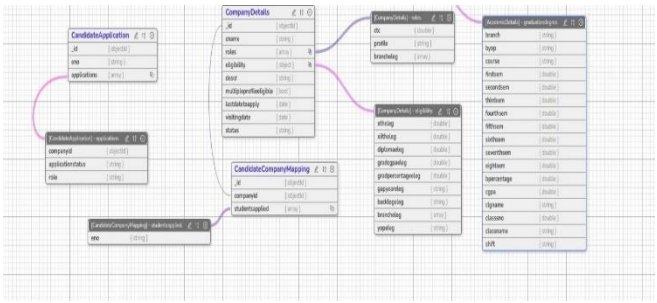

Fig. 3. Database Design

IX. METHODOLOGY

We have designed the following modules to support the various requirements of the system:

A. Students

Following are the features provided to the student:

1. User Profile –: Every student will have access to the page MY PROFILE, where he/she can view or update his/her personal and academic details. Once the student completes its profile, then only he/she will be able to apply in various job applications.

2. Data update, i.e. academic as well as personal data - The personal details include the enrolment number, email address, name, phone number, gender, DOB, fathers and mothers name and residential address of the student. The academic details includes the information regarding class Xth, class XIIth, diploma (if applicable) and graduation degree percentage and active backlogs details.

3. Change Password -: Every user can change his/her password by providing a new password.

4. See Various Jobs Posted -: Every student will be given access to the Job Applications where he/she can view the available active job applications and apply in the same if he/she is eligible for the respective company evaluated according to the eligibility criteria provided by the company. Once the student applies successfully in any company, the apply button will be disabled and an alert message will be displayed which says ―you have already applied‖ in order to avoid multiple entries in the database.

5. Apply to Jobs if Eligible -: Student can apply to any job only if he/she is eligible for that particular job application.

6. Check their Application Status -: Every student can access this screen where he/she will be shown the job applications in which he/she has applied. Initially the application status is pending and when the result is uploaded by any student placement coordinator, the application status changes to either Shortlisted for further rounds‘, Selected‘ or Rejected‘. With the help of this, the students can keep track of their applications and prepare accordingly.

7. Forgot Password -: Every user has access to this feature where if he/she forgets his/her password anytime, they can reset it by simply providing the registered email address where they will be provided with an OTP which they has to provide in the portal and after successful verification they can finally reset the password.

B. Student Placement Coordinators

Student Placement Coordinator has all the similar functionalities as of the student but also have some additional functionalities:

1. Add a Job Application -: Only student placement coordinators and teacher placement coordinators will have access to this screen where they can add any job application visiting the campus in the database after which it will be available for application to students. The information required is the company name, roles, eligibility criteria, job description and last date to apply.

2. Update existing job application -: Only student placement coordinators and teacher placement coordinators can update any active job applications.

3. View all the active job applications.

4. Generate excel sheets for companies application received -: The student placement coordinators can generate the excel sheets of all the eligible students for a company where they can also select the type of details they want to include in the final sheet to be send to the company. They just simply need to check the boxes of the details the company wants.

5. Upload the result after successful completion of any recruitment drive -: Whenever any recruitment drive‘s result is out, the student placement coordinators can update the same on the portal to keep everyone updated and prepared. He/she will be first provided with a template and after uploading the shortlisted student‘s data and the remaining details, the result will get uploaded and all the students will get notified over emails and the portal.

C. Teacher Placement Coordinators

In addition to the responsibilities of the Student Placement Coordinator, a Teacher Coordinator can perform the following:

1. Add and update an existing Job Application.

2. View all the active job applications.

3. Can assign Student Placement Coordinators -: The teacher placement coordinators have access to a special feature where they can activate the accounts of any number of student placement coordinators by specifying their enrolment numbers in the screen given below.

4. View the statistics of total placed students.

D. The Training and Placement Officer

The TPO has access to the following features -:

Activate the accounts of Teacher Placement Coordinators -: The training and placement officer of the institution is given special privilege where they can activate the accounts of teacher placement coordinator by providing their information which includes their unique employee number, name, mobile number and email address after which the respective teacher will be notified over email with their login credentials.

View the statistics of total placed students.

X. RESULT AND CONCLUSION

Thus hereby we conclude that the proposed system helps in eliminating all the hardships faced by the training and placement cell of MSIT in the existing system by providing an interface where the student placement coordinators are no longer required to be worried about any false information by any student, they can maintain the status of applications and update the result on the portal so that the students can track their applications and prepare accordingly. The proposed system provides the automation in all the functionalities like checking the eligibility of students for every job opportunity, generating student data dynamically which has to be forward to the company, activating and deactivating the accounts of student and teacher placement coordinators and the final result of the batch, that is, generating reports.

Thus the developed system can guarantee to keep the records safe and secure in the database. It converts unstructured data into structured data and according to the required format hence reducing the probability of errors. It is very reliable and performs functionally well to get an alert message and emails whenever any data is submitted or updated on the portal. With the help of this portal, the student placement coordinators can validate the student‘s information and generate the list on the basis of company‘s eligibility criteria and send the converted excel sheet of applications to the respective company. Therefore the proposed system with its user-friendly interface minimizes the dependency of students on their respective coordinators by making the whole process transparent. Overall, all the process of the training and placement department is automated.

Fig. 4. Add Job Profile

Fig. 5. Landing Page

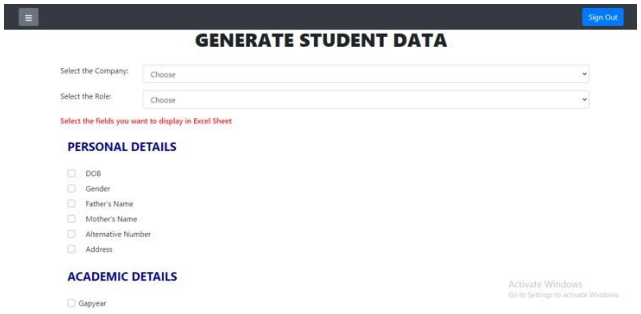

Fig. 6. Generate Student Data

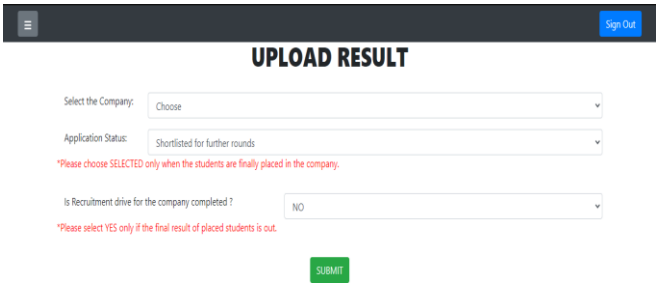

Fig. 7. Upload Result

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Design Issues in Digital Image Watermarking

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Abstract: Digital watermarking is the process of clandestinely embedding a watermark over the host data. The host data may be any audio, video, or image. Digital Image Watermarking has turned up as a potential solution to the threats over copyright and/ or integrity of digital images spread over ubiquitous digital networks. The anytime, anywhere availability due to the availability of the internet makes such images highly prone to be modified intentionally/ unintentionally. Digital watermarking is as a potential tool to offer copyright protection to digital data. The various design issues related to digital image watermarking are presented in this paper.

Keywords: Digital watermarking, design issues, copyright protection, multimedia security.

I. INTRODUCTION

In the past few decades, the popularity of internet technology has increased enormously. It has led to easiness in communication and distribution of digital data such as image, video, text, and audio. However, the very conveniently available image processing tools make it even easier to duplicate, modify, and redistribute such multimedia data. These acts of copying, modifying and redistribution of digital data violate the intellectual property rights of the multimedia data owner. Hence, copyright protection of digital data has emerged as a potential area of research in the current scenario [1-4]. To address the issues related to copyright protection of multimedia data, numerous information security techniques have been proposed in the literature as shown in Fig.1. Digital watermarking has evolved as a very effective information security technique for copyright protection or copyright authentication. Broadly, these approaches can be characterized as the Cryptography approach and Information Hiding approach [6-7]. The use case of the Digital Watermarking system decides its required characteristics. To preserve the copyright information of the host image, a robust watermarking system is required. The essential aspect of robust watermarking is that such a watermark when inserted in the host image, sustains the attacks imposed by attackers. Instead, in the applications where the integrity of the host image is to be preserved, fragile watermarking schemes are deployed. Fragile watermark gets vanished from the watermarked image on the introduction of any kind of attack.

Robustness and imperceptibility are the two key characteristics that illustrate the efficacy of the watermarking system. Since the evolution of the Digital Watermarking method, various conventional and hybridized methods have been developed by the researchers.

II. DIGITAL WATERMARKING

In this section, some basic terms associated with digital watermarking, its characteristics, classification of watermarking techniques on various grounds, and its applications are discussed. Some of the standard terms used in our thesis are as follows:

- Watermark: it is a visible binary image or logo which is inserted in the original image. In this thesis, we have used binary images as well as the logo as a watermark.
- Host Image: host Image is the original image whose copyright needs to be protected.
- Watermarked Image: We get this image after the watermark embedding process.
- Watermark Embedding: This includes several steps for inserting a watermark over the cover/ host image.
- Watermark Extraction: This is the process of recovering back the original host image by means of extracting the watermark from the watermarked image.

Image processing/ Geometric attacks: These are the alterations that the watermarked image may encounter across the channel or by some unintended recipient. These alterations are due to some basic image processing tools such as sharpening, JPEG compression, blurring of the image, sharpening of the image, noise addition, filtering, etc. as well as geometric attacks wherein the shape or the size of the host image gets altered. Geometric attacks include resizing, cropping, rotation, and translation of the host image among others. The effect of some image processing & geometric attacks on Lena's image has been presented in the fig. 1.

III. DESIGN ISSUES

There are certain design issues in Digital watermarking systems such as robustness against various attack situations, distortion and visual quality, working domain, Human Visual System (HVS), a trade-off between robustness and

imperceptibility, computational cost, etc. these issues are discussed in detail below.

A. Robustness against various attack conditions

The attackers in a digital watermarking system can be classified as a Passive attacker and an active attacker. The passive attacker doesn't harm the watermarked image directly, instead, he just detects the presence or absence of the watermark in the watermarked image. However, the active attacker will extract the watermark from the watermarked image and will try to later or destroy the watermark. In this way, the active attacker can alter the copyright over the watermarked image [5]. In actual scenarios, the transmitted watermarked image travels through wired or wireless channels, and in this course, they face several image processing or geometric attacks [5-6]. Fig. 2 shows the possible cracking of watermarking system by passive and active attackers. It has been observed that most of the available watermarking methods are resistant to compression, filtering, and some other conventional image processing attacks but they lag in providing enough robustness against geometric attacks.

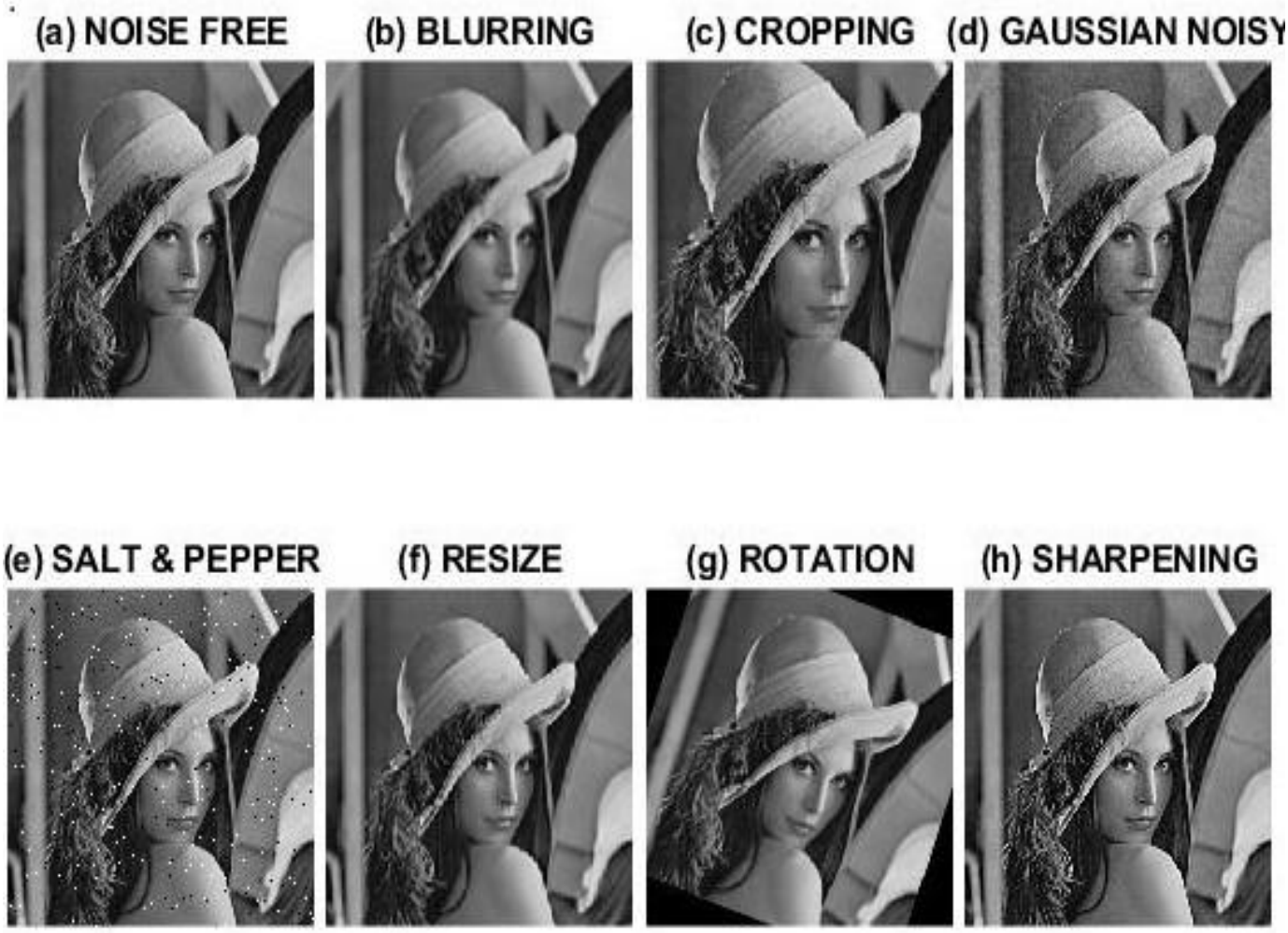


Fig. 1. Effect over Lena image (a) without any attack (b) with blurring (c) with cropping (d) with addition of Gaussian noise (e) addition of Salt & Pepper noise (f) with resizing effect (g) with rotation attack (h) with sharpening attack.

Hence, it becomes an important issue to design a watermarking system that can provide robustness against geometric attacks as well. Along with robustness, it is also very important to make the watermark secure against unauthorized detection and hence alteration.

B. Distortion and Visual Quality

Insertion of the watermark over the host image directly affects the visual quality of the host image. The distortions introduced during the watermark insertion process and due to the intentional/ unintentional attacks across the channel are

generally asymmetric in nature, hence there is a wide range of Peak Signal to Noise Ratio (PSNR). The imperceptibility offered by any watermarking scheme is evaluated with the help of achieved PSNR. Hence, the visual quality of the watermarked image or the imperceptibility of the watermarked image is proportional to the PSNR attained.

C. Working Domain

The least significant bit (LSB) and most significant bit (MSB) are the two most widely adopted spatial domain watermarking methods. Fig. 3 showcases a sample of insertion of watermark bits over the host image, the generation of watermarked bits, and finally, the major changes introduced extracted watermarking bits using LSB based watermarking method in the spatial domain [9-11]. The major advantage of LSB based watermarking schemes over MSB based watermarking schemes is that the LSB watermarking

introduces less distortion as compared to MSB watermarking schemes. Spatial domain watermarking methods are computationally less expensive and easy to implement but these methods offer very less robustness against the imposed attacks, low imperceptibility, and less security to the watermark as compared to the transform domain watermarking methods. In transform domain methods, instead of modifying the pixels directly, the watermark is inserted on the transformed coefficients of the host image.

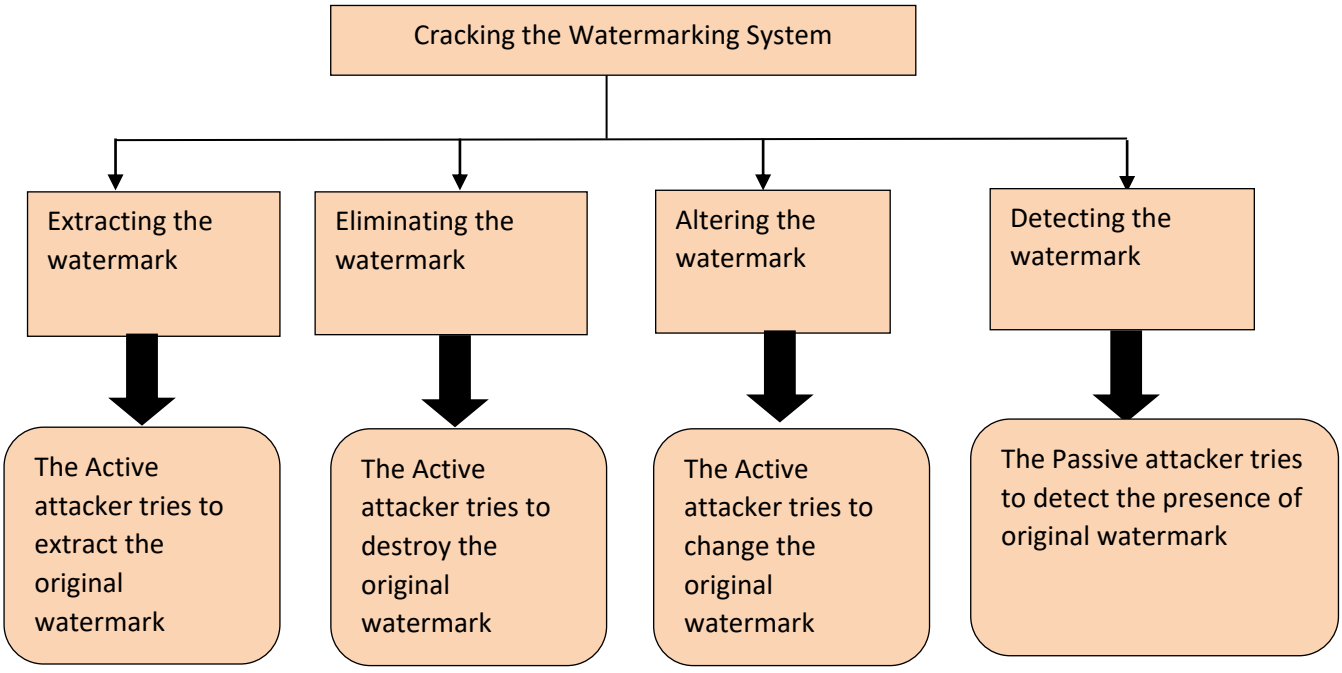


Fig. 2. Breaking watermarking system by possible attackers.

D. Human Visual System

The visual quality or the imperceptibility parameter in the digital image watermarking methods can be achieved by exploiting the features of the Human Visual System (HVS) while designing the watermarking system. It has been observed that the multi-resolution property of Discrete Wavelet Transform (DWT) makes it similar to HVS [1-2]. Hence, where the imperceptibility parameter is an important parameter in a watermarking system DWT is preferred.

E. The trade-off between Robustness and Imperceptibility

It is desired that the designed watermarking system should be capable of providing high imperceptibility, robustness towards the attacks, high fidelity, and security. The watermarking system should be able to insert a maximum capacity watermark without severe degradation in the visual quality of the host image and make sure that it is very difficult to remove the watermark from the watermarked image. The fundamental issue in the design of a digital image watermarking system is to achieve this trade-off between robustness and imperceptibility because both these parameters are conflicting with each other.

F. Computational Cost

Computational cost or time complexity is another major aspect of digital image watermarking. The designed watermarking scheme should be able to execute efficiently by consuming minimum execution time. To maintain a trade-off between

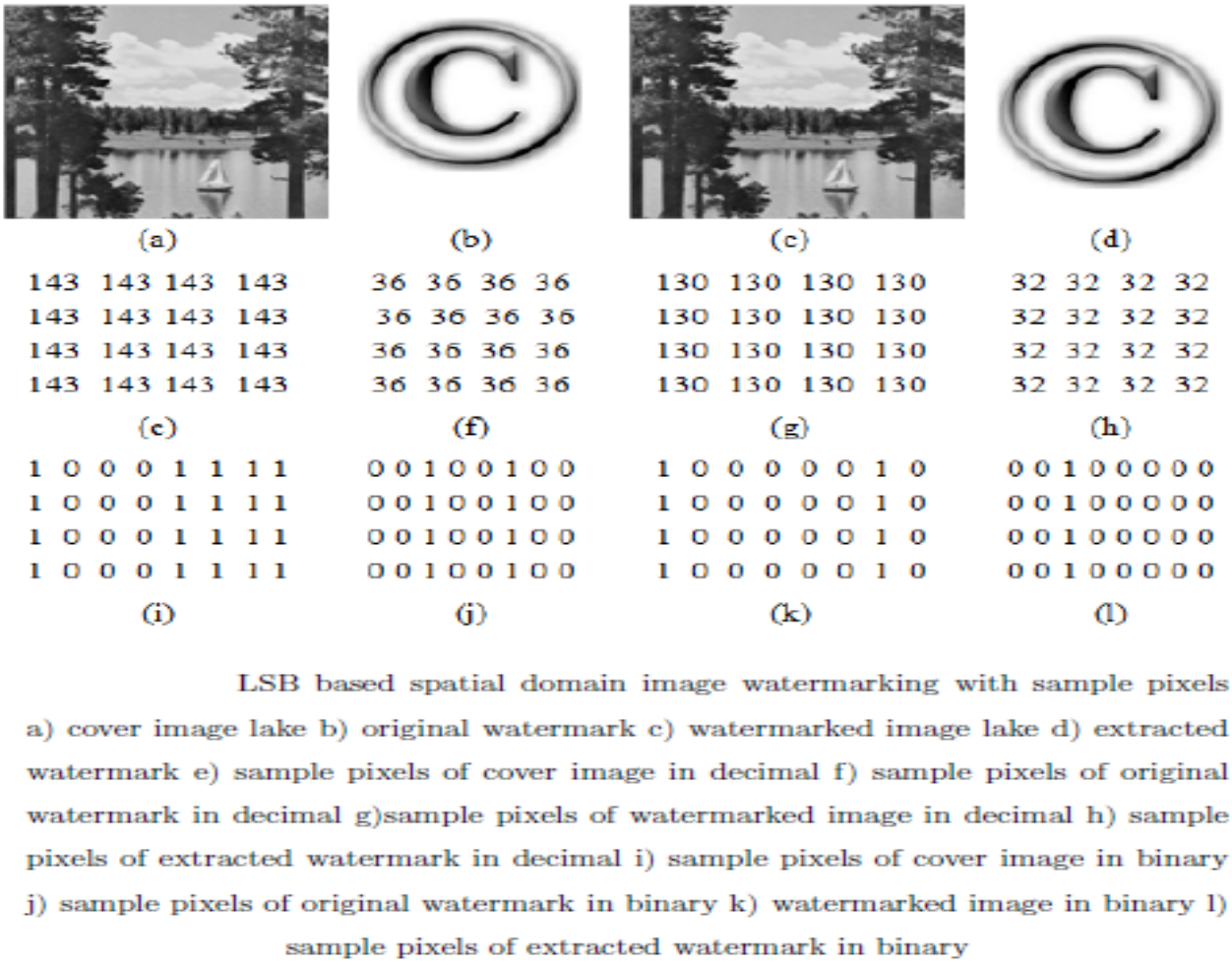
robustness and imperceptibility various available GA or optimization techniques can be used. But, as these optimization methods take much execution time, hence designing a computationally efficient digital watermarking method is a very important design issue [7-8].

IV. IMPORTANCE OF SCALING FACTOR

Robustness and Imperceptibility are the two important characteristics that need to be taken care of while embedding a watermark.

When a watermark is robust it means it will be able to resist all intentional as well as unintentional distortions. The watermarked image generated at the encoder while traveling through the channel faces intentional and/or unintentional modifications or attacks. Intentional modifications are purposely done and are like image processing operations and geometric modifications. For example, a watermark is said to be robust, if it can be retrieved after say image compression. Common image processing operations that are done on images are contrast adjustment, image smoothening, cropping and noise insertion, etc. Common geometric modification operations include scaling, rotation, and translation. While unintentional modifications may be resampling, resizing and addition of Gaussian or non-Gaussian noises, rescanning and printing, etc. Although it is desired to design an image watermarking algorithm that is robust against all possible intentional or unintentional distortions, a different type of application requires a different subset of robustness. This gives a scope to embed the watermark in different images in a different quantity or in other words different values of scaling factors can opt. If we choose a high value of scaling factor, a good quality watermark can be recovered from the received image even if it faces severe attacks or distortions.

Imperceptibility is another factor that plays a significant role in deciding the Scaling factor. Imperceptibility states the extent of resemblance between watermarked image and host image. It is normally preferred that the watermarked images should be perceptually similar to the host image. Otherwise, the distortions in the host image caused due to the embedding



LSB based spatial domain image watermarking with sample pixels a) cover image lake b) original watermark c) watermarked image lake d) extracted watermark e) sample pixels of cover image in decimal f) sample pixels of original watermark in decimal g)sample pixels of watermarked image in decimal h) sample pixels of extracted watermark in decimal i) sample pixels of cover image in binary j) sample pixels of original watermark in binary k) watermarked image in binary l) sample pixels of extracted watermark in binary

Fig. 3. An example of LSB Spatial Domain Watermarking.

of the watermark would change its aesthetic values. Human Visual System (HVS) models are generally used and applied while embedding the watermark. According to this model, human eyes are less sensitive to changes that are made in highly textured regions of the image compared to the flat textured regions. These regions could be easily explored by transform domain techniques. Now the extent of embedding can be controlled at the encoder by choosing different scaling factors, depending upon the desired visual quality of the watermarked image. Low values of scaling factors are preferred to get a high visual quality of the watermarked image.

So while designing a highly robust watermarking algorithm, high values of scaling factor are desired, on the other hand, to have high imperceptibility low values of scaling factor are desired. Therefore, there is a tradeoff need to be maintained between robustness and imperceptibility.

The second important component of the watermarking system is the decoder- here the watermark is recovered from the received image. The attacked image, when received by the user and verified for authenticity by extracting the watermark from received data, is known as the extraction process of Digital Watermarking.

V. CONCLUSION

Some of the important design issues such as scaling factor, robustness, imperceptibility etc. that plays significant role in Digital Image Watermarking have been presented in this paper.

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Analysis of Speech for Detection of COVID- 19

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Abstract: The COVID-19 pandemic has proven itself as a global challenge surpassing barriers of countries, race, religion, or economy. An immense contribution and considerable efforts by all the service providers throughout the nations across the world had been vital in the fight against this virus. Being a disease that affects the throat area, the major symptoms of COVID-19 are related to the respiratory system include cough and breathing difficulties. The current widely excepted method for COVID-19 detection is the Reverse transcription-polymerase Chain Reaction (RT-PCR) testing. However, as the pandemic spreads throughout the world at an alarming rate and lesser accuracy rate of the current method, RT- PCR test is costly, time-consuming, and more importantly, violates the first rule of protection against pandemic i.e. social distancing. There is a need for an alternative way to diagnose COVID- 19 which overcome these limitations and have the potential of deployment at a very large scale. We foreknow that respiratory sounds, when analyzed using machine learning techniques, can provide useful insights about the health of the respiratory system thus, enabling the design of a diagnostic tool.

I. INTRODUCTION

Coronavirus (COVID-19) is a disease that is communicable from severe acute coronavirus syndrome 2 (SARS-CoV-2). People with this virus suffer from mild to moderate respiratory diseases and may recover without specific therapy. Older persons and people with underlying medical issues such as cardiovascular disease, diabetes, chronic lung disease, or cancer are more prone to acquire major diseases. Only by being informed about the symptoms it caused and how it might spread can the spread of COVID-19 prevent and restrict it.It is advisable to wash your hands or to use an alcohol- based rub often and not to touch your face to prevent you and others from infection. Studies show that, if an infected individual toys or sneezes, suspended into the air, it is mostly disseminated by the goutlet of the saliva or discharge out of his nose. It is thus necessary to use breathing labels as well (e.g. by coughing into an elbow) or to constantly use a mask. COVID-19 impacts various people in various ways. It takes an average of five to six days to see signs from someone who may have the virus infection. An infected individual develops on average mild to severe disease and can recuperate without a hospitalisation up to 14 days inside a week. Fever, dry cough, tiredness are the most frequent symptoms. In certain situations, less common symptoms including aches and pains, throat ache, diarrhoea, conjunctivitis, headache, taste or smell loss, a skin rash, or finger or teeth discolouration have been reported. However, the greatest death rate from COVID-19 was found in individuals with cardiovascular and chronic respiratory illness preconditions.

Continuous over-supply of COVID-19 has led to significant collaboration among several areas in order to manage and prevent the spread of the virus on a daily basis. But the current, mostly accepted COVID-19 detection technology, Reverse Transcription Polymerase Chain Reaction (RT-PCR), despite all its efforts and recommendations, has enormously increased the danger of the virus spreading unless it is properly administered. Once all the predominant symptoms have been seen, the respiratory area may be associated in most instances. The following are included:

- difficulty breathing or shortness of breath.
- chest pain or pressure.
- loss of speech or movement.

As per World Health Organization (WHO) guidance, Nucleic Acid Amplification Tests (NAAT) such as real-time Reverse Transcription Polymerase Chain Reaction (rRT-PCR) should be used for routine confirmation of COVID-19 cases by detecting unique sequences of virus ribonucleic acid (RNA).

II. LITERATURE

By penetrating healthy cells, the COVID-19 virus infects the body. There, the virus builds clones and seeds over your body. The novel coronavirus attaches spiky surface proteins to healthy cellular receptors, particularly lung receptors. In particular, ACE2 receptors are used to break viral proteins into cells. When the coronavirus is within, it gradually hi- jacks the healthy cell and kills some of it. Thus, transient limitations of the neuromuscular and loss of taste and odour. Some physiological manifestations in speech production can influence muscle control and proprioceptive feedback. Given the physiological effects of the respiratory effects, the link between speech features and heart rate correlation and heart rate measurements has been indicated by existing research, observation, and experience. With the use of diverse signal processing techniques and artificial algorithms, we can estimate the changes in COVID 19 for patients in published literature each with their degree of precision, complexity and limitations. Consequently, the Virus may be detected using these biological markers related with the COVID-19

symptoms. This may be done by representing the waveforms of speech in a spectral form and the temporal variation to observe if the difference between them is detectable. The link between respiratory pattern and speech and its influence on breathing pattern variability is known as respiratory arhythmia sinus (RSA). The MFCC vectors and pitches are removed with independent speech processors in these systems. A mixed-signal architecture approach, for example, in [4] enabled robust voice recognition for wearable goods. The reliance on one type of speech feature for feature extraction may constrain the performance and utility as MFCC are unreliable in presence of audio degradations. Concerning the currently existing literature, this is where we present our work, as detailed in the following sections. We propose a deep learning- based algorithm, referred to as Convolutional Neural Network, to analyze the speech features given by MFCC, for learning a joint feature space that efficiently models the entire speech chain. Finally, we describe the known result sample verification to demonstrate the superior representation capability of the joint feature space. The dependence on one type of talk function for function extraction might limit performance and utility as the MFCC is untrustworthy in the event of deterioration of audio. With regard to current literature, we offer our study in the following parts as stated. To evaluate the speech features provided by MFCC, we propose a high level method, known as the Convolutional Neural Network, to train a common feature that represents the complete chain of voice effectively. Finally, the known results sample check is described to show the higher representational capabilities of the space of the joint function.

Symtoms	COVID 19	Influenza	Cold
Breathing: Dypnea	✓✓✓	✓✓	✓
Breathing: Difficulty	✓✓✓	✓✓	✓
Nasal Congestion	✓	✓	✓✓✓
Coughing	✓✓	✓✓	✓
Sneezing	✓	✓	✓✓✓
Sore Throat	✓	✓✓	✓✓✓
Body Pain	✓	✓✓✓	✓✓
Headache	✓✓	✓✓✓	✓
Fatigue, Tiredness	✓✓	✓✓✓	✓
Appetite Loss	✓	✓✓✓	✓
Onset Gradient	✓	✓✓✓	✓

Fig. 1. Comparision of different respiratory affecting diseases according to their impact on the sounds

III. DATASET DESCRIPTION

COVID-19 symptoms are largely connected to the development of respiratory issues, and thus varied patterns of breathing, respiratory and lung sounds may be monitored by tracing different sounds, including their vocal arousals and changes in the course of time to diagnose COVID 19 infection. The described approach to identify speech change is to extract and evaluate acoustic characteristics for the variations. For this to be done, cough sound is ideal, as the acoustic characteristics of a cough sound rely on the airflow rate, voice tract and airway size. As breathable illnesses change the physical structure of the respiration system, pathological conditions such as breathing and phonetics may also be classified based on other noises. Those designated as COVID-19 are therefore a collection of sound samples from healthy and ill persons. In terms of sound information we focus on nine distinct categories of breathing (two types, shallow and deep), cough (two types; shallow and heavy), continuous vowel telephony (three types; /æ/ produced, /ɪ/ in the kit, /u:/ gooses), and a counting of one- to nine digits (two kinds; normal and fast paced). No personal information is gathered. No personal information. Data are also stored anonymously.

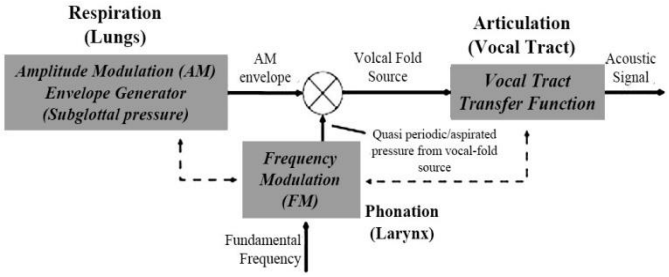

Fig. 2. Fundamental speech-production subsystem model illustrating two of the potential points of coordination

IV. FEATURE EXTRACTION

Mel-frequency cepstral coefficients are mainly intended to detect monosyllabic syllables in a continuous phrase, computing is to replicate a human hearing system to implement the working principle of the ear artificially, assuming that the human ear is a trustworthy speaker recognizer. In order to maintain the phonically essential characteristics of the voice signal, MfCC is aware of the difference between the crucial bandwidths of the human ear and frequency files that are divided linearly at the low frequencies.A collection of filters mirrors the working mechanism of the human auditory system and can process the acoustic data at different frequencies. The MFCC describes the energy distribution of the signals in the Mel frequency domain as a sort of feature.

1) DATA COLLECTION AND CONVERSION: The analog speech signals are converted into the digital domain by analog to digital converter with at least the sampling rate of 48 kHz. In the conversion, the continuous input signal is sampled and quantized into the discrete signal.

2) FRAMING MODULE: As the spectral amplitude of the speech signal is fully equilibrated, the framing operation is carried out with a half overlap in order to maintain the invariance of functions and the smoothness of the signal in every frame. Frame by frame are all following actions.

3) FREQUENCY-DOMAIN TRANSFORMATION: FFT is used to translate the signal in the time domain into the frequency domain, and a quadratic process is implemented to extract the energy distribution on the spectrum and to transform the signal amplitude to the energy spectrum.

$$X[k] = |FFT(x[n])|^2.$$

4) MEL-FILTERS AND POST-PROCESSING: The bandwidth of mel filters is progressively expanded with the rise in frequency in order to collect enough energy information from low frequency bands since the human ear was more sensitive to low frequency than to high frequency speech. The limits of each filter are derived using fixed frequency-mel frequency equation. After processing, including logarithmic multiplication and Discrete Cosine Transition (DCT), the filtered signals are transformed into MFCC functionality. As follows:

$$C[m] = \sum_{k=1}^{K} Log(X[k]) cos(\frac{\pi m (k - 0.5)}{K}), \qquad (2)$$

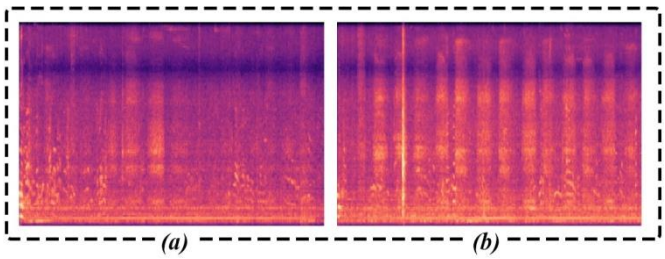

Fig. 3. MEL Spectrogram of breathing (a) Deep (b) Shallow

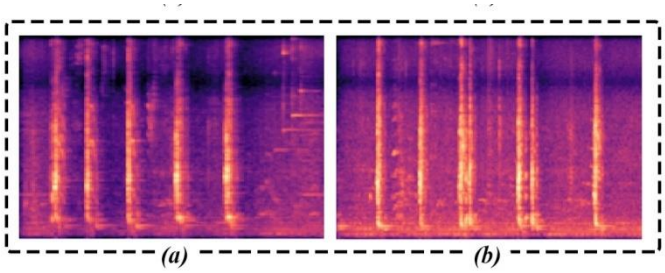

Fig. 4. MEL Spectrogram of coughing (a) Heavy (b) Shallow

where m = 1,. . . , M is the length of MFCC of each frame, X[k] is the output energy of the Kth band, and C[m] is the output feature.

Feature extraction is considered a significant step since one of our objectives is to find a suitable feature extraction method that improves our system's accuracy. "Fig. 3", "Fig. 4", "Fig. 5" and ,"Fig. 6" ' shows the extracted acoustic features of various sounds samples. Further, we can be seen that the COVID-19 and non-COVID-19 uncorrelated from features perspective.

V. CONVOLUTIONAL NEURAL NETWORK

The Convolutionary Neural Network (CNN/ConvNet), is utilised in a deep learning technique for classifying the MEL spectrum that consists of different speaking samples. This network has a MEL input image In this example the Spectrogram attaches emphasis to several features of the spectrogram (learnable weight and bias) so that the network can discriminate between them. In a ConvNet, pre-processing is far less than other classification methods. A ConvNet architecture is similar to that of the connection patterns in the human brain of individual neurons that react to stimuli only in a limited visual field area known as the receptive field. The overlapping of the collection of such fields covers the whole visual region. A ConvNet captures in an image the spatial and time dependencies using the corresponding filters. Because the amount of parameters involved and the reusability of weights reduces the architecture is more appropriate for picture data.

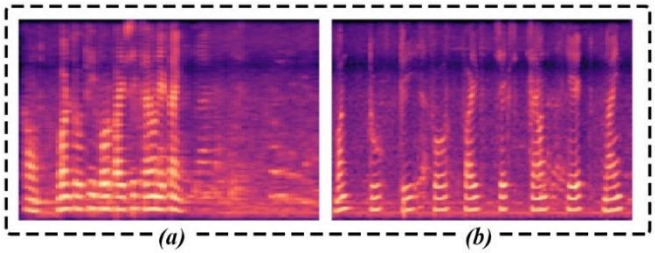

Fig. 5. MEL Spectrogram of counting (a) fast (b) normal

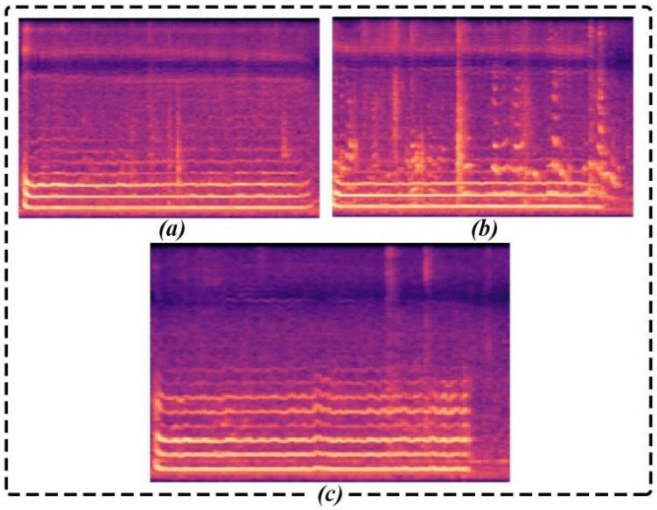

Fig. 6. MEL Spectrogram of phonetics (a) vowel- a (b) vowel- e (c) vowel- o

A. Layers of CNN

While working with convolutional neural network, There are three layers that are used for Neural nettwork namely; convolutional layer, pooling layer, and fully connected layer. Each of these layers has different parameters that can be optimized and performs a different task on the input data.

- Convolutional layers are the layers where various filters are applied for the feature extraction of the spectrograph. These filters are generally based upon small kernels that learns by using a one bias per filter. The activation function is then applied on every value of feature map. The parameters that can determine what this layers can do includes number of kernels, size of each kernels. The size of the kernel is usually given by W and H unless input cube defines it to be D. This layer inputs the 3- D set of values or the previous set of feature maps to produce 3D cube or one 2-D map per filter depending on the input.

- Pooling layers, similar to convolutional layers, perform a specific function which takes the maximum value in a certain filter region known as max pooling, or takes the average value in a filter region known as average pooling and then reduces the dimensionality of the network. The approach to achieve this, is through sliding window technique. The parameter of this technique can be determined which includes the stride and the window. For reducing this 3D cube or previous set of feature maps into spatial dimensions either 3-D cube or one 2-D map per filter are generated.

- Fully connected layers are placed before the classification output of a CNN and are used to flatten the results before classification. This is similar to the output layer in case of Multi Layer Perceptron. The number of nodes and the activation function are the parameter that determines the output including which is usually changed depending on the role of the layer. If information is aggregating then ReLU is used whereas when final classication is to be produced the Softmax is used. The input to this layer is a flattened 3-D cube or the previous set of feature maps and the output is 3-D cube or 2-D map per filter.

The "Fig. 7" shows the working diagram of the feature extraction and prediction using MFCC spectrogram and Convolutional Neural Network with the layers and the inputs provided.

VI. RESULT

For training of this model, 69 COVID-19 positive patient's voice sampling is done against 168 healthy patients. The percentage accuracy of the model gave on an average was 80 % in differentiating the infected and the healthy person apart. For validation samples, we collected 20 samples from people who were COVID affected but recovered completely. "Fig. **??**" shows the prediction of the neural network after being trained. The Convolutional Neural Network model is implemented using Keras toolkit with 20 epochs. The model worked at 252ms/ with the step loss of 0.5667. The loss of the value was 0.4529.

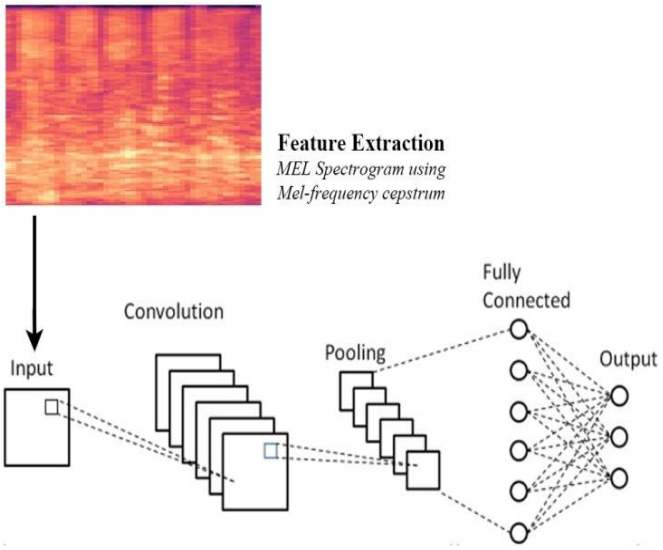

Fig. 7. Block Diagram of Convolutional Neural Network.

```
In [9]: if result[0][0] == 1:
            prediction = 'positive'
        else:
            prediction = 'negative'

        print("AI's prediction is: "+ prediction)

        AI's prediction is: negative
```

Fig. 8. Output of the Prediction model

VII. HARDWARE

Our model is based on the Raspberry Pi 4 Model B which is a credit-card sized single-board computer equipped with a 1.5 GHz 64 bits quad-core ARM Cortex- A72 processor on board 802.11 ac Wi-fi, Bluetooth 5, full gigiabit Ethernet, two USB 2.0 ports, two UsB 3.0 ports and Dual moniter supprots via a pair of micro-HDMI (Type D) port for up to 4k resolutions. The Pi 4 is also powered via a USB- C port enabling addtional power to be provided to downstream peripherial when used with an appropritate power supply unit. It is designed for the people who practice file server and media server applications or work on them as an hobby. There are vast number of projects which are readily available on the Internet to start working on any of the 1st, 2nd, and 3rd generation Raspberry Pis. For this project we require an audio input for the testing i.e. an anaog input and since the Raspberry Pi does not have natively an analogue input, we used an external USB

microphone with the 33051D chipset, that supplies the audio input via USB ports to the module in order to do the analysis. Remark 1: Since the usb port is used as the input audio signals, its sampling frequency is limited to 48000 samples per second (with a resolution of 16 bits per sample). This means that the band of the audio singal that can act as the input must be within the interval of 0-24 KHz. This might be a severe limitation because in bandpass signals the carrier frequency manage must be in the order of 15-20 kHz and the bandwidth in the order of few kHz. The model we developed include the generation of digitally modulated signals with a bit rate up to 4.8 kbps. Furthermore, according to our research, even when more sophisticated (and more expensive) platforms (e.g., Texas Instruments C6748) are adopted, still their audio ports are usually adopted as analog input/output interfaces, with the same bandwidth limitation. [20]

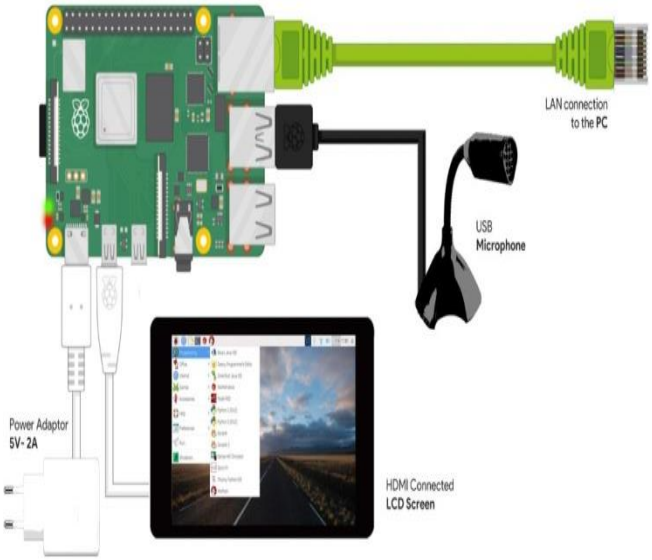

Fig. 9. Basic required setup for implementation

The setup can use collected data for training and thus accuracy increases with continuous usage. The number of tests per day can be increased by increasing the storage memory which can be expanded using any type of external memory. Unlike present methods, if implemented this setup will require no experts of any kind which will in turn increase the portability of the testing.

VIII. CONCLUSION

This will be a novel method of COVID-19 detection based on the research done on the Parkinson disease which was also an respiratory disease. In order to extract information about the respiratory system, it has been proven that different features of speech can be used. It is therefore possible to detect the COVID-19 infection through the voice. The detection of the COVID- 19 using speech signals can facilitate in real- time, remote monitoring of infected/symptomatic individuals, resulting in containing the spread of the infection. With implementation of machine learnig and Artifical Intelligence high accuracy can be yeild in the context of this work, as the advent of deep learning and self-learning AI algorithms can be used for speech analysis to measure physiological parameters more feasibly - and what better time to put this promising concept to use than now, when it can prove to be a huge reprieve during this global pandemic of COVID-19.

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Assessment and Control of Photovoltaic Storage System using DC/DC Converter

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Abstract: The most clean and green source of power generation is obtained from sunlight using Photovoltaic (PV) solar cells. Photovoltaic system utilizes the sunlight to generate power which is unpredictable and is dependent on the weather conditions. The power obtained from the PV module relies on the solar irradiations and cell's temperature. Hence, the power obtained from PV is not constant and maximum power point tracking (MPPT) technique is needed to draw peak power from the PV module to obtain maximum energy under varying operating conditions. This work presents, a PV system along with battery storage, for continuous power supply, using bidirectional DC/DC converter designed for employing a dynamic load. The vitality of the implemented control scheme against changes in weather conditions is presented and obtained using MATLAB simulations.

Keywords: PV, Buck converter, boost converter, SOC, MPPT.

I. INTRODUCTION

The need for electricity is increasing drastically as the population is increasing. Also, the power is generated using fossil fuels which are depleting and causes severe environmental pollution. The scarcity of fossil fuels and their adverse effects on environment has enforced the search for some sustainable sources of energy such as green energy sources (GESs). Hence, to meet the electricity demand and to prevent the air pollution some of these GESs such as solar, and battery are utilized. The solar energy is transformed to electrical energy with the implementation of semiconductor devices such as photovoltaic cells which work on the principle of photovoltaic effect. The power generated from PV systems has increased many folds in the recent years. Along with this, the power generated using PV systems is unpredictable in nature as it is dependent on weather conditions. For increasing the output from PV systems, different areas are studied such as developing MPPT algorithms and effective use of storage system [1]. Hence, the MPPT adjusts the operating point of PV system such that maximum power is delivered. The photovoltaic exhibits the non linear current-voltage characteristics curve and with the designing of appropriate MPPT technique the tracking of PV power output is ensured.

The different MPPT techniques that have been proposed for the standalone and grid connected power system are discussed in the literature. In [2], perturb and observation technique, whereas in [3], incremental and conductance technique for MPPT in PV systems have been employed. The various other techniques that have been utilized for obtaining MPPT in PV systems are sliding mode control in [4], linear quadratic in [5], open circuit control [6], evolutionary control techniques. For MPPT of PV fuzzy logic control is implemented in [7,8] and batteries output power is controlled for charger current [9] with the illustration of voltage control of the hybrid energy system [10]. As the power output from PV is not constant in [11] different backup storage systems utilized to balance the load demand have been discussed and presented. The different components employed are to be controlled for power management and to meet the required changing load demand.

In this paper, assessment of different components of the PV system is presented which includes the power generated from solar cells with the implementation of buck and boost converters. The control of power output of PV system to obtain maximum power output by perturb and observation technique. Also, the battery is employed for backup storage and the output of the battery is controlled by maintaining and investigating state of charge (SOC).

II. MODEL CONFIGURATION

The model considered for this work is presented in figure 1. The various components of the system under consideration are PV system, an inverter and DC/DC converter. The maximum power from solar cells is obtained by employing MPPT technique. The output of PV is not constant and hence storage system is incorporated. The SOC of battery is investigated and maintained while deciding the power is supplied to the load as and when required. The random load taken for the study is given in figure 2.

III. PV SYSTEM MODELLING

This paper, utilizes a single diode solar cell to model the PV system. It consists of current source I_{SC} along with an inverted diode in parallel to it, and a series and parallel resistence ie. R_S and R_P. The photocurrent and output current is given by equations 1, 2, and 3 [12].

$$I_{SC} = \frac{[I_S + K_1(T_C - T_{ref})]\lambda}{1000} \quad (1)$$

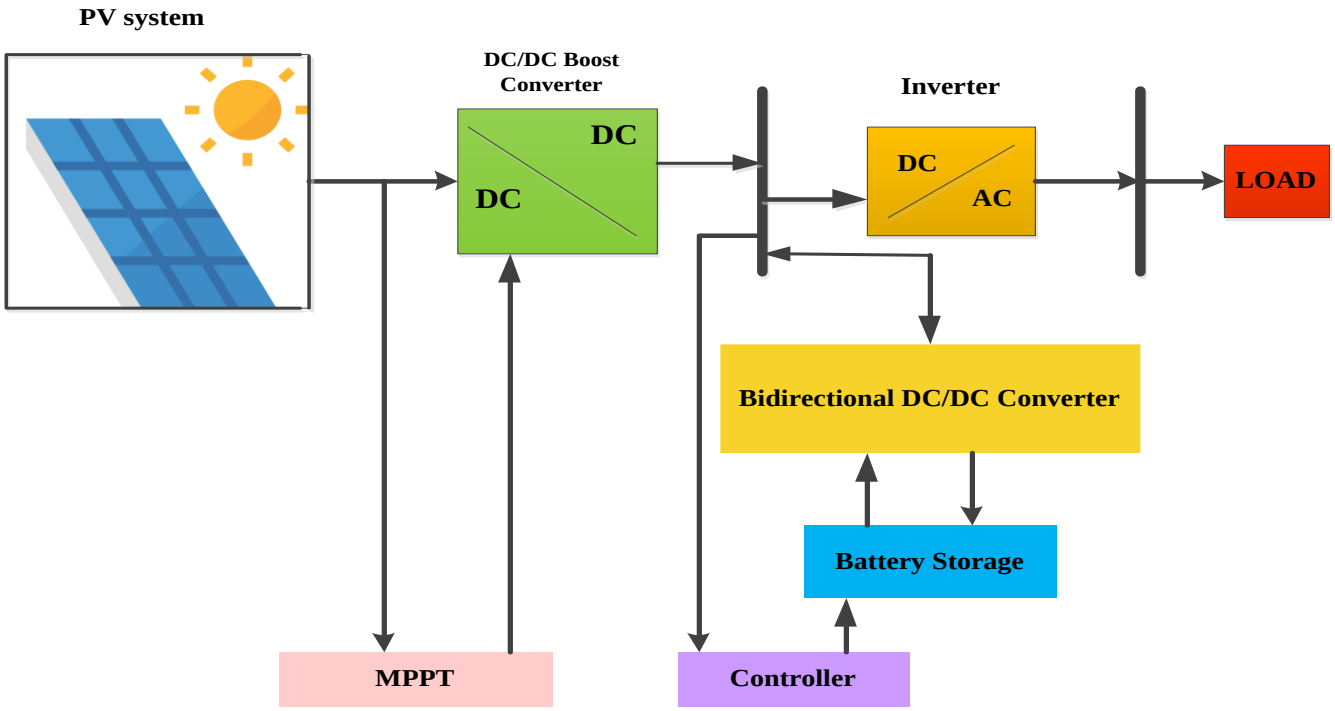


Fig. 1. Model configuration

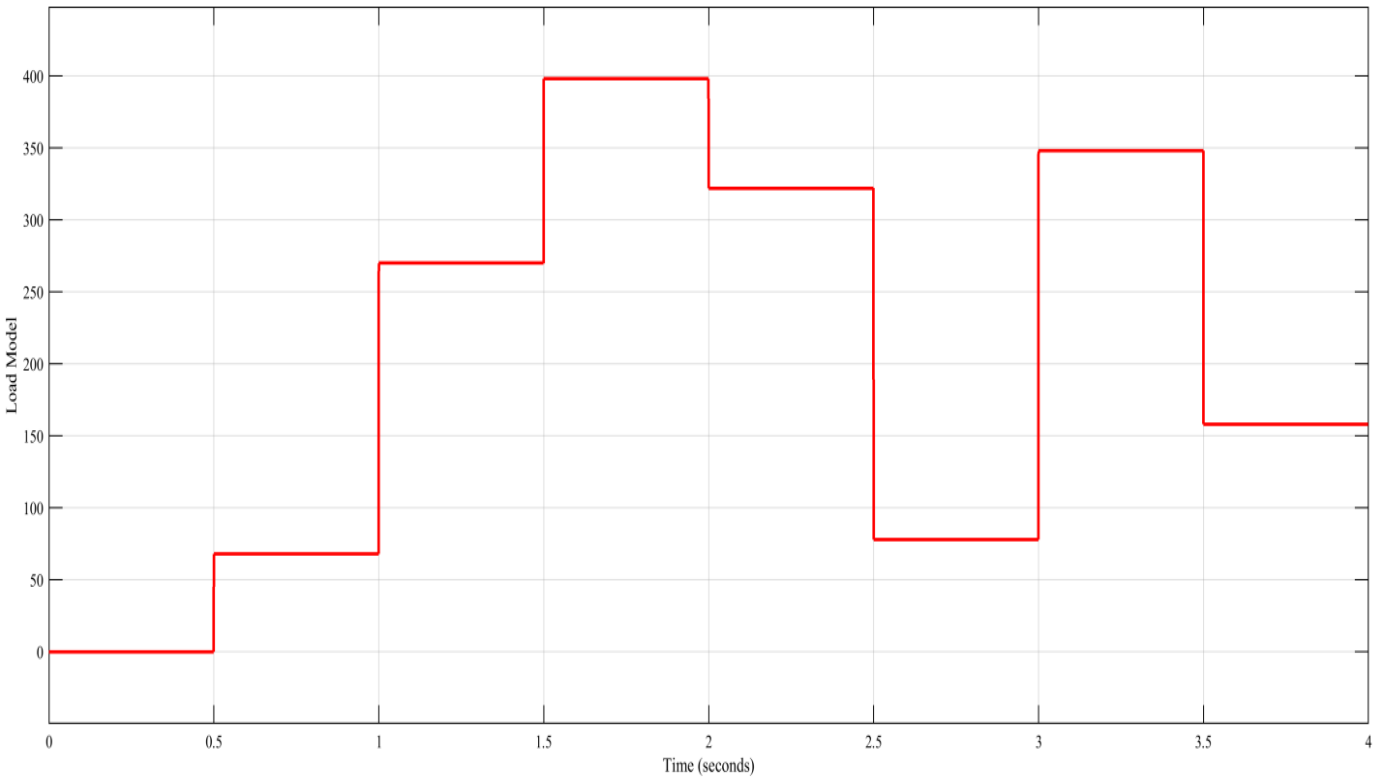


Fig. 2. Load Model

$$I_{PV} = N_P I_{SC} - N_S I_S[\exp\left(\frac{q\left(V_{PV}/N_S + I_{PV}R_S/N_P\right)}{kT_C A}\right) - 1] \quad (2)$$

$$I_S = I_{rs}(T_C/T_{ref})^3 \exp\left[\frac{qE_g\left(\frac{1}{T_{ref}} - \frac{1}{T_C}\right)}{kA}\right] \quad (3)$$

where V_{pv} is output voltage of PV system, Is presents cell's saturation current, N_p, N_s are number of strings connected in parallel and series, q is the electron charge, T_c, T_{ref} are PV surface and reference temperature, I_{rs}, I_s is the reverse saturation and short circuit current, E_g is the energy band gap of silicon, K_1 is the short circuit temperature coefficient, λ is the irradiation level, K is the Boltzmann constant.

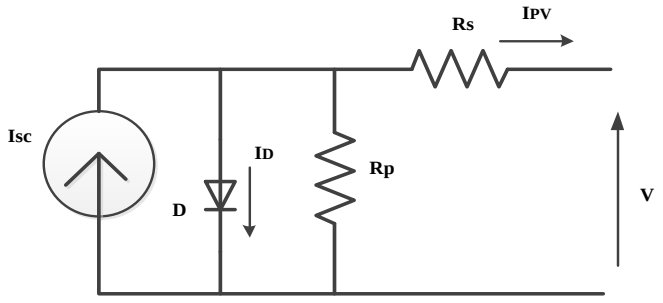


Fig. 3. Model of PV cell

Maximum Power Point Tracking

The solar radiations change with season and during the day and hence it is difficult to obtain maximum power (MP) which enforces the attainment of the MP the whole day and even under changes in solar radiations. The PV system always works on specific value of voltage where global maximum of I-V characteristic is acquired. From the I-V characteristics it is extrapolated that for any specific operating point; MP output can be obtained from the solar panel and is called the Maximum Power Point (MPP). On the knee of I-V curve of solar panel lies, the MPP. From here it is inferred that on the I-V curve of PV cell a point called MPP always occurs on the knee point of the curve where the generated PV power is maximized. The position of MPP changes constantly at every instant of time as the temperature and irradiation changes [9]. Here, perturb and observation method is employed for obtaining this MPP point and is similar to hill climbing algorithm. This method is most widely adopted for industrial applications due to its robust convergence for MPP. Knowing the direction of sun radiations the output voltage changes thus, adjusting the duty cycle of the converters. Instead of two cases to follow, there are four cases to follow, and are represented by flow chart given in figure 4.

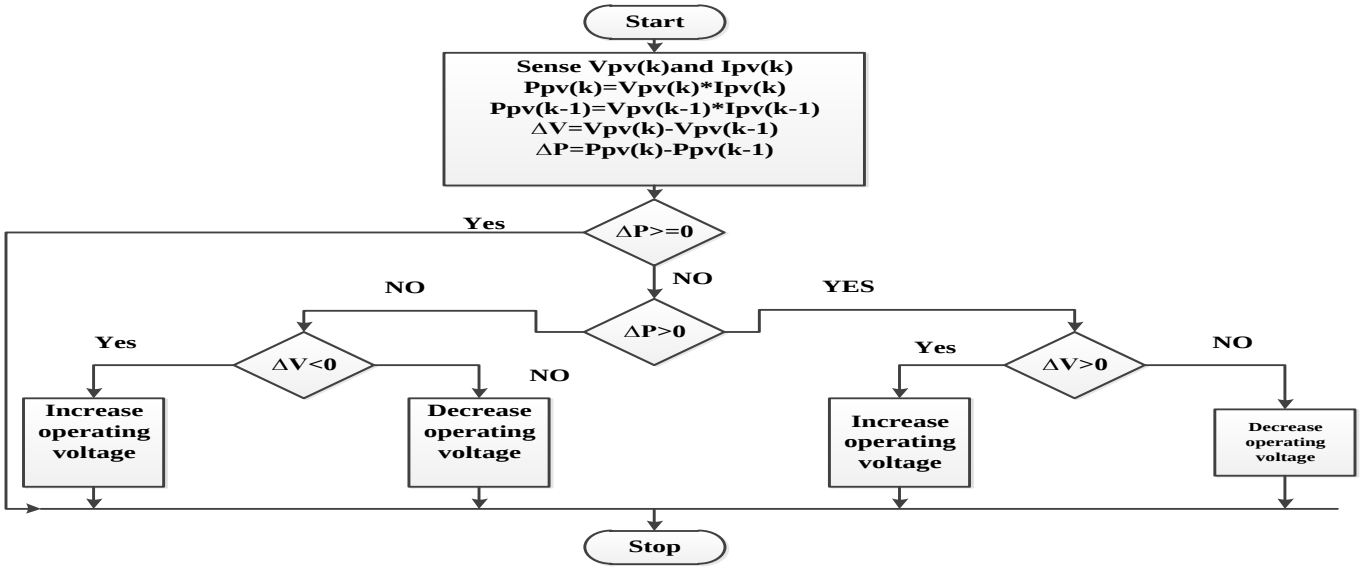


Fig. 4. Flow chart for P&O method

PV system with storage system and converter

DC/DC converter is incorporated as it necessitates power transfer between two devices. It is the essential part of the PV system for interfacing with the battery storage system. Also an inductor, and diodes/switches are also coupled to boost the voltage as and when required from the battery. This converter either works as buck or boost converter depending upon the

charging and discharging operation to be provided by the battery system. With PV voltage source there is a boost converter which is controlled by MPPT controller and steps up the PV voltage to obtain MP from the PV system during its operation. Then it is connected to two IGBTs and a battery which act as an ancillary source. These two IGBTs are responsible for the operation of DC-DC converter which is further is controlled by two different controllers. One controller works as a Boost converter providing the control signal and the second controller works converter providing the control signal. The PV system follows the following four modes of operation.

Mode 1: For this mode, whole system gets shut down when the demanded power is than the power generated by PV system with the battery system deeply discharged.

Mode 2: The second operating mode comes under operation when PV power is less than the power demanded but the SOC of battery system is more than its minimum value providing power output until its SOC limit is reached. In this mode, battery operates in boost mode of operation of the buck/boost converter. Also, the minimum value for SOC is taken into account.

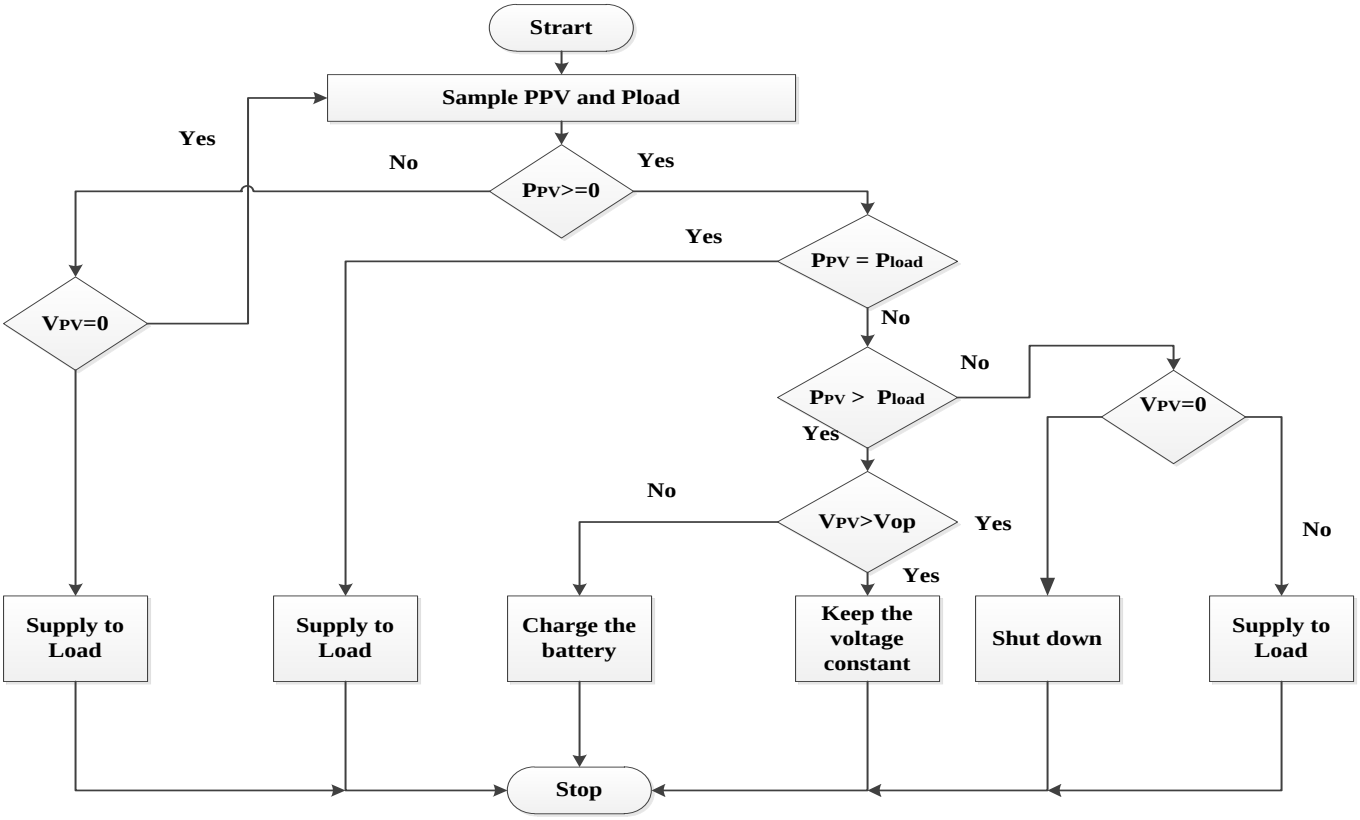


Fig. 5. Flow chart for operating different operating modes

Mode 3: In this mode, SOC of the battery is not 95% i.e. it is not completely charged and the power generated by PV system is more than power demanded. During this mode of operation the PV panels not only supply power to the load under MPPT control but also charges the battery when excessive power is generated by the PV panels. The bidirectional buck/boost operates in buck mode of the converter and is utilized to charge the battery during this mode of operation

Mode 4: When the PV system generates more power than the power demanded and also the battery is fully charged with its SOC as 95%, the PV system supplies power to the load. While enabling the MPPT control mode, it is to be verified that battery remain in fully charged state i.e. SOC remains 95% through constant voltage charging so that the battery does not have any kind of self-discharge. These operating modes have been illustrated using the flowchart in figure5.

IV. SIMULATION AND RESULTS

The model considered, is shown in figure1 consisting of PV System, battery storage unit with bidirectional DC-DC

converter and inverter is simulated using MATLAB Simulink to obtain the output under various modes of operations. The simulation model can be seen in fig.6 and the results obtained are presented below. The model is simulated for the time of 4 sec and using MATLAB software.

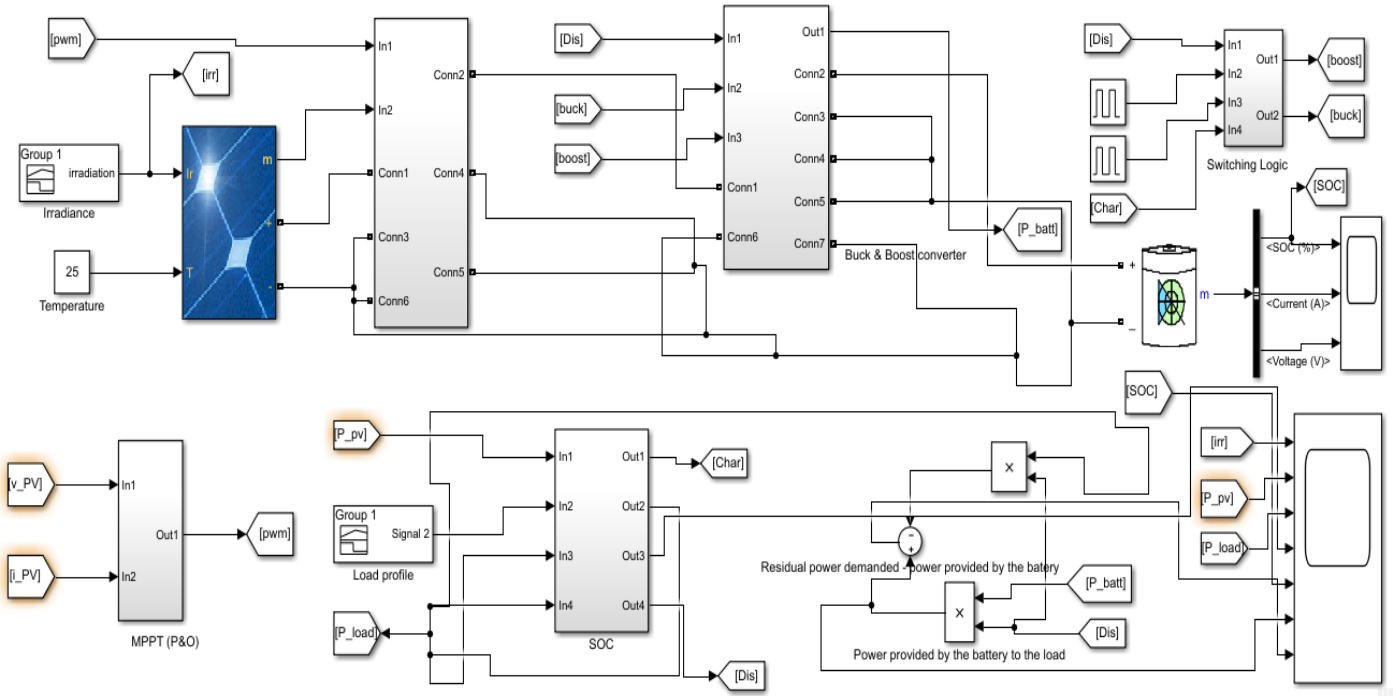


Fig. 6. MATLAB/Simulation model

when the temperature is constant and irradiance is variable and load is randomly changing

In this case, random variations in load and the solar irradiations are considered as given in figure 2 and temperature is taken as constant with 25ºC. The PV system voltage variations with the application of MPPT are visualized in figure 7. The SOC of battery and its voltage output with charging and discharging operation is given in figure 8. When the PV power output is equal to the power demanded and when PV power is less or greater than the load demanded can be clearly seen in figure 9.

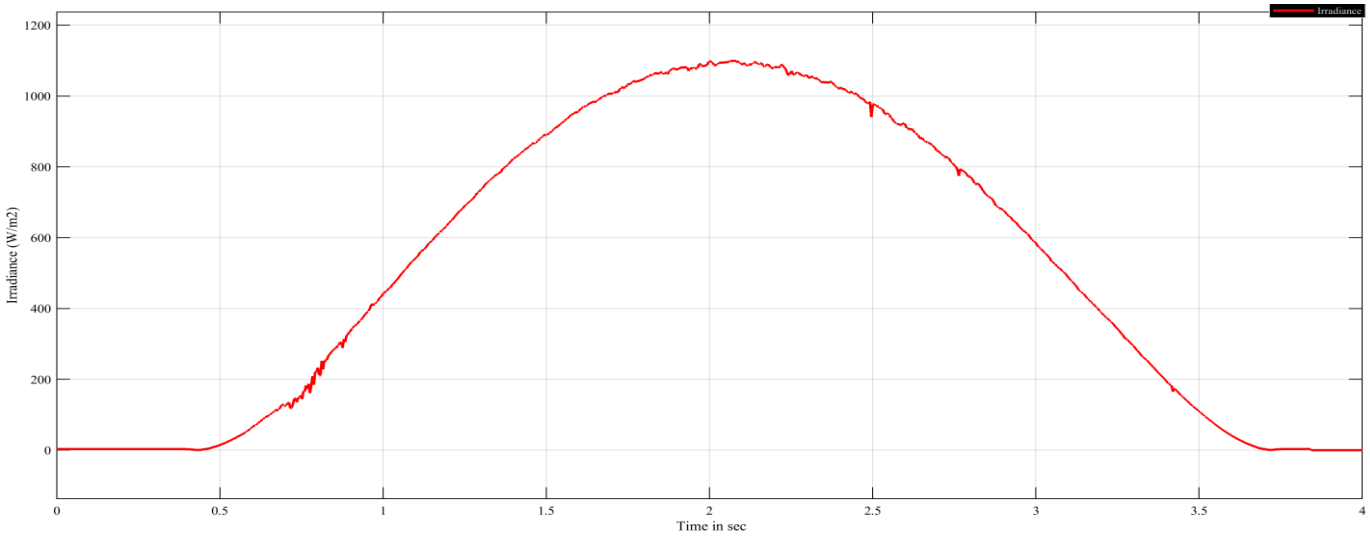


Fig. 7. Variable Irradiance

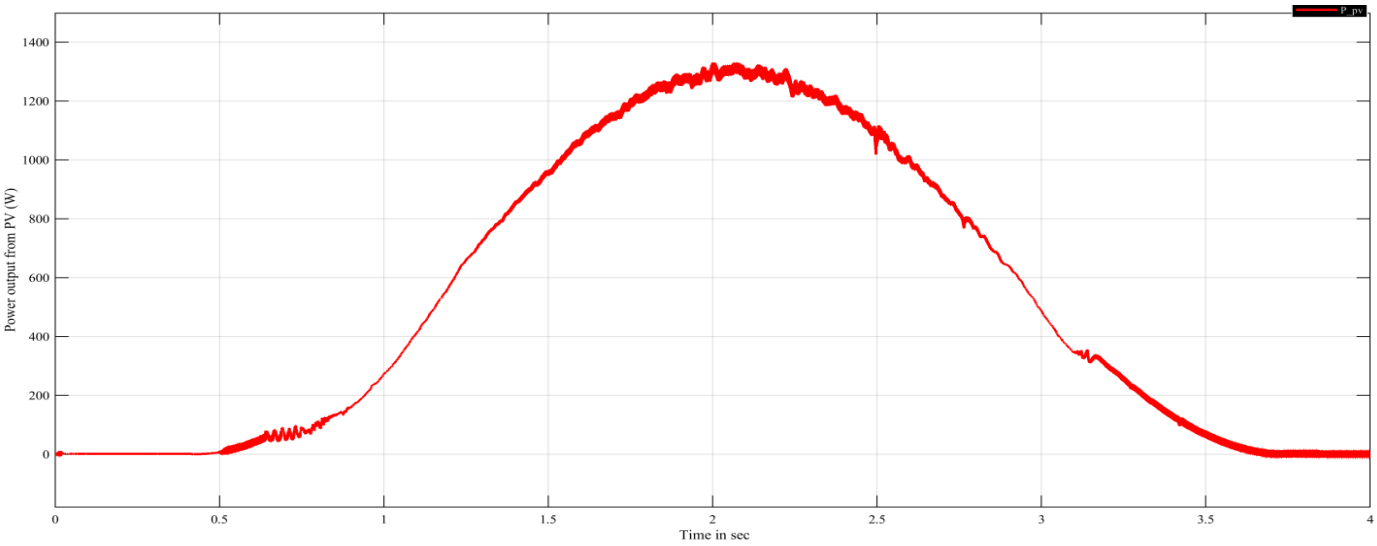


Fig. 8 (a). PV system power output

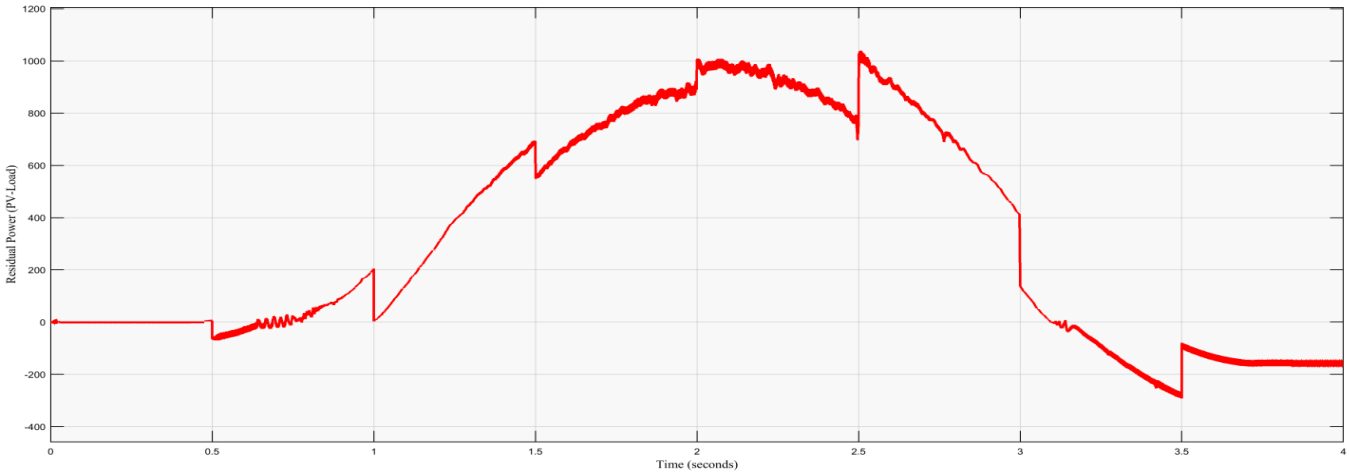
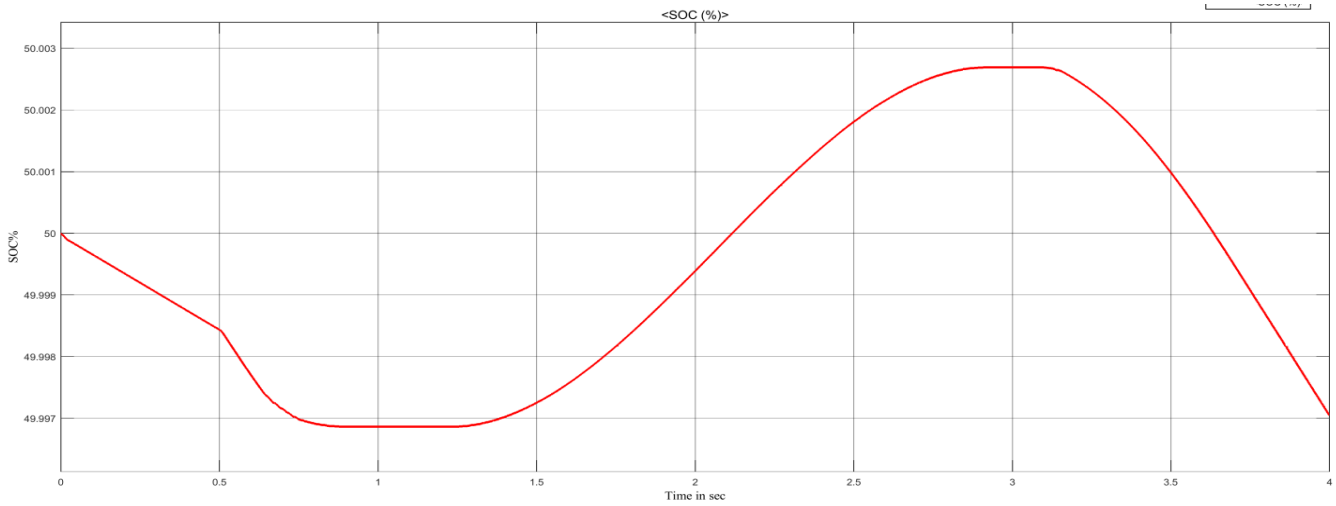


Fig. 8(b). Residual Power



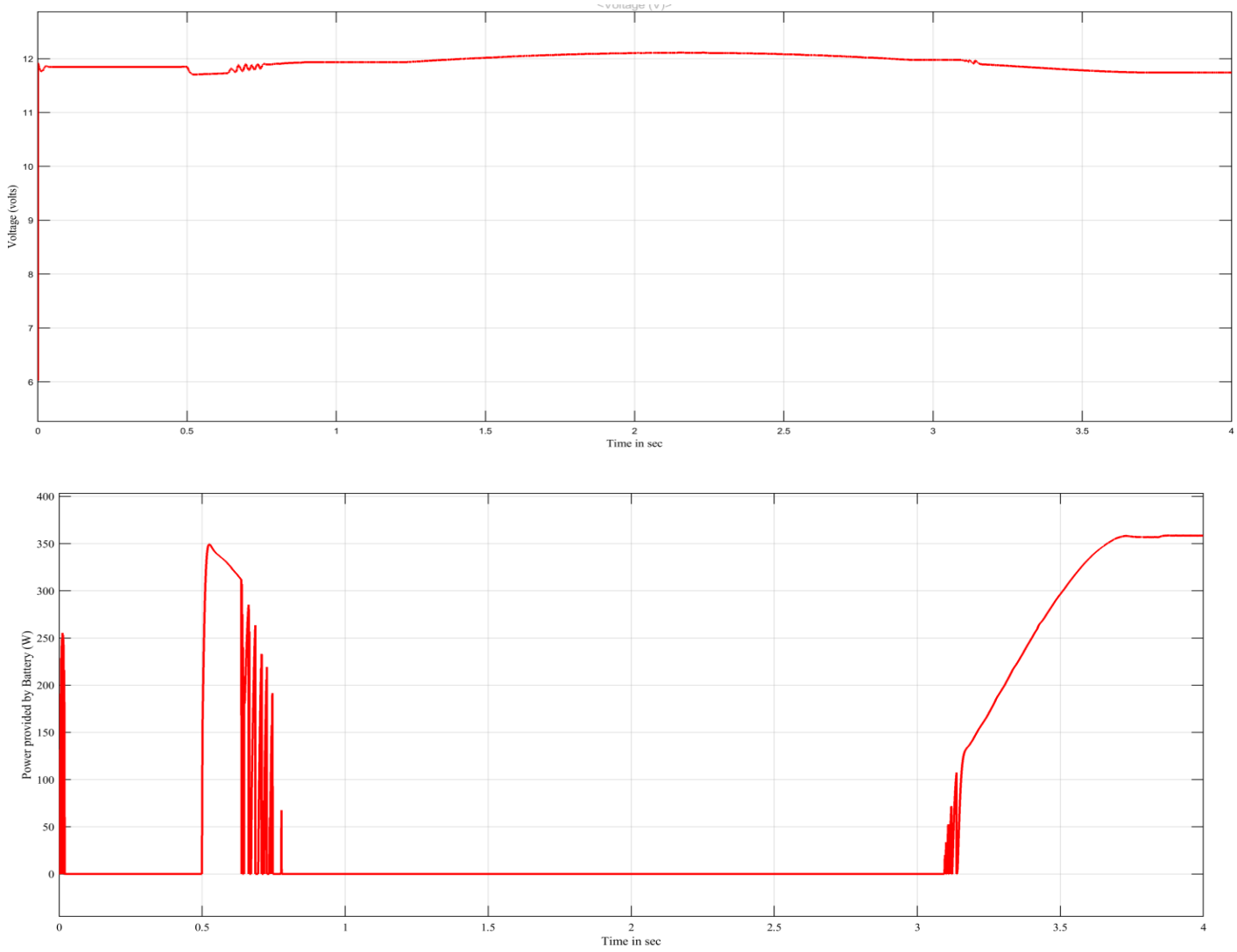


Fig. 9. SOC (%), Voltage of the battery, and Battery Power output

V. CONCLUSION

In this research work, PV system, enabled with MPPT control along with storage system utilizing converter, has been successfully modeled and simulated. A Boost and Buck operating modes of converter that helps to elevate the PV output voltage has been effectively modeled and simulated. MPPT for the system was obtained by employing P&O along with the help of controller. Finally, with the implementation of MATLAB software the system considered has been simulated and the results obtained are acceptable. Although, with the improvement in the MPPT control algorithm transients can be minimized. Also, with the employment of advance controller and improvements in the operation of converter better charging and discharging of battery can be obtained to maintain its SOC.

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Virtual Self Assessment Model

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Abstract: ***The project will tackle the issue of lack of a practice platform for students to prepare for video interviews and essay writing for interview/exam preparation. Proposed platform acts as a self-assessment interface for students to practice and judge themselves with the help of built-in machine learning models and functionalities to simulate a real environment and scoring facility. This will help students judge the accuracy and proficiency of their essays, as well as check for plagiarism simultaneously so as to avoid any issues in the real exam. Automated real-time scoring will be implemented for students, which will help them understand the key points helpful for increasing their scores over a period of time. Live Interview functionality will help students gain confidence before actual interviews, and will help to prepare answers. A confidence score will be calculated to help student's improvement. Also, student's answers will be converted to text and will be sent to them, so that they can assess their answers better and improve further.***

Keywords: CNN; RNN; Self-assessment platform

I. INTRODUCTION

In India, English is not the first language of many students, and despite having good technical and creative skills, they lack self-confidence when walking in an interview because of their lack of self-confidence in English speaking skills, which definitely hurts their chances of selection in the procedure, leading to regret and depression in severe cases.

Most of the interviews in leading companies and selection tests for universities require fluent English speaking and writing skills and often have a test section dedicated to checking these skills. Even after being aware of their shortcomings in these skills, many students lack the services and infrastructure required to test and enhance their skills and simulate the test environment. Also, there are very few services available that help students to prepare such activities under a controlled environment free of cost.

Our solution tackles these problems and is targeted for students specific to India. India is a country that has a lot of potential with almost 30,00,000 students graduating every day. Out of which about 18.6 million jobless people were reported in 2018. With the advent of High-Speed 4G internet at very low costs the Indian students can skill up.

In recent years, Artificial Intelligence has achieved great success in solving many real-life problems. Proposed work acts as a beacon to aid student's practice for general interview questions and essay writing skills. An automated deep learning solution has been proposed to check and evaluate their practice online.

II. MODELS DEVELOPED

Various independent models are integrated into development. All the modules are solved using deep learning techniques, after reviewing lots of latest research.

A. Automated Scoring:

A quadratic weighted kappa model, to measure agreement between 2 different rates, namely Long short Term Memory (LSTM) and Relu function over 5 fold epoch strategy will be used to attain accuracy [6][7].

B. Plagiarism Detection:

We reviewed several techniques like fingerprinting, Bag of words model and tools and API available. We are moving forward with an affinity-based, frequent analysis model, using string sub-matching and word frequency model, to detect plagiarism, even if, some paraphrasing is performed[1][2].

C. Speech to Text:

A recurrent neural network (RNN) based approach has been used to improve accuracy over time. Recurrent Neural Network along with a Connectionist Temporal Classification (CTC) is being used. The role of CTC is to make a sequence of repetitive characters without space into one. RNN output is 10 times smaller than the input. Web Speech API along with custom wrapper is employed in the initial prototype of the project. [3] [4] [8] [9].

D. Audio Analysis:

Support Vector Machine (SVM) is used for performing sentiment analysis on audio. Actually, it acts as a non-probabilistic model that uses various representations of exemplary text as points in multi-dimensional space [2] [5] [9].

III. ALGORITHM

Various types of deep-learning models are developed to provide functionality. Many different types of artificial neural network algorithms are used based on the input type and type of output required.

A. Convolution Neural Network

In the field of deep learning, the convolutional neural network usually called ConvNet or CNN is a type of artificial deep neural network which are most commonly applied to the application of analyzing visual imagery. They are also known as shift invariant or space invariant artificial neural networks (SIANN), based on their shared-weights architecture, translation invariance characteristics.

They can be perceived as the regularized versions of multilayer perceptron. Multilayer perceptron usually mean the fully connected networks, in which, each neuron in a single layer is connected to all neurons in the next following layer. This "fully-connectedness" of the network causes the problem of over-fitting of data in them. The usual ways of regularization include adding magnitude measurement of weights at the loss function.

B. Recurrent Neural Network

In various cases ordinary Neural Networks are unable to perform very well for conditions where the sequencing of data is critically important. Thus, to solve this problem, RNNs were invented. RNN stands for “Recurrent Neural Network”. They are different from CNN as RNN cell considers not only its present input but also the output of preceding RNN cells, for computing its present output.

RNN cell equation is shown in fig. 1. It performs very well on sequential data.

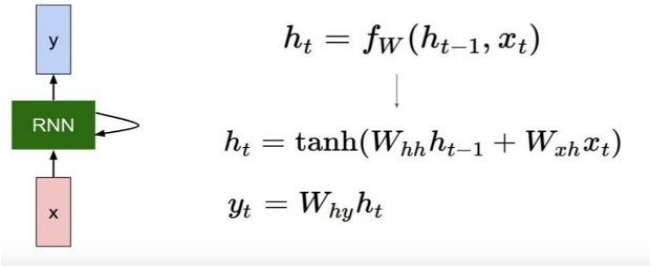

Fig 1. RNN Cell equation

C. Long Short Term Memory (LSTM)

LSTMs are special kinds of RNNs with the capability of handling Long-Term dependencies. It is a type of artificial recurrent neural network (RNN) architecture that is used in the field of deep learning. Unlike the regular feed-forward neural networks, LSTM has feedback connections. It not only processes the single data points but also the whole data sequence. Also, they solve the problem of Exploding or Vanishing Gradient.

A common LSTM unit is composed of a cell, an input gate, an output gate and a forget gate. The cell remembers values over arbitrary time intervals and the three gates regulate the flow of information into and out of the cell.

D. Quadratic Weighted Kappa Approach

Different submissions are scored according to the quadratic weighted kappa approach which is then measured as the agreement between two ratings. This metric typically varies from 0 (random agreement between raters) to 1 (complete agreement between raters). If in a certain case, the agreement is very less, then the score may also become negative. The quadratic weighted kappa is calculated between the predicted scores and scores which are expected or known beforehand.

We develop a matrix of expected ratings, E, which is an N-by-N histogram matrix and it is calculated, assuming that there is no correlation between rating scores. This is calculated through equation (1) and the outer product between the predicted rating's histogram vector of ratings and the actual rating's histogram vector of ratings, normalized such that sum remains the same.

$$p_e = \sum_k \widehat{p_{k12}} = \sum_k \widehat{p_{k1}}\widehat{p_{k2}} = \sum_k \frac{n_{k1}}{N}\frac{n_{k2}}{N} = \frac{1}{N^2}\sum_k n_{k1}n_{k2} \quad (1)$$

IV. DEVELOPMENT PROCESS

Our interface acts as a practice platform for students to assess their progress through time-constrained, real-world simulated environment and automated scoring facilities to help students prepare better for their interviews/exams.

To aid users, there will be 2 different types of analysis present, namely, Speech analysis for live interview functionality and the Text Analysis for essay writing functionality.

A. Text Analysis

In-text analysis, we will perform an essay writing analysis and implement the automated scoring system and plagiarism detection.

The model used for the automated scoring system consists of 2 Long Short Term Memory (LSTM) layers with a Dense output layer. The final layer uses the Relu activation function. Finally, the outputs of layers averaged using the Quadratic weighted kappa (QWK) approach. The QWK is at last calculated on the training dataset using the 5-Fold Cross-Validation technique and taking the average for all the five folds. Using this particular approach we were able to maximize the accuracy of our model.

Plagiarism checker was developed using the “Bag of words Model”, web crawler tool and public API available for accurate matching. An affinity-based, frequent analysis model, using string sub matching and word frequency model, to detect

plagiarism with the local database is used, even if some paraphrasing is performed

B. Speech Analysis

Speech analysis maps the current sentence the final required spoken contents and leads to speech to text conversion. Thus it allows the users to review or enhance their answers in mid of answering session. Also, the audio analysis has been incorporated with the stored user response that allows user to review, replay and record their answers.

We used the custom package of Web Speech API for converting the speech to text in real-time. The audio is stored in the local cache of the browser. The stored audio is secured as data is not sent data over the server. It also provides fast functioning on the client's side by decreasing encryption and decryption of data manifolds.

The audio is divided into the current and final sentences which are determined by the pauses in audio which has been implemented in the custom wrapper developed for the web speech API.

The audio is analyzed using the Recurrent Neural Network (RNN) and support vector machines along with a custom wrapper for existing IBM Watson API.

V. RESULT

The project was completed in a web application form, allowing users to access the product using the deployed website. The functionalities of Essay Writing and Video interview along with the mentioned models were developed and are ready to use by users. Users can now uniquely sign in/ sign up to the platform using email id and other necessary details.

After signing in, users can choose either of these functionalities and will be directed to the required page.

A. Video interview

Users after choosing their questions and recording answers can view their answers converted into text, and can identify their mistakes and can enhance their vocabulary and content of answers. Users can also restrict their answers to the given time frame of 1 minute, thus getting and appropriate and concise answers for a lot of general interview questions.

Users can practice live interview by choosing from a desired set of questions. We included the live interview question panel, microphone, and video (camera) options, allowing the user to improve see how they passively react and improve themselves. Users can now click the play button, after choosing the desired questions and can answer them, which will be recorded and can be replayed. The interface for this is shown in fig. 2.

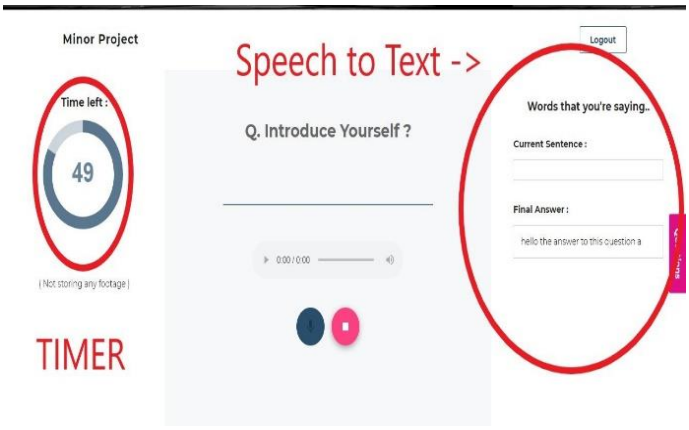

Fig. 2. Live Video Interview panel

B. Essay Writing

Users can choose from a set of questions, write their answers and submit them, after which an automated score on the basis of their essay submitted, will be visible to them, out of the maximum score available for it.

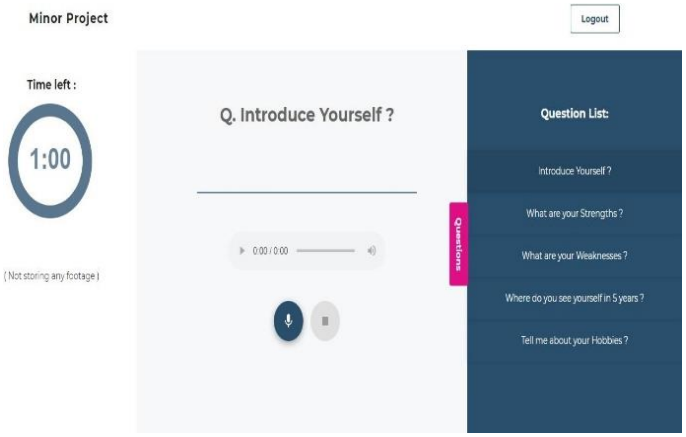

Fig. 3. Live Interview Panel for Eassy Writing

Additionally, a report of plagiarism, including total content matched their respective URLs, titles, and percent of content matched with the submitted essay will be mailed immediately to the users. The options are shown in the interface of fig. 3.

The model can test their usage of vocabulary, context-driven word usage, analysis of speech used, grammatical and spelling errors, length and structure of essays submitted and various other factors to provide a score using LSTM neural network with sigmoid and Relu activation functions, by QWK (quadratic weighted kappa) approach.

The model was supported by a user interface developed using the MERN stack to allow users to access and submit their essays.

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A Review on Vehicular Networking: Motivation, Architecture and Issues

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Abstract: ***Vehicular networking is a hopeful key that was perceived to overwhelm the delay and extreme usage of radio resources which needs to access the clouds. It comprises the bandwidth optimization and to reduce the latency in fetching the cloud of the network edge. Recently this perception has been widely used in new paradigm of vehicular networks named internet on vehicles. To attain the benefits, researchers have explored the effectiveness of clustering in VANETs, whereby a throughout the network via some sort of clustering algorithm. According to our findings, the efficient cluster is formed by machine learning based algorithm but better cluster stability is provided by fuzzy logic based algorithm. The hybrid architecture that combine fuzzy logic and machine learning based approaches can provide efficient cluster and better stability. The mobility based algorithm that considered the stability based parameter to cluster formation and to select the cluster head. On the other hand, multi hop approaches also provide more stability to the cluster but as increases in hop, also increases in packet loss which decrease the network performances. In this paper we overview the diverse vehicular networking architecture. Finally we conclude that the most essential portions in VANET networking are the cluster-formation and the cluster head selection, which are still under research.***

Keywords: ***machine learning, fuzzy logic, VANET, Clustering.***

I. INTRODUCTION

1. In a Vehicular Ad-Hoc network (VANET), all vehicles are participating in networking fitted out with wireless transceivers which allowed them sharing of their information with other vehicles. Also route the packets in the network where the destination vehicles are not in the direct communication range of the source vehicle. The external infrastructure for one hop connectivity is not necessary, even if the fixed road side units possibly will take part in a VANET. Such an approach potentially may help the development of applications in VANET ranging from enhanced the traffic safety and jamming prevention to vehicle information and entertaining system. VANETs operates in a stimulating communication environment, which the deployment of technology have limited in practical. The hidden node problem, limited radio resources like inadequate spectral bandwidth and channel affected by both mobile and stationary obstructions and intrusion sources are particularly vulnerable to VANET. Ad-hoc network has an insignificant advantage over the infrastructure based networks in such an environment. Infrastructure base network, distribution of the network resources and optimally scheduling of channel access is allowed in a relatively simple manner through access point. A large number of access point needs to deploy throughout the large coverage area. The researcher have inspected the new approaches of clustering in VANETs for taking the profits of infrastructure based network deprived of the essential for the fixed infrastructure [1]. In recent years, amazing advantages have been accomplished in VANET which are considered as the explicit type of mobile ad-hoc network with a predominantly motion (speed and direction). Vehicles travelled according to a well-organized configuration based mobility model, which is particularly built on predefined environment like roads, building and intersection, etc. [2][3]. The distinguishing of the VANET nodes are two types: fixed nodes recognized as road side unit and mobile nodes recognized as vehicles. The deployment of road side unit is very critical and it solely responsible to provides services like internet access and also provide some data aggregation services. The vehicle and road side unit exchange their message with destination nodes via inter-vehicle communication and vehicles to road side communication. The vehicle to vehicle and vehicles to infrastructure communication has been established by wireless technology like IEEE 802.11p. Recently, a new project underneath the umbrella of the 3rd generation partnership project (3GPP) provides a wireless standard for vehicle to everything communication that support the vehicles communication with each other's and with fixed structure i.e vehicle to vehicle and vehicle to infrastructure [4]. The vehicles are fortified with wireless communication technologies to offer Ad hoc connectivity in VANET. For the scalability of the VANET, the architecture has efficient and effective routing is essential for the data dissemination. The security and safety of vehicles is primarily aim for the VANET environment [5]. The optimum information communication in VANET, several clustering routing information are investigated also clustering algorithm used the intelligent approaches. The initiation of the internet of things (IoT) in many industries, the communication among vehicles can be possible through the internet of vehicles [6]. It may help to enhance the safety and traffic

management policies implementation which makes smart vehicles communication.

2. The Concept and motivation of review the VANET networking are explained in section-II. The vehicular networking architecture in VANETs that relates the important part of VANET networking are the cluster formation and the cluster head selection discusses in section-III. Also highlights the different problem in various techniques of clustering in cluster making and cluster head selection based on machine learning, fuzzy logic, hybrid and intelligent approach. The vehicular networking issues are elaborated in section-IV and finally, section-V concludes the review work.

II. CONCEPT AND MOTIVATION

Cluster computing methods and the VANET concept are combined to represent the idea of the vehicular networking. Many researcher focused on these concept for enhancing the efficiency and safety of vehicles in real time scenario. To review these features, it is necessary to study the basic concept about clustering and VANET technologies for providing the better services though the vehicles and fixed infrastructure.

A. VANET Clustering:

A sequence of essential techniques are involve in the realization and looking after of clusters, which may necessity to be recurrent reliant on the techniques of the process and the dynamic nature of the network [2]. The common routine movement of a clustering process is shown in fig.1. Nodes contributing in or looking for to join in a cluster will usually accomplish nearly or all of the processes styled below.

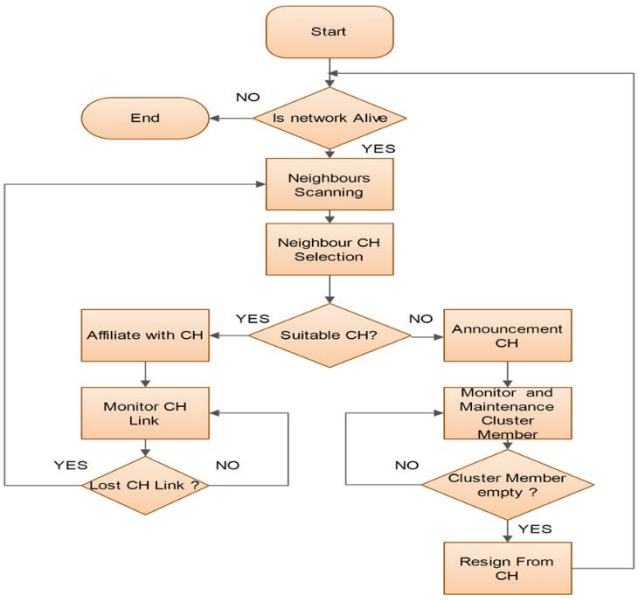

Fig. 1. cluster selection and maintenance process

1. Neighborhoods Discovery: When a vehicle is agreeable to participate in VANET, first it initially links with the road network and tuned its communications system. When it entered a network, the node considered as the member node itself. A node will periodically broadcast a message to its neighbours and show their presence in the network. Also it will collect similar information from its neighbours, which is updates in neighbours table and that can be used by clustering algorithm.

2. Cluster Head Selection: When node collect data and updates the neighbouhood table, it observe the neighbourhood table to discover the suitable Cluster head. In different clustering algorithm, the function of cluster head are varies like relaying function, routing, finding the cluster membership etc. If node found a suitable cluster head within the neighbours than it proceed for cluster member and go for monitoring the cluster link. Also if the node not found the suitable cluster head than it announced itself as a cluster head and go for monitoring and maintenance phase.

3. Affiliation: When the node will find the suitable cluster head from its own observation then it effort to become a member of that cluster. In security sensitive application, additional step of authentication is required where positive and negative acknowledgement of the node which need to be affiliation. The affiliated node are considered as cluster member and once node conceded as cluster member than go further for monitoring the cluster link.

4. Announcement: If the node does not find the suitable cluster head than it announced itself as a cluster head to its neighbours and start the process of the affiliation. When the node has accumulated cluster member, it proceeds for monitoring and maintenance phase. If the cluster head has found the empty cluster member list then it resign from the cluster head and process start from beginning.

5. Maintenance: The procedure of the maintenance phase is for cluster head or cluster member are different as below:

   a) The node as a Cluster Head: To evaluate the status of the cluster, node will survey the cluster member. The different approaches of different algorithm that permit the clusters to change its head or merging the clusters and also tracking the cluster member's link lost. If the cluster head has found the empty cluster member list then it resign from the cluster head and process start from beginning. Alternatively, if the coverage area need to increase then merging the neighbours cluster with predefined set of rules.

   b) The node as a member: To evaluate its links to its cluster head, the node will periodically sending message to show their existence in the network or

waiting for a pool time frame from the cluster head. If the renewed cluster head send the affiliation request to the node then it withdraw from its previous cluster and join the present cluster. If the evaluated link of the cluster head fails then it will go further for neighbourhood discovery process.

B. Internet of vehicle:

The internet of vehicles is a scattered network that provisions the use of data produced by a associated car and vehicular Ad-Hoc networks. An important goal of the internet of vehicle is to allow vehicle to communicate in real time with their human drivers, pedestrians, other vehicles, roadsides infrastructure and fleet management system [17]. The IoV supports five types of network communication as shown in figure2:

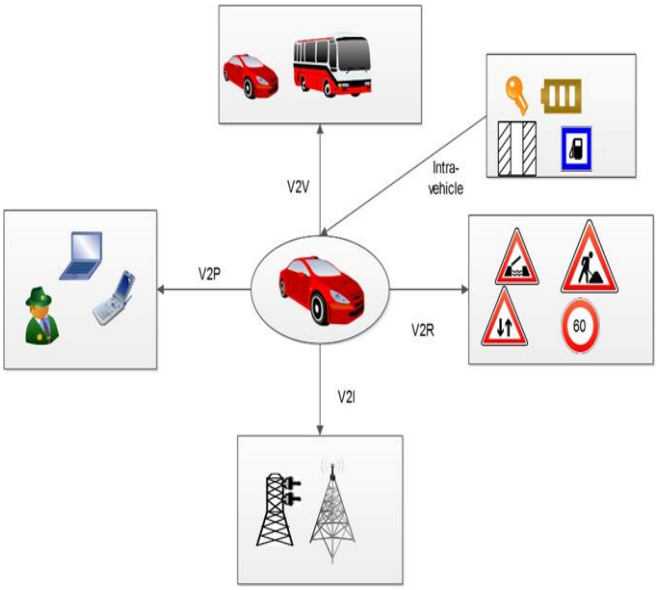

Fig. 2. Five types of network communication in IoV.

1. Intra-vehicle communication: In intra-vehicle communication system that monitor the vehicles internal performance throw on board unit.

2. Vehicle to vehicle communication: It supports the wireless conversation of information about the speed and position of neighboring vehicles.

3. Vehicle to Infrastructure: It supports the wireless conversation of information among a vehicle and associate roadside units via wifi or LTE/4G/5G.

4. Vehicle to Pedestrian: It supports awareness full road users such as pedestrians and cyclists.

5. Vehicle to Road: It supports the wireless exchanges of info between a vehicle and fixed road side unit via WAVE.

III. VEHICULAR NETWORKING ARCHITECTURE

A clustering algorithm based on K-means is proposed by Bansal et.al [7], which is distributed the vehicles into form of cluster network. The parameter which is used to forming the cluster is x dimension, y dimension and the location of vehicles in the network. The input of the k-mean is number of cluster, then K-means algorithm is divided the number of vehicles into clusters. In clusters, the cluster heads is elected by finding the centroid of the clusters. In cluster communication security is increase using encrypt or decrypt the data packets. When Cluster head is selected, then other vehicles link the cluster as the cluster member. In intelligent clustering using k-means, the clusters cannot overlap so no maintenance is required. Additionally, the mean of the cluster can be reformed if some vehicle joins or leave the cluster. This may change the cluster head itself, which causes the cluster lifetime and cluster stability is reduced. The stability of the cluster is extremely depends of the lifespan of the clusters. The high life time of the clusters is not assured in k-means based algorithm, because the entire algorithm is reset if any vehicle leave or join the cluster and the cluster head can be changed frequently.

The limitation of k-means algorithm is overcome by hierarchical clustering algorithm [8], where velocity and direction of vehicles are considered along with k-means parameter to create a cluster network. The quality of service parameter and past performance of cluster head also be deliberated for cluster head election procedure. The number of cluster as the participation unlike k-mean are not required in hierarchical clustering. In improvement in clustering approach some of researcher proposed clustering approached with the help of fuzzy logic. As in the fuzzy logic false or true, the degree of certainty is to be well-thought-out for the fuzzy logic system. The input parameter as previous algorithm are well defined in first phase. After that the input parameter is transform into a fuzzy set in which knowledge base fuzzy rules applied to generate the output fuzzy sets. This output passed the defuzzyfication process and finally refinement of the system is accomplished for settled the variety of the input and outputs. The fuzzy logic based cluster head selection algorithm where the first occurrence of introducing the fuzzy system in VANET is proposed [9]. In the first phase of fuzzy system where relative speed and distance based matrices are used for clustering formation process. Second phase, study the driver's behaviors for predicting the future point and speed of the vehicles. Based on predicting value of speed and position of vehicles, the cluster head is elected. The new cluster head selection process is initiated only when the stability factor of cluster head is fall below a predefined threshold value. Also if the neighbor cluster head reaches the half of the transmission range of cluster head then both clusters are merge and neighbor cluster head work as cluster member. However, these

approaches demonstrated unsatisfactory for the extremely dynamic nature in VANET.

Recently hybrid approach make more efficient in cluster formation and cluster head selection procedure. In hybrid approach the fuzzy logic system incorporated with machine learning algorithms to improve the reliability and efficiency of VANET through cloud facilities. A novel architecture [10] is proposed using Q-learning, reinforcement learning algorithm alongside with fuzzy logics. In that approach the cluster head elected using fuzzy logic based approach and the q-learning algorithm is used for efficient utilization of resources. The communication range of the cluster member is limited to cluster head and the cluster formation based on degree, speed and RSU link quality. Cluster head selection based on fit factor which is broadcast by every vehicles in the VANET. Also the cluster head selection process considered the relative speed of the vehicles among the mobility parameter. The consideration of relative speed to elude frequent changes of cluster heads. The slow vehicles cannot be considered for cluster head because the high speed vehicles will pass the low speed vehicles in a very little period of time. That may be effect the stability of cluster head in VANET. The strategies on mobility is the ultimate clustering approaches in VANET environment. The mobility based parameter like relative speed, acceleration position and moving direction etc., are used for cluster head selection process. Frequent changes in clusters of VANET because of high mobility of the vehicles. So, the stability of clusters is the prime anxiety instead of the efficiency of the clustering algorithm. In a highly mobile network, to improve the clusters stability a dynamic clustering algorithm DCA is proposed [11]. The cluster formation procedure considering the relative speed of the vehicles and the cluster head is elected on the basis of acceleration and average velocity without any prediction of movement or direction of the vehicles. This algorithm also allow to multiple cluster head with in the communication range for a short period of time. So it increase the stability of the cluster by prevent repeated merging of the clusters. For the enhancement in the previous method, a mobility estimate depended clustering MPBC is projected by Ni et.al.[12]. The relative speed of the vehicles is predict by analysis the hello packets which is exchange periodically among the vehicles. The vehicles which has lowest relative speed is to be elected as cluster head. After the cluster formation, the prediction of the future movement of vehicles is to calculate using the exchange messages. Similarly, to enhance the cluster stability depends on social pattern, a software-defined networking enabled social aware clustering algorithm SESAC [13] is projected. The social pattern is calculated using the moving pattern and sojourn time. Based on these vehicles are gathered into a cluster which follow the similar route. The cluster head selection parameter is considered as relative speed and vehicles distance in a cluster. This approach shows the improvement in cluster lifetime, but the stability cannot measure only on basis of cluster lifetime. The frequent change in cluster member also affect the stability of the cluster. Define the approach to form the cluster by considering the relative vehicle position, moving direction and link life time. The cluster head is elected only on those vehicles which are near to the center of the cluster so that cluster member spent more travel time in a cluster. Furthermore, a QoS parameter of Vanet to improve by proposed a density based scheme [14]. To diminish congestion and improve the QoS, this scheme used a trained data set. Cluster formation process is initiated only when the density of node crosses the predefined threshold. The cluster head is chosen on the basis on stability and reliability score of node.

The QoS with mobility metrics like as the degree of the neighborhoods, bandwidth and link quality are well-thought-out for selection of cluster head [15]. Here clusters are distributed into static and dynamic clustering. Static clustering is considered for vehicles to infrastructure and dynamic clustering considered for vehicle to vehicle communication. Infrastructure communication unit i.e. Road side unit RSU, if Cluster head is in the range of RSU than it act like as Cluster member and if no RSU found than it act as cluster head. Also merging of cluster is permitted if they are be present in within the transmission range for a definite amount of time. Many clustering algorithms are focus on to reduce the clusters in VANETs. For that some of researcher are put out in the literary works on the multi hop communication of the packet to decrease the number of the clusters. So a single cluster head can shield a large area and deliver superior stability. In multi-hop based algorithms, the cluster head can reach to all vehicles in a cluster via 2 hop or more hops [16]. Each vehicles calculates its relative mobility by receiving the broadcast beacon message periodically. After that they computes the aggregate mobility value and the weighted rate for all the neighboring nodes in N-Hops. They share their cumulative mobility value with the N-hop neighborhood and the vehicles which has least cumulative mobility value is elected as the cluster head. If the vehicle received numerous beacon messages, it elects the cluster head which is the closet in term of hop count. If more than one vehicles has same hop count than lowest relative mobility based cluster head evaluated. In multi hop algorithm, the average lifetime of the cluster is always higher than the single hop algorithms. So the stability and trustworthiness of the clusters is found better in multi-hop strategies.

On the other hands, a latest research on perceived to overwhelmed the delay constraints and extreme use of radio resources required to access the clouds. It consists in carrying the cloud to the network edge to decrease latency and improve the bandwidth uses. Recently this method has been prolonged to vehicular networks named internet on vehicles. As a result, vehicular cloud integrates cloud computing and vehicular ad-hoc network (VANET) [3]. In this strategies, vehicles are used for providing the services to user vehicles in real time scenario.

As vehicles has high speed, user in vehicles need a particular mechanism to support the application of internet access, data and storage. The quality of services are varies from one vehicles to another, so user need the most appropriate services. In RCVC, the vehicle cloud construct using road side unit directory and the resources of supplier vehicles are provided by cluster head. The number of vehicles that moves in form of cluster on the identical road as a mobile cloud and the remaining vehicles create a cloud which covers by the road side unit. The intake of internet services is achieved through the service selection method. These services are optimized by the architecture which involved the mathematical model based analysis the communication among RSU, the cluster head and the consumer vehicles. [17] Introduce a new collaborating clustering methodology for internet of vehicle named CCA-IoV, in which the capabilities of modern vehicles are used to accomplish the clustering process. This approach generate the node score and a vehicles which has high node score is to be elected as a cluster head. The CCA-IoV strengthens the cluster stability configuration by selecting the vice cluster head as a complement to cluster head.

IV. VEHICULAR NETWORKING ISSUES

The significant parts in VANET networking are the cluster formation and the cluster head election strategies. In the cluster formation process the each vehicles link the cluster and centered on the cluster size or cluster member the cluster head selection strategies can be applied. Clustering algorithms in the VANET are dynamic in environment, the vehicle join into any cluster depends on their physical location. The efficiency of the clusters is mostly be contingent on the cluster formation procedure and the parameter which is used for calculated the efficiency are packet loss, throughput, and end to end delay. The stability of the clusters depend upon the cluster head selection process and the parameter which is used to calculated the stability are average cluster member duration, average cluster head duration, number of clusters and number of state changes. For a given scenario, different combination are possible with established efficient path with better lifetime. The efficiency of clustering utilize fuzzy logic and machine learning based algorithm for creating the clusters. Machine learning based algorithm accomplish enhanced in cluster formation but due to vehicle mobility the frequently change in cluster size. Hence clustering stability beside the clustering efficiency is correspondingly essential for VANET clustering. The fuzzy logic centered algorithm can deliver superior stability as associate with machine learning algorithm due to guessing the forthcoming movement of the vehicles. The combination of machine learning and fuzzy logic algorithm provide the hybrid architecture which creates stable and efficient clusters. In Hybrid architecture, efficient cluster formation process involve the machine learning algorithm while the clusters stability improve by electing the most adequate vehicle as cluster head using fuzzy logic. The learning process of fuzzy logic supports the vehicles to acquire from environment nearby the changes and takes action accordingly. Another approach of clustering based on mobility are also common techniques in VANET, where the clustering parameter of relative speed and the mobility pattern are important. In that approach, the key point of the clustering approach is vehicle mobility. Also the improvement in clustering area, the multi hop based approach is proposed by many researcher. To deliver better stability and trustworthiness of the clusters, in multi hop approaches select the suitable cluster head that can acquire a larger coverage in a multi hop environment so that number of clusters are reduces in a network. In multi hop approaches can covers the 2 hop, 3 hop, 4 hop and the 5 hop in the recent researches. This approach also has challenges that increase the hop may increase in the end to end delay and packet loss. So network performance is degrade as increase the number of hop in multi hop algorithms.

V. CONCLUSION

VANETs operate in a stimulating communication environment, which the deployment of technology have limited in practical. Ad-hoc network has an insignificant advantage over the infrastructure based networks in such an environment. Infrastructure base network, distribution of the network resources and optimally scheduling of channel access is allowed in a relatively simply manner through access point. A large number of access point needs to deploy throughout the large coverage area. The researcher has inspected the new approaches of clustering in VANETs for taking the benefits of infrastructure based network deprived of the essential for the fixed infrastructure. According to our findings, the efficient cluster is formed by machine learning based algorithm but better cluster stability is provided by fuzzy logic based algorithm. The hybrid architecture that combine machine learning and fuzzy logic based approaches can deliver efficient cluster and superior stability. The mobility centered algorithm that considered the stability based parameter to cluster formation and to select the cluster head. On the other hand, multi hop approaches also provide more stability to the cluster but as increases in hop, also increases in packet loss which decrease the network performances. In this paper we overview the diverse vehicular networking architecture. Finally, the most imperative portions in VANET networking are the cluster formation and the cluster head selection, which are still under research.

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Image Captioning Generator Text-to-Speech

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Abstract: A model is created for the blind which will guide them while travelling on the roads without the support of anyone else. This can be accomplished by first converting the scene to text, then the text to voice, then a method for generation of image legends based on deep neural networks. With an image as an entry, the method can display an English sentence describing the contents of the image. The user first provides a voice command, then a quick snapshot is captured by the camera or webcam. This image is then fed as input to the image caption generator template that generates a caption for the image. Next, this caption text is converted to speech, which gives rise to a voice message on the description of the image.

I. INTRODUCTION

When there is a descriptive sentence for a given image, creating captions is a fascinating artificial problem. It consists of two computer techniques for understanding the content of an image and a language model from the field of natural language processing for correctly translating image comprehension into words Figure 1.

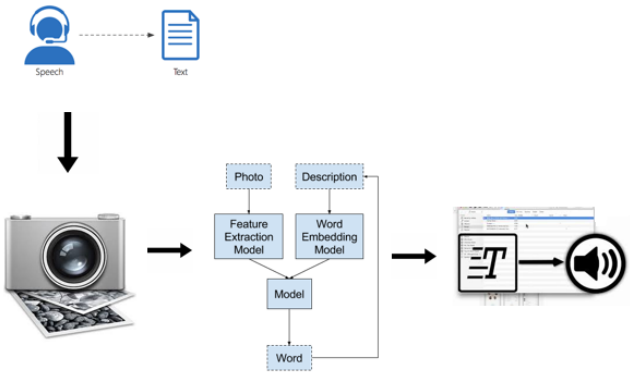

Fig. 1. Process

Image captioning has a wide range of uses, including editing suggestions, the use of visual assistants, image interpretation for the visually impaired, social media, and a variety of other language processing applications. Deep learning models are capable of producing positive outcomes when it comes to captioning issues. Rather than requiring complex data or a pipeline of custom-designed models, a single end-to-end model can be specified to predict captions provided by an image, Figure 2. The amount of memory available on the GPU used for network training, as well as the amount of time allowed for training, decide the limits of neural network.

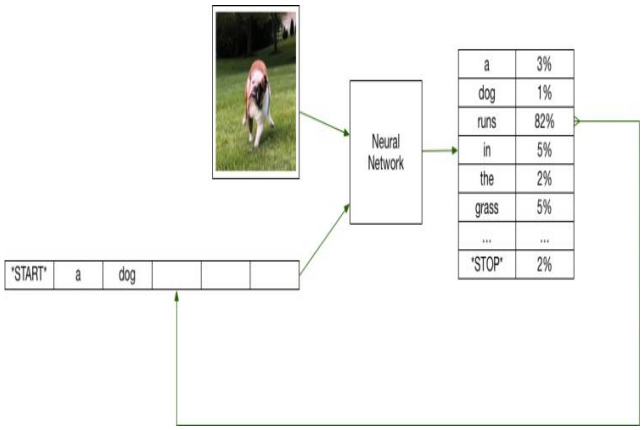

Fig. 2. Caption Generation Process

Using faster GPUs and larger databases, we can enhance our results based on our findings.

- Section 2 covers all the literature survey in Image captioning generator and neural network used and text to speech or speech to text which is in python.
- Section 3 describes how LSTM and CNN work with full details
- Section 4 describes the design and implementation.

There are several APIs available for converting text into speech in python. These APIs are the Python Text to Speech API popularly known as the pyttsx3 API. pyttsx3 is a simple-to-use tool which converts text into audio.

II. RELATED WORK

Since the inception of the Internet and its widespread adoption as a medium for image sharing, the problem of captioning captions and potential solutions has existed. Researchers of various types have produced a broad variety of algorithms and techniques. Krizhevsky et al. [1] used non-complementary neurons to activate the neural network, which uses a special GPU operation for convolution. They were able to eliminate

excess using a standard approach known as exit. Maxpooling layers and the last 1000-way softmax made up their neural network. Deng et al. [2] have released ImageNet, a vast archive of images generated using WordNet's theme structure. In the semantic population, ImageNet organized different picture groups. To learn the specifics of the corresponding internal language, Karpathy and FeiFei [3] used picture data sets and captions for their sentences. Their research represented the development of a multimodal recurrent neural network that learns how to create visual novel captions by using a consistent pattern of elements. Yang et al. [4] proposed a method for automatically producing the image's natural language context, which will significantly help in the image's comprehension.

The proposed multimodal neural network, which includes object recognition and location modules, resembles a human visual system in that it can automatically read and interpret image information. Aneja[5] proposed a flexible network model for machine translation and conditional image processing to solve the problem of complex and naturally sequential LSTM units. Pan et al. [6] experimented extensively with network-building skills in large databases containing a range of content types and introduced a unique model that shows substantial changes in word rendering and is more accurate than previously proposed models. Vinyl's et al. [7] proposed a production model that incorporates the deepest repetitive type and makes use of mechanical translation and computer vision to produce natural meanings for images by ensuring that the maximum number of sentences is used to accurately define the target image. Xu et al. [8] proposed an oriented model that learned to identify image regions automatically. By optimizing flexible low binding, the model was trained using typical backpropagation techniques. The model was able to learn to automatically classify an object's parameters while also creating an exact descriptive expression.

Enable Adjustment For Ambient Noise: Since the ambient sound level varies, we need to give the device a second or two to adapt the recording ability to the external audio level.

Text-to-speech: This is done using Google Speech Recognition and need an active internet connection. Offline recognition systems, such as the Pocket Sphinx, are available, but they require a more rigorous installation process and a higher level of trust. One of the best approaches is to use Google Speech Recognition. The Python Speech Recognition Library is used in this project.

III. PROPOSED WORK

With the image caption function, an unspecified database of multiple images is available. The most common ones are the Pascal VOC dataset, Flickr 8K and MSCOCO Dataset. Flickr 8K image database is used for the proposed model. Flickr 8K is a database with 8,090 images from the Kaggle.com website.

This database contains a list of everyday events as well as captions for each one. Each element in the image is first labelled, and then a definition based on the objects in the image is added. We divided the 8,000 images in this corpus into three distinct sets. There are 6000 images in the training database, and 1000 images in each of the validation and testing databases. To test pairs of picture captions, we need to check them to match previously available images and captions.

Several recurrent and complex networks are used to create captions for model images. The CNN model is used to derive elements from an image that is accompanied by Recurrent Neural Network (RNN) captions. Figure 3 depicts the arrangement of the image caption model.

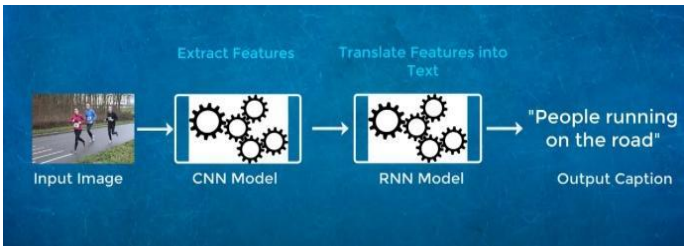

Fig. 3. Architecture

The model consists of 3 stages:

1. Speech-to-text

The method of translating spoken words into written texts is known as speech to text conversion, Figure 4. Speech recognition is another name for this method. Speech recognition is often used to describe the broader process of extracting meaning from speech, i.e. speech comprehension, despite the fact that the words are nearly interchangeable. The word "speech recognition" should be avoided because it is often confused with "speaker recognition," which is the method of recognizing an individual based on their voice.

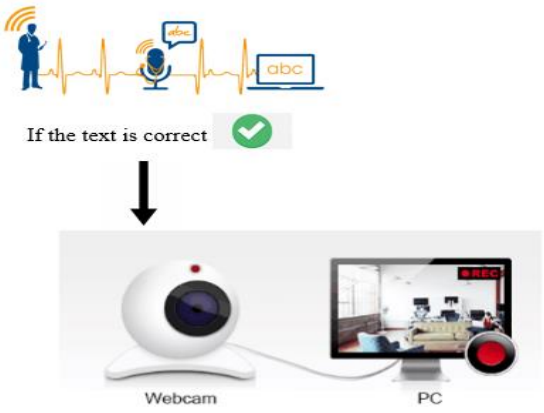

Fig. 4. Speech-to-text

2. Image Caption Generator Model

A. Image element release

- (Data Preprocessing — Images)

Due to the object's model performance, image elements from the Flickr8K database are extracted using the INCEPTION V3 model. INCEPTION V3 is a 16-layer convolutional neural network with a 2-layer correction pattern accompanied by a 1-layer cessation pattern until the layer is completely connected at the top, Figure 5. Since this model change is learned easily, the stop layers are there to prevent overuse of the training database. This is then passed through a dense layer, which produces a representation of the image's 4096 vector elements, which is then passed through the LSTM layer.

B. The sequence system

- (Data Preprocessing — Captions)
- The sequence processor's job is to serve as a word integration layer and manage text entry. The embedded layer has rules for extracting the required elements from the text, as well as a mask that ignores compressed values. For the final captioning step, the network is connected to the LSTM.

C. Data Preparation using Generator

- Function & Model Preparation

The final step of the model receives a 256 Neural layer, then the final dense layer, which produces softmax prediction of the next word in legends about the entire vocabulary generated from the text data processed in the processing phase, by combining the input of the image extraction phase and the sequence using a supplementary feature.

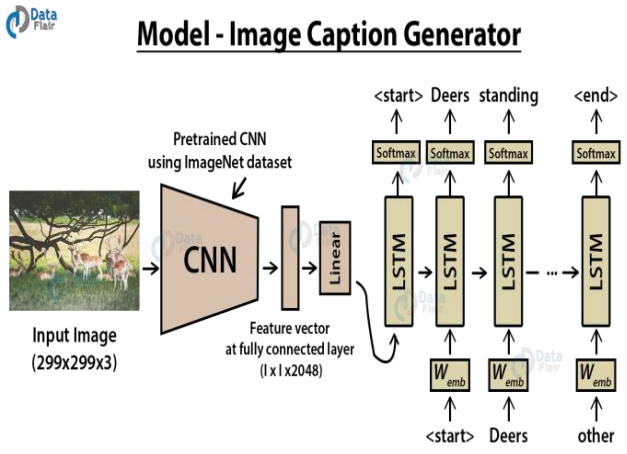

Fig. 5. Model-Image caption Generator

3. Text-to-Speech

TTS (text-to-speech) is an assistive device that reads digital text out loud. It's also known as "spoken aloud" technology. TTS can translate words on a screen or other electronic gadget into sound with the touch of a button or the pressure of a finger. TTS is very beneficial to children who have difficulty in reading. It will, however, assist children with writing, editing, and even concentrating.

IV. TRAINING PHASE

We supply two image data and sufficient captions for the image caption model during the training process. The VGG model is programmed to recognize all potential objects in an image. After seeing the picture and all of the previous terms, the LSTM part of the system is learned to predict all of the words in the sentence. Add two more signs to each article to denote the start and end of the series. When two stop words cross, the string comes to a halt and the end is marked. When 'I' supports the input data and 'S' supports the created caption, the loss function of this model is estimated. The number of sentences generated is N. The chance and the expected term at that time are represented by pt and St, respectively. We managed to keep this lack of work load to a minimum during rehearsal.

$$L(I,S) = -\sum_{t=1}^{N} \log p_t(S_t)$$

V. DESIGN & IMPLEMENTATION

The Python SciPy framework was used to apply the model. Due to the inclusion of the INCEPTION V3 which was used to define the entity, Keras 2.0 was used to use an in-depth teaching technique. The Camera architecture includes the Tensor flow library as a backend for creating and training deep neural networks. Google's Tensor Flow is a robust reading library.

It offers a sophisticated platform for developing algorithms for low-power devices like cell phones, as well as a massive distributed infrastructure with thousands of GPUs. The Nvidia Geforce 1050Ti graphics rendering unit was used for convolutional neural network.

Tensor Flow uses a graph description to describe the structure of our network. Once the graph is specified, it can be created on any platform that supports it. A pre-built and stored model is used to pre-install image features in a computer. To limit the usage of each image per network, these functionalities are imported and applied to our model as a summary of the image given in the database. The preload of image elements is also made for real- time implementation of the caption model. The model structure is shown in Figure 6.

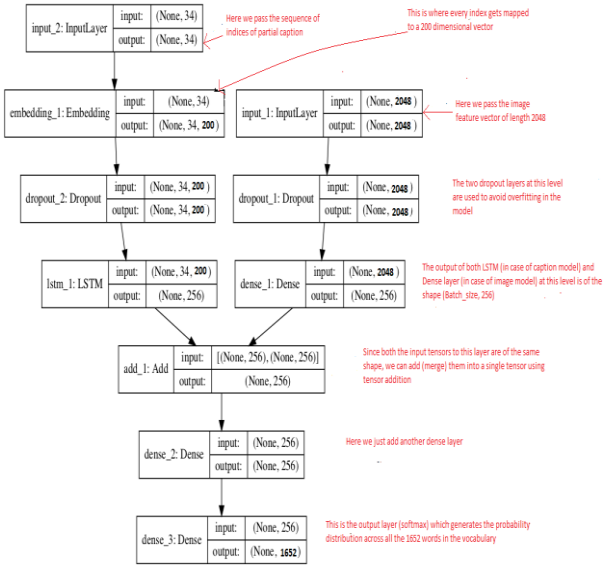

Figure 6. Image Captioning Model

VI. RESULTS

We are using an image caption model and were able to generate captions that were moderately comparable to those produced by humans. The INCEPTION V3 paradigm prioritizes the options for all potential image properties, as shown in Figure 6. The model transforms the picture into a word vector. This word vector is provided as an input into the LSTM cells that will be used to create a statement from it. A black dog jumps into the ocean beside a rock (in a produced sentence), Figure 7. While, a black dog runs into the ocean next to a mound of seaweed , black dog runs into the ocean, a black dog runs into the ball, a black dog runs to a ball (in a human-generated sentence).

So, combining the speech-to-text, image capturing and then generating its caption and text-to-speech, we can predict the caption for any image that is present in front of the person.

Fig. 7. Input Image

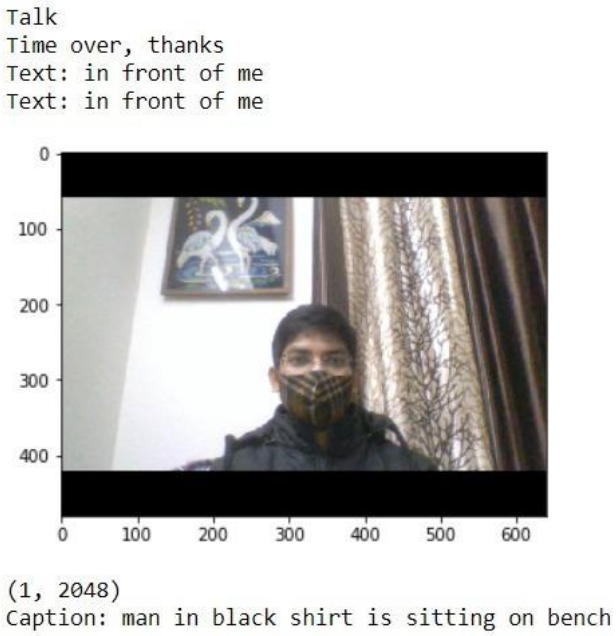

Fig. 8. Result

VII. CONCLUSION

The Image Caption Generation model successfully gives the caption of an input image. Combining it with the Speech-to-text, Text-to-speech frameworks and Open CV for an effective way to use it. The model is useful in detecting the activities going in front of a blind person which will guide him. Of course, this is a first-cut option but several changes as suggested below can be made to strengthen it:

- Making use of a broader dataset.
- Adding an attention module to the model architecture, for example.
- Increasing hyper parameter tuning (learning rate, batch size, number of layers, number of units, dropout rate, batch normalization etc.).
- To think about overfitting, by using a cross validation function.
- While inference, use Beam Search rather than Greedy Search.
- Using the BLEU Score to assess and quantify the success of the model.

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Design and Analysis of Rectangular Slot SIW Cavity-Backed Antenna at 9.2 GHz

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Abstract: The presence of a dielectric limits the performance in the designing of devices like filter, especially at high frequencies. With the aim of solving this problem a new designing technique has been adopted in substrate integrated waveguide structures wherein the dielectric is removed, while maintaining the advantages of low cost, low profile, easy manufacturing, and integration in a PCB. This paper consist of two structures in which analysis of SIW filter design with less dielectric substrate is put up and compared.

I. INTRODUCTION

A filter is a circuit capable of passing (or amplifying) certain frequencies while attenuating other frequencies. Thus, a filter can extract important frequencies from signals that also contain undesirable or irrelevant frequencies. In the field of electronics, there are many practical applications for filters. Radio communications: Filters enable radio receivers to only see the desired signal while rejecting all other signals (if the other signals have different frequency content). DC power supplies: Filters are used to eliminate undesired high frequencies (i.e., noise) that are present on AC input lines. Additionally, filters are used on a power supply output to reduce ripple. Audio electronics: A crossover network is a network of filters used to channel low-frequency audio to woofers, mid-range frequencies to midrange speakers, and high-frequency sounds to tweeters. Analog-to-digital conversion: Filters are placed in front of an ADC input to minimize aliasing.

1.1 SIW filter

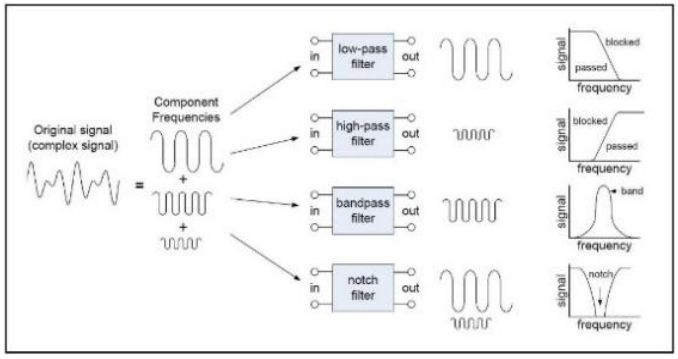


Fig. 1. A basic depiction of the four major filter types.

The SIW filter is an artificial waveguide synthesized and constructed with rows of metalized via-holes embedded in the same substrate used for the planar circuit as shown in Fig.1. In SIW filter the side walls of rectangular waveguide are replaced by the rows of metallic via-holes which converts the conventional The SIW filter is an artificial waveguide synthesized and constructed with rows of metalized via-holes embedded in the same substrate used for the planar circuit as shown in Fig. 1.

In SIW filter the side walls of rectangular waveguide are replaced by the rows of metallic via-holes which converts the conventional waveguide into planar structure. So SIW has a property of high Q-factor and low radiation losses same as metallic waveguide with the advantage of compact size. SIW only supports the transverse electric modes. If TM mode generates it will create loss through unbounded via window along the transversal direction. Due to absence of TM mode in SIW leakage losses are low which creates favorable condition for the bandpass filter design because certain mode problems due to out-of-band parasitic responses, can be avoided. This gives a distinct feature to SIW technique for filter designing [6].

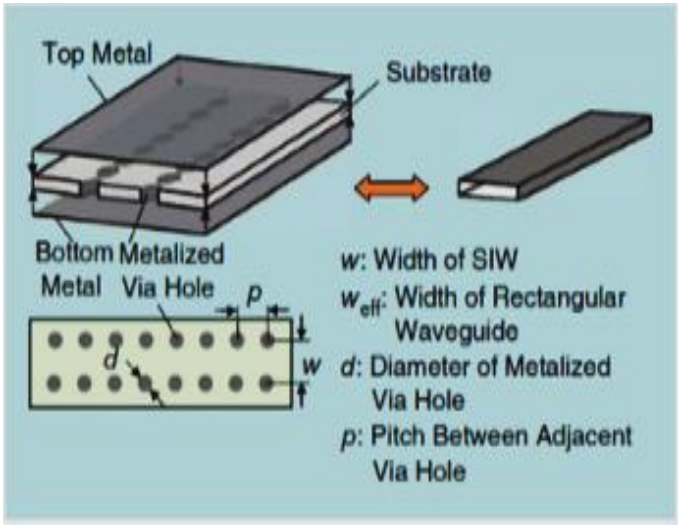


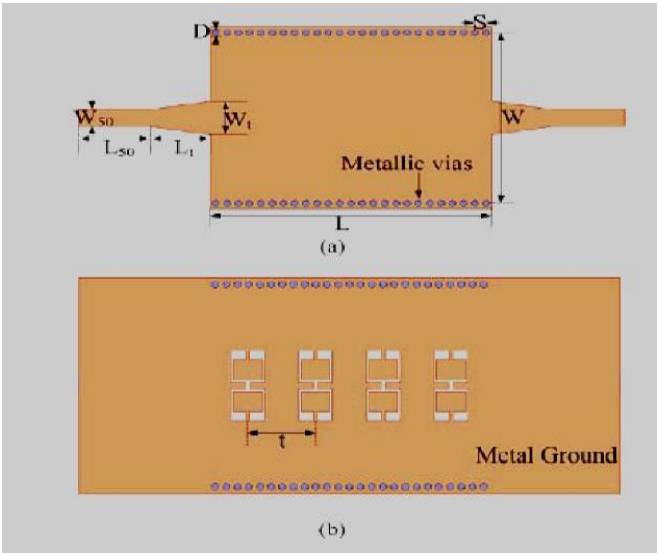
Fig. 2. An SIW and its equivalent rectangular waveguide [5]

II. LITERATURE REVIEW

According to the different paper study two types of topologies presented here for literature review: SIW with Defected Ground Structure and SIW with less dielectric.

SIW with Defected Ground Structure

A wideband bandpass filter is proposed, which combines substrate integrated waveguide (SIW) with four improved dumbbell defected ground structure (DGS) cells. The novel DGS, as a resonator on the metal ground, can produce two transmission zeros, aiming to improve the frequency selectivity and extend the upper stopband. The roll-off at the upper side is extremely sharper (about 58 dB/GHz). Therefore, the filter shows advantages in terms of the compact size, stopband rejection, good bandpass, and high frequency selectivity. The centre frequency of the filter is 8.98 GHz with 3 dB bandwidths of 47.4% (from 6.85 to 11.11 GHz). The measured S-parameters show 1.5 dB insertion loss and better than 18 dB return loss in the passband.



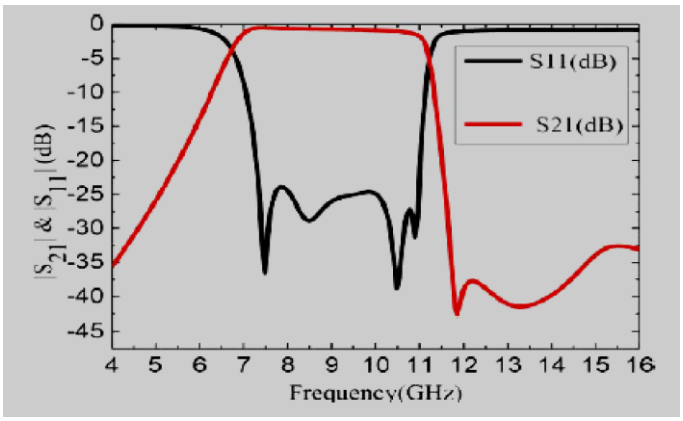
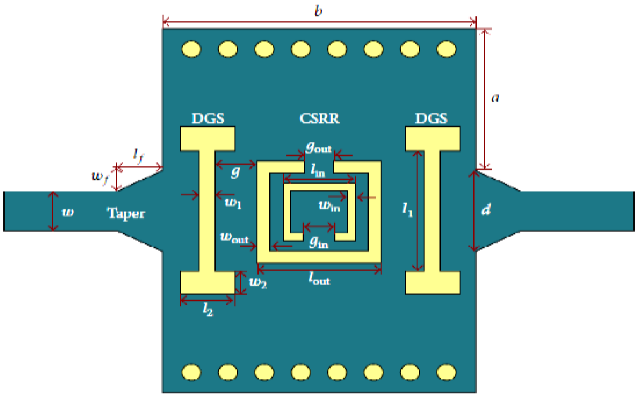


Fig. 3. SIW cavity Filter with DGS and results [7].

A X-band wideband bandpass filter based on a novel substrate integrated waveguide-to-defected ground structure (SIW-DGS) cell is presented. In the cell, the DGS is etched on the top plane of the SIW with high accuracy, so that the performance of the filter can be kept as good as possible. The filter consist of three cascaded cells, is designed and measured to meet compact size, low insertion loss, good return loss as well as smooth group delay. the filter has a central frequency of 9 GHz, a fractional bandwidth of 32%, insertion loss is 0.80 dB and return loss better than 20 dB in the whole passband. A substrate integrated waveguide (SIW) bandpass filter using defected ground structure (DGS) with complementary split ring resonators (CSRRs) is proposed. By using the unique resonant properties of CSRRs and DGSs, two passbands with a transmission zero in the middle have been achieved. The resonant modes of the two pass bands are different and the bandwidth of the second pass band is much wider than that of the first one. In order to increase out-of-band rejection, a pair of dumbbells DGSs has been added on each side of the CSRRs. Its centre frequency is 5.4 GHz with the insertion loss of 1.1dB and the relative 3dB bandwidth of 17.2%.



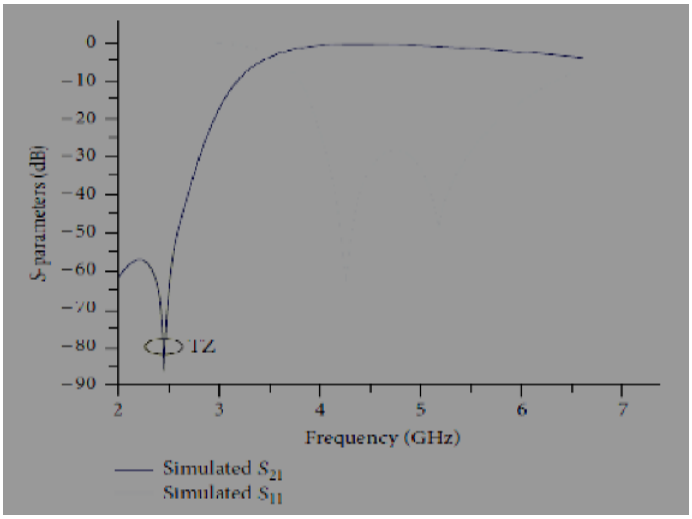


Fig. 4. SIW cavity Filter with CSRR and two DB-DGS with S-parameter results [9].

SIW with less dielectric

The presence of a dielectric in these devices limits their performance, especially at high frequencies, because of the losses in the substrate that significantly increase the total insertion losses and reduce the related Q factor. To solve this problem, a new type of SIW has appeared where the dielectric is removed, while maintaining the advantages of low cost, low profile, easy manufacturing, and integration in a PCB. The first empty line truly integrated in a substrate was theoretically proposed in [10] in 2006. It was called a modified SIW (MSIW): its behaviour was simulated, but it was not manufactured. It was an SIW line partially emptied, so that the electromagnetic waves propagated mainly through air. In 2014, the empty SIW (ESIW) was presented in [11] and the hollow SIW (HSIW) [12].

III. EMPTY SIW (ESIW)

In order to improve the performance of the integrated circuits, a new methodology for manufacturing empty waveguides, without a dielectric substrate, but at the same time completely integrated in a planar substrate, is proposed in this work. A wideband transition with return losses greater than 20 dB in the whole bandwidth of the waveguide allows the integration of the empty waveguide into the planar substrate so that the waveguide can be directly accessed with a microstrip line. Therefore, a microwave circuit integrated in a planar substrate, but at the same time with a very high-quality factor and very low losses is successfully achieved.

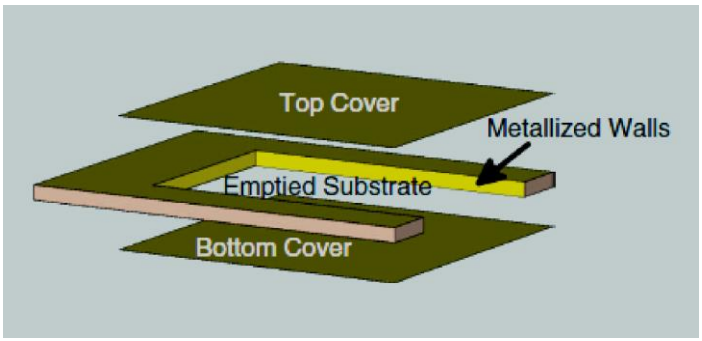
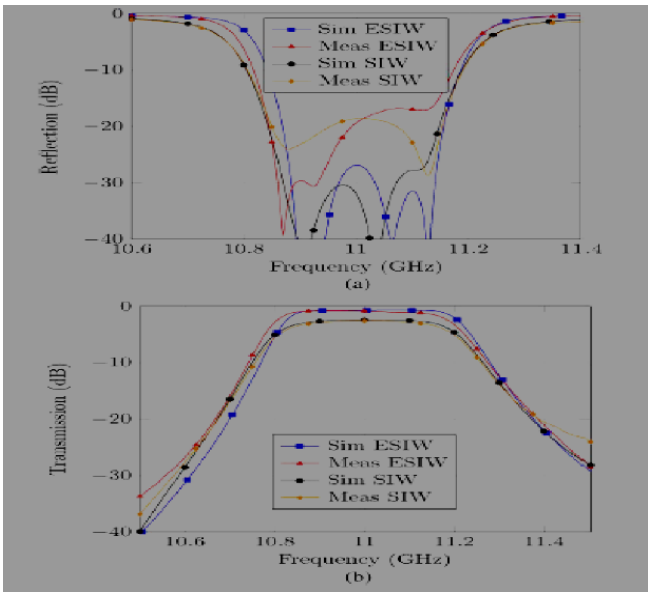


Fig. 6. Empty SIW Filter with fabricated 4-pole and 5-pole filter [11].



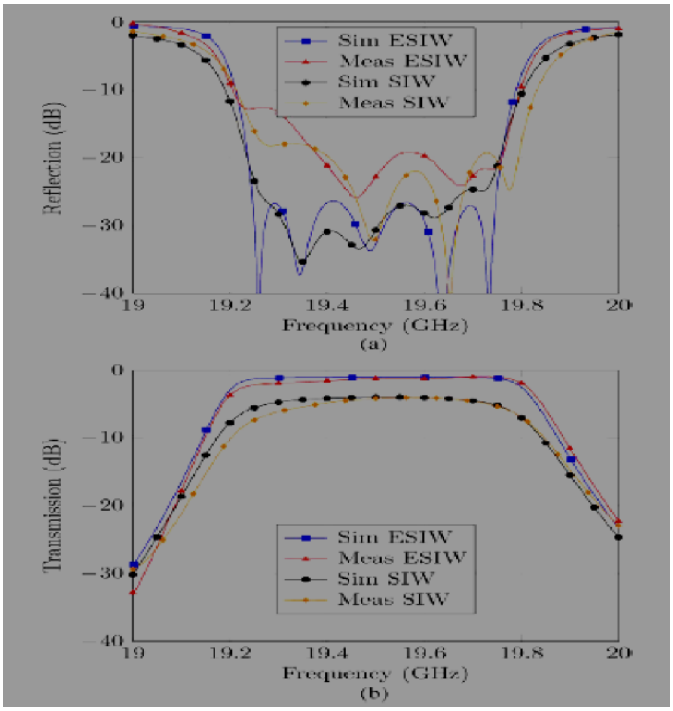


Fig. 7. Frequency response of Empty SIW Filter with fabricated 4-pole and 5-pole filter [11].

IV. ANALYSIS OF SIW FILTER WITH LESS DIELECTRIC SUBSTRATE

For the analysis of SIW filter using less dielectric different shape slots are created in the substrate and simulate the design using HFSS 19.0. Different slots are analysed for the same filter dimensions.

Design 1

In design #1 circular slot is created in substrate of 6 mm radius. The cut off frequency is 9.27 GHz and bandwidth is 2.07 GHz. For the given design insertion loss is less than 1.07 dB and return loss is better than 20 dB. The simulated results are shown in result analysis.

Specifications

Ground plane 20mm X 20mm X 0.2mm
Top patch 15mm X 15mm X 1.5mm
Slot in substrate (Circle) 6mm radius
Via radius 0.3mm
Pitch 0.75mm
Substrate Neltec NH9348(tm)
Dielectric constant (εr) = 3.48
Loss tangent (tanδ) = 0.003

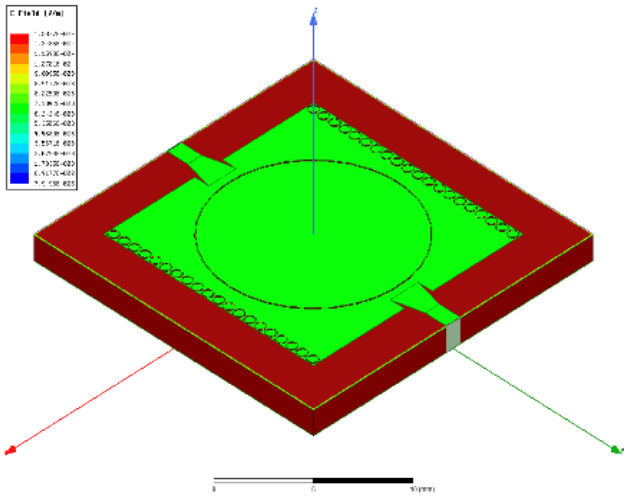


Fig 8: Structure of Empty SIW for Circular Slot

Design #2

In design #2 square slot is created in substrate of 12 mm arm. The cut off frequency is 9.02 GHz and bandwidth is 2.03 GHz. For the given design insertion loss is less than 0.97 dB and return loss is better than 15 dB. The simulated results are shown in fig. 11

Specifications

Ground plane 20mm X 20mm X 0.2mm
Top patch 15mm X 15mm X 1.5mm
Slot in substrate (Square) 12mmX12mm radius
Via radius 0.3mm
Pitch 0.75mm
Substrate Neltec NH9348(tm)
Dielectric constant (εr) = 3.48
Loss tangent (tanδ) = 0.003

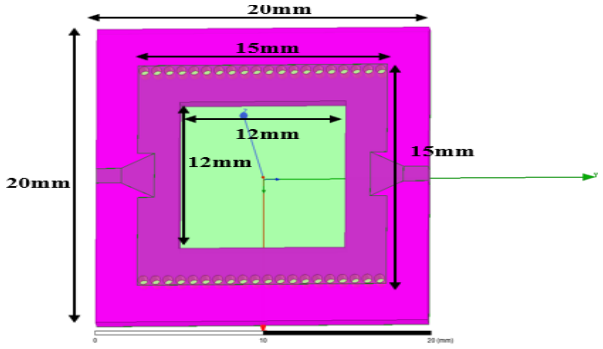
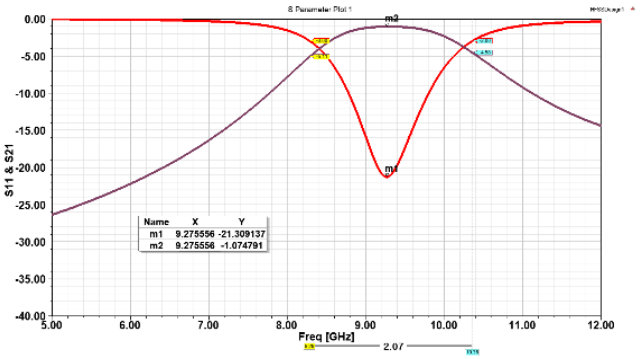


Fig 8. Structure of Empty SIW for Square Slot

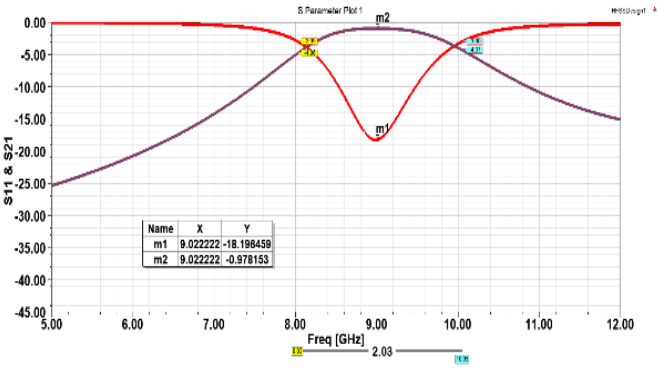
V. RESULTS

- **S-Parameter Design#1**



The cut off frequency is 9.27GHz and bandwidth is 2.07 GHz. For the given design the insertion loss is less than 1.07 dB and return loss is better than 20dB.

- **S-Parameter Design#2**



The cut off frequency is 9.02 GHz and bandwidth is 2.03 GHz. For the given design the insertion loss is less than 0.97 dB and return loss is better than 15 dB

VI. CONCLUSION

Substrate integrated waveguide technology is very favourable for integration of mm-wave circuits and applications in mm-wave frequency region. Various SIW active and passive components as well as SIW antennas have been introduced by adopting various technologies and techniques in different frequency region. Research and investigation on all these advancements is done to find which one of these design exhibit parameters like low losses, good performance and can even operate on high frequency range.

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Speech Emotion Detection using MFCC and HMM

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Abstract: Speech recognition is an area of machine learning which is significant in the for robotics and future of AI. Understanding what is being said is the major concern of speech recognition but understanding the emotion of the speaker is also equally important. This paper aims at understanding the emotion of the speaker from his speech signal. In this work, MFCC has been used to extract features from speech signal and HMM has been utilized to detect the emotion from the signal. The experiments show better accuracy with HMM compared to traditional machine learning models.

Keywords: Emotion Detection, Hidden Markov Model, Machine Learning, Speech Recognition.

I. INTRODUCTION

Since computers are developed, scientists and engineers thought of artificially intelligent systems that are mentally and/or physically equivalent to humans and their intelligence. In the past few decades, the increase of generally available computational power provided a helping hand for developing fast learning machines, whereas the internet supplied an enormousamount of data for training. These two developments boosted the research on smart self- learning systems, with neural networks among the most promising techniques [1] and [2]. Speech emotion recognition can be divided into two main parts: emotional features extraction and pattern recognition algorithms. It attracted many scholars to apply themselves to this research. Yamada [3] divided the emotions into sadness, excitement, joy and anger, and then used ANN to recognition with recognition rate of 70%. Dellaert [4] compared the performance of the three methods including Maximum Likelihood Bayes Classification, Kernel Regression and KNN to identify four emotions about sadness, anger, happy and afraid.

II. LITERATURE SURVEY

A lot of work is being done and is currently in progress. Including detection of speech, differentiating the speakers from the combination of the speech and emotion detection using speech of the speaker. Few of the previous work are mentioned below.

Ooi et al. [5] worked on a new architecture of intelligent audio emotion recognition. It uses spectral features and prosodic. It involved two main paths. First path involves processing the prosodic features and the second is for the spectral features. Two analysis namely BDPCA and LDA are done and then performance of the system is evaluated using eNTERFACE'05 and RML databases. In this, gender is not considered for emotion detection. Gender detection using Naive-bayes method was the next work worked upon.

Schuller et al. [6] worked on Hidden Markov Model-based Speech Emotion Recognition. In this they introduced and worked on speech emotion recognition using HMM. Two methods were used for analysing and comparing in which first one was the global statistics framework using Gaussian mixture model while the second one was to derive the features of speech by the raw pitch and energy contour.

Ramdinmawii [7] worked on 5 emotions Anger, Happy, Sad, Fear, and surprise which are some common case to the study. They used features like loudness, energy of excitation, detection of voiced and unvoiced region, instantaneous F0, and strength of excitation in their work. Also they used Rectangular window with window size of 200 samples and get quite good result.

Speaker state recognition using an HMM-based feature extraction method was worked by Gajšek et al. [8]. Acoustic features were used in this system for recognizing various paralinguistic phenomena. Monophone-based Hidden Markov Model was built where UBM was modeled with acoustic features for representation of UBM in the GMM (Gaussian Mixture Model). This involves two step transformation from (monophone based segmented) HMM-UBM to a GMM-UBM and then it adapts the HMM-UBM directly. Both the alcohol detection task and emotion recognition task are approached using supervised learning.

Hewlett [9] used two methods K-Means and Support Vector Machines to classify theopposing emotions. It first finds the relation between the gender and emotional content ofspeech by distinguished the speech by speakers gender. Pitch, Mel Frequency Cepstral Coefficients (MFCCs) and Formants of speech were used as input as classifying algorithms. A work on Speech Emotion Recognition Based on Gaussian Kernel nonlinear Proximal Support Vector Machine done by Zhiyan HAN, Jian WANG. The project used Gaussian Kernel Nonlinear Proximal Support Vector Machine (PSVM) [10] was proposed to recognize four basic human emotions (angry, joy, sadness, surprise). The complete process was broken in three main parts. In first part basic operations on speech like preprocessing, quantification, etc. was done. In the second phase extraction of prosody features and quality

features of speech was done. In the third and final part six Nonlinear Proximal support vector machines was used to recognize the emotion and final recognition result through majority votingprinciple.

III. HIDDEN MARKOV MODEL (HMM)

Hidden Markov Model is the extension of Markov Model with the system having unobservable or hidden states modeled as markov process. In probability theory, a Markov model is a stochastic model which is used to model randomly changing systems. It is assumed that future state depends only on the current state, not on the events that occurred before it, ie, it assumes the Markov property. Generally, this assumption enables reasoning and computation with the model that would otherwise be intractable. For this reason, in the fields of predictive modelling and probabilistic forecasting, it is desirable for a given model to exhibit the Markov property.

Hidden Markov Model (HMM) is a statistical Markov model in which the system being modelled is assumed to be a Markov process with unobserved (i.e. hidden) states. The mathematical model for Hidden Markov Model is defined as:

- $\boldsymbol{S} = \{ \mathbf{1, 2, \ldots, N} \}$: A set of states representing the state space. $\boldsymbol{S_t}$ is denoted as the state at time $\boldsymbol{t}$. For speech recognition these would be the phoneme labels, for text it would be the set of characters.
- $\boldsymbol{O} = \{\mathbf{o_1}, \mathbf{o_2}, \ldots, \mathbf{o_M}\}$: An output observation alphabet. The observation symbols correspond to the physical output of the system being modeled. For speech recognition these would be the MFCCs.
- $\mathbf{A = \{ a_{ij} \}}$: A transition probability matrix, where $\boldsymbol{a_{ij}}$ is the probability of taking a transition from state $\boldsymbol{i}$ to state $\boldsymbol{j}$.
- $\boldsymbol{B} = \mathbf{\{ b_i (k) \}}$: An emission probability distribution, where $\boldsymbol{b_i(k)}$ is the probability of emitting symbol $\boldsymbol{o_k}$ when in state $\boldsymbol{i}$.
- $\pi = \mathbf{\{ \pi_i \}}$: An initial state distribution where $\pi_i = \boldsymbol{P}(s_0 = i)$ $1 <= i <= N$.

A complete specification of an HMM includes two parameters N and M, representing the total number of states and the size of the observation alphabet, the observation alphabet O, and three sets of probability measures **A**, **B**, π .

A HMM is often denoted by Φ, where Φ = (**A**, **B**, π). Given the definition above, three basic problems of interest must be addressed before HMMs can be applied to real-world applications:

1. The Evaluation Problem. Given a model Φ and a sequence of observations $\boldsymbol{X = (X_1, X_2, \ldots, X_T)}$, what is the probability that the model generates the observations, P = (X|Φ).
2. The Decoding Problem. Given a model Φ and a sequence of observations $\boldsymbol{X = (X_1, X_2, \ldots, X_T)}$, what is the most likely state sequence $\boldsymbol{S = (S_0, S_1, \ldots, S_T)}$ in the model that produces the observations.
3. The Learning Problem. Given a model Φ and a sequence of observations $\mathbf{X = (X_1, X_2, \ldots, X_T)}$, how can we adjust the model parameter Φ' to maximize the joint probabilityπ_x $P (X | \varphi)$ i.e. train the model to best characterize the states and observations.

1. Forward Algorithm

Forward algorithm also known as *filtering*, in HMM, is uses the probability on the basis of previous or history data. Its goal is to calculate and give the joint probability as many different paths or state can lead to same output so we need to calculate the joint probability.

$P(x) = \sum P(x, \pi)$

where x is the sequence of states and π is an event.

$\alpha_t(i) = P(O_1 O_2 \quad O_t, q_t = S_i | \lambda)$

The probability of the partial observation sequence and state Si at time t given the model.

The initialization is done as

$$\alpha_i(t) = \pi_i b, 1 \leq i \leq N$$

Induction is as follows

$$\alpha_i(t) = \left[\sum_{j=1}^{n} \alpha_i = 1(j)\alpha_{ij}\right] b, 1 <= I <= N$$

and the termination is as

$$P(O|\lambda) = \sum_{i=0}^{N} \alpha(i)$$

IV. VITERBI ALGORITHM

Viterbi algorithm is used to find out the most likely sequence of hidden state and the sequence that is generated. At its pure form, this algorithm generates the network in whichthe nodes represents the different and distinct time points while branches represents transaction.

VITERBI $(O, S, \Pi, Y, A, B): X$
function
$i = 1,2, \ldots, K$
for each state do
$T_1[i,1] \leftarrow \pi_i \cdot B_{iy_1}$
$T_2[i,1] \leftarrow 0$
end for
$j = 2,3, \ldots, T$
for each observation do
$i = 1,2, \ldots, K$
for each state do
$T_1[i,j] \leftarrow \max_k \left(T_1[k, j-1] \cdot A_{ki} \cdot B_{iy_j}\right)$
$T_2[i,j] \leftarrow \arg\max_k \left(T_1[k, j-1] \cdot A_{ki} \cdot B_{iy_j}\right)$
end for
end for
$z_T \leftarrow \arg\max_k (T_1[k,T])$
$x_T \leftarrow s_{pT}$
for $j = T, T-1, \ldots, 2$ do
$z_{j-1} \leftarrow T_2[z_j, j]$
$x_{j-1} \leftarrow s_{z_{j-1}}$
end for
X
return
end function
\

3. Baum-Welch Algorithm

In Hidden Markov Model, there are some unknown parameters present, to find those parameters, Baum-Welch algorithm is used. It uses other algorithms like forward-backward algorithm to do its work. Forward-backward algorithm, basically is mix-up or hybrid of forward and backward process. It contains the benefit of both the forward and backward algorithm. This algorithm is used when we want to know the probability of a sequence that comes after some event/state k, i.e.

$P(\pi = k|x)$

V. METHODOLOGY

The approach for the word done in this paper here is shown with the help of Figure-1. The data for this project is taken from the RAVDESS dataset and using **Mel-frequency cepstral coefficients (**MFCC), **K-nearest Neighbors** (KNN) and Hidden Markov Model(HMM) approach. Feature extraction and optimization is done using MFCC and then Gaussian and KNN is applied with 5 clusters. The result obtained is fetched to HMM and the result emotion obtained is compared to the original emotion of the speaker.

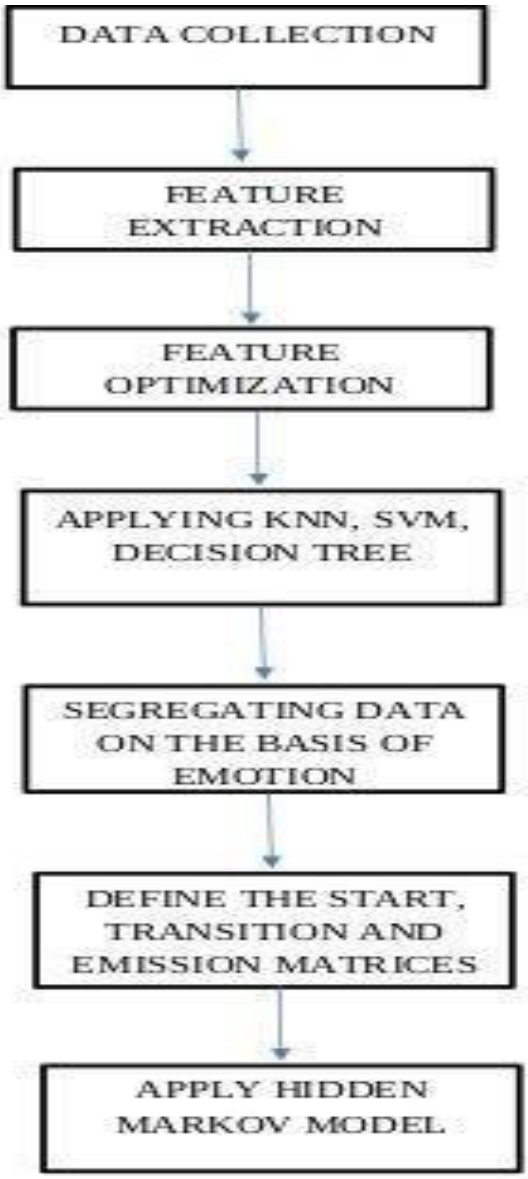

Fig. 1. Approach for Emotion Detectionusing MFCC and HMM

We first do classification of the emotion that we are going to work on and then selectfeatures of the speech on which we are going to work to get the desired emotion. To study the emotion of the speech signal, an effective and reasonable classification for emotion based on certain characteristics is necessary. Emotions constitute the primary motivational system of humans. Each of the primary emotions supplies its own unique kind of motivating information. So it is hard to give an accurate definitionfor emotion. We usually use daily language tags to identify and classify the emotion, such as fear, anger and pleased. According to the degree of purity and raw, the emotion can be divided into two categories: major affective (raw emotional) and secondary emotions (derived emotional).

At the areas of feature extraction of speech emotion, it's failed to reach a total training what feature can really distinguish emotion category. Since, to select applicable features carrying information about emotion is necessary for emotion recognition. In this paper, we choose the first and second derivatives of short-term energy, the combination of the first and second derivatives of pitch, 12-order MFCC.

At the study of emotion recognition of speech, the common approaches relate to Mel- frequency cepstral coefficients (MFCC), Hidden Markov Model (HMM).

MFC are basically made up of coefficients known as Mel-frequency cepstral coefficients (MFCCs). They are basically derived from the cepstral audio clip (a nonlinear "spectrum-of-a-spectrum") representation. The difference between lies in the fact that in MFC, the melscale is used to equally space the frequency band, which approximates the human auditory system response. This results in better sound representation as in audio compression.

MFCCs are commonly derived as follows:-

1. Fourier transform of (a windowed excerpt of) the signal is taken.
2. Power of the spectrum so obtained is mapped onto the mel scale, via triangular overlappingwindows.
3. The log of the powers is taken at each of the mel frequencies.
4. Discrete cosine transform of the list is taken of mel log powers, as if it were a signal.
5. Resulting spectrum obtained is the amplitudes for the MFCCs.

Gaussian Mixture model or GMM is used for the grouping of the data points or the grouping of various fields like pitch, energy level and other features obtained from the MFCC onwhich the detection is based so that we can collectively have one input for the HMM model. We deduce a gaussian distribution and make certain cluster which helps forming the hidden state which is required for the HMM model. In this we use Expectation maximization Algorithm which is basically an iterative.

Hidden Markov Model (HMM) is a statistical Markov model in which the system being modelled is assumed to be a Markov process with unobserved (i.e. hidden) states. The hidden Markov model can be represented as the simplest dynamic Bayesian network. The following image is the design that is being used and applied for the project.

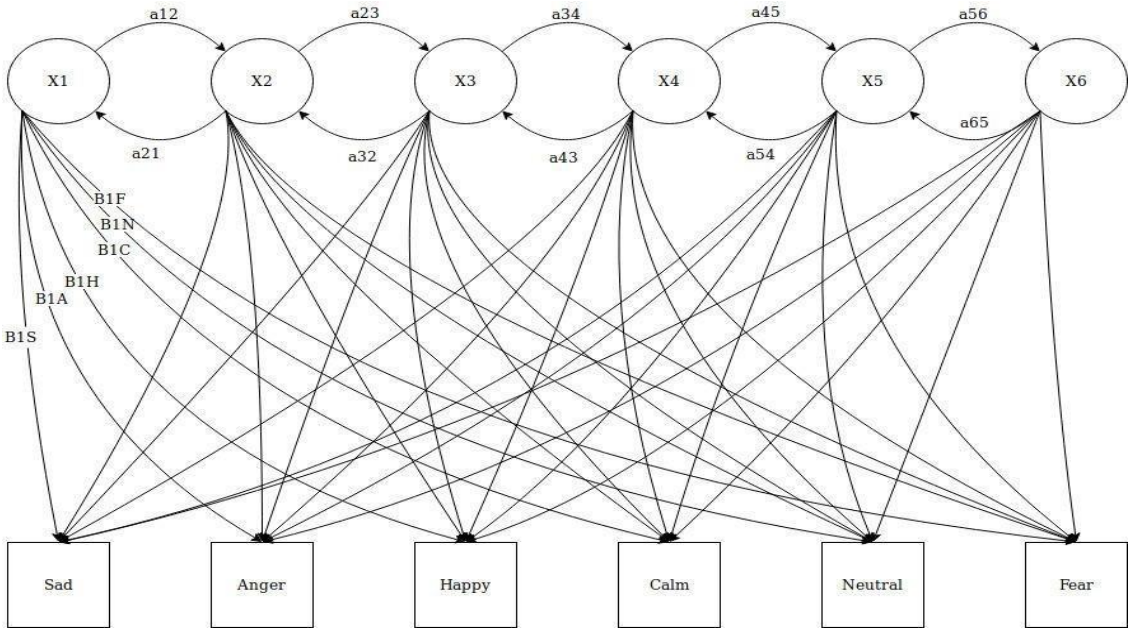

Fig.-2. HMM for speech emotion recognition

As someone is speaking, for one willing to know the emotion of the speaker needs to look for certain aspects or characteristics of the speaker's voice such as his pitch, loudness, energy, etc. Now, for machine this is quite complicated task. Emotions are the final state, that we can see represented in the square box in the diagram: *Sad*, *Anger*, *Happy*, *Calm*, *Neutral*, *Fear*. The speech is divided into several sets and for each set a hidden state is obtained: x1, x2, x3, x4, x5 and x6. From these states via given probability, i.e., a12 for moving from x1 to x2,a23 for moving from x2

to x3 and so on and from x1 to sad as b1S, from x2 to sad as b2S and so on. So that the probability of the observed sequence:

$B = B1S, B2S, B3S, ..., Bnm$

where:

n = No of hidden states (ie, 6 for this state)
m = observable states (ie, sad, happy, etc or number of observations)

$P(B) = P(B|A) / P(A)$,
where A is the probability of the hidden nodes given by:

$A = a12, a23, a34, ...$

where a12 = probability of moving from hidden state 1 to 2.

VI. EXPERIMENTS AND RESULTS

After applying MFCC and HMM the result obtained is shown in the figure 2. The column shows the actual emotion while the first row is the obtained emotion. The values are in percentage.

	Neutral	**Happy**	**Calm**	**Anger**	**Sad**	**Fear**
Neutral	95.2380	0	0	4.7620	0	0
Happy	0	100	0	0	0	0
Calm	9.5238	9.5238	76.1904	0	0	4.7620
Anger	9.5238	0	4.7619	71.4285	0	14.2857
Sad	0	0	4.7619	0	85.7142	9.5238
Fear	0	0	0	4.7619	4.7619	90.4761

Fig. 3. Result obtained by applying the MFCC & HMM

VII. CONCLUSION

From the above observations we found that KNN gives the accuracy of about 41%. SVM on the other hand gave an accuracy of about 42%. Decision Tree and Random forest gave an accuracy of 34% and 25% respectively. The Hidden Markov Model gave the best accuracy of 87%, which is highest amongst all the Machine Learning techniques applied.

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Incremental Conductance MPPT Algorithm Using Boost Converter

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Abstract: ***Sun oriented energy is bounteously accessible which make it conceivable to collect it and use it appropriately. Sun oriented energy would be an independent producing unit or may be a lattice associated creating unit relying on accessibility of a framework close by. Accordingly, it tends to be utilized to control provincial regions where the accessibility of lattice is extremely low. One more benefit of utilizing sun oriented energy is the convenient activity at whatever point and any place important. To handle the current energy emergency, one needs to foster a productive way in which force must be separated from the approaching sun based radiation. The utilization of the most current force control instruments called the Maximum Power Point Tracking (MPPT) calculations prompts the expansion the productivity of activity of the sun oriented modules and is successful in the field of usage of inexhaustible wellsprings of energy. MPPT calculation controls the force converters to consistently identify the quick greatest force of the PV exhibit. MPPT calculation expands the sun based energy proficiency of a sunlight based PV frameworks. Gradual conductance based MPPT procedure is utilized to follow greatest force point precisely with quick reaction. The Incremental conductance strategy search the specific MPP dependent on the input voltage and ebb and flow however doesn't rely upon the qualities of PV exhibit. The MPPT calculation is carried out in PV based force age frameworks alongside two unique DC-DC converters to support up the yield voltage. The working of proposed calculation is checked by re-enactment utilizing MATLAB and Simulink framework generator.***

Keywords - Solar Energy, Incremental Conductance, Boost Converter.

I. PHOTOVOLTAIC CELL

A photovoltaic cell is essentially a semiconductor diode whose p–n intersection is presented to light. Photovoltaic cells are made of a few sorts of semiconductors utilizing distinctive assembling measures [4-8]. The mono-crystalline and polycrystalline silicon cells are the main found at business scale right now [12]. Likewise, outer converse biasing is given to the photovoltaic module to build the exhaustion width of the p-n intersection.

Working of a PV cell depends on the essential standard of photoelectric impact [16-18]. Photoelectric impact can be characterized as a wonder wherein an electron gets launched out from the conduction band as a result of the retention of daylight of a specific frequency by the matter (metallic or non-metallic solids, fluids or gases).

In a PV trademark there are fundamentally three significant focuses viz. open circuit voltage, impede and most extreme force point [19-20]. The greatest force that can be extricated from a PV cell are at the most extreme force focuses. .

As a rule, makers give these boundaries in their datasheets for a specific PV cell or module.

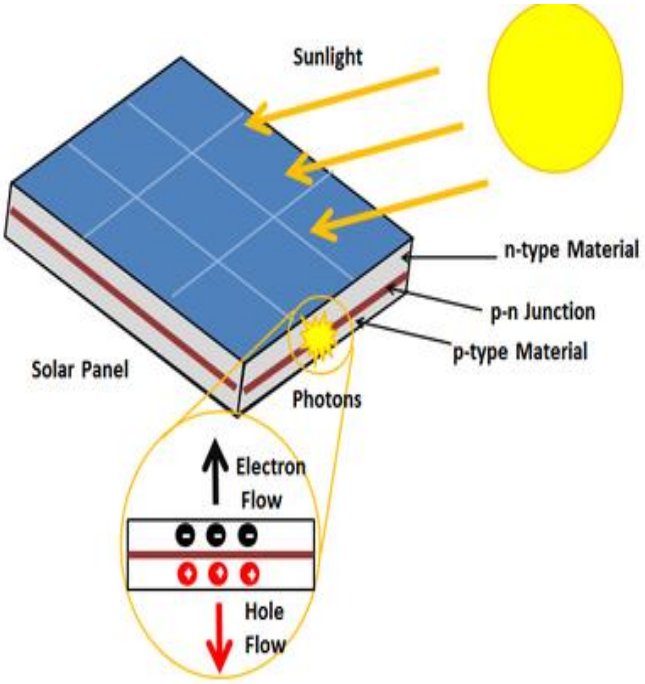

Fig. 1. Structure of a Solar Cell

The basic equation [22] from the theoretical operation of semiconductors that mathematically describes the I-V characteristic of the ideal photovoltaic cell is:

$$I = I_{ph} - I_O \times \left(e^{\frac{q \times (V + I \times R_S)}{n \times k \times T}} - 1\right) - \frac{V + I \times R_S}{R_P} \quad \ldots (1)$$

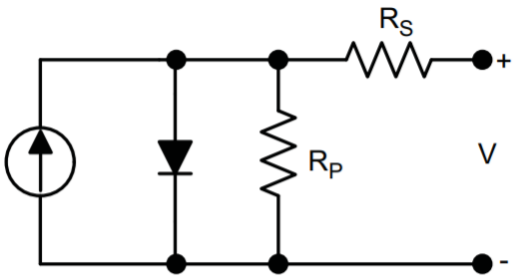

Fig. 2. Simple PV Model

RP is parallel leakage resistance and is typically large, > 100kΩ in most modern PV cells. This component can be neglected in many applications except for low light conditions.

Current through the diode is represented by:

$$I_O \times (e^{\frac{q \times (V + I \times R_S)}{n \times k \times T}} - 1): \ldots \quad (2)$$

Where:

- IO = Diode saturation current
- q = Electron charge (1.6x10-19 C)
- k = Boltzmann constant (1.38x10- 23J/K)
- n = Ideality factor (from 1 to 2)
- T = Temperature (ºK)

Sun oriented Cell I-V Characteristic Curves are charts of yield voltage versus flow for various degrees of insolation and temperature and can see you a ton about a PV cell or board's capacity to change over daylight into power. The main qualities for working out a specific board's power rating are the voltage and current at greatest force.

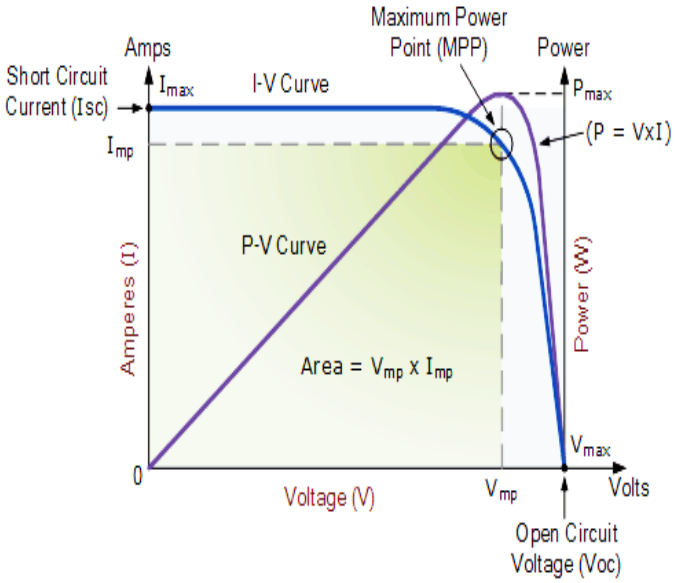

Fig. 3. Ideal IV and PV Characteristics

The above graph shows the current-voltage (I-V) characteristics of a typical silicon PV cell operating under normal conditions. The power delivered by a single solar cell or panel is the product of its output current and voltage (I x V). If the multiplication is done, point for point, for all voltages from short-circuit to open-circuit conditions, the power curve above is obtained for a given radiation level.

II. MODELLING OF PV ARRAY

The electrical specification of the PV array used are stated below:

TABLE 1: PV Array Module Data

MODULE DATA	VALUE
Maximum Power (W)	**213.15**
Cells per module (Ncell)	**60**
Open circuit voltage Voc (V)	**36.3**
Short-circuit current Isc (A)	**7.84**
Voltage at maximum power point Vmp (V)	**29**
Current at maximum power point Imp (A)	**7.35**
Temperature coefficient of Voc (%/deg.C)	**-0.36099**
Temperature coefficient of Isc (%/deg.C)	**0.102**

TABLE 2: PV Array Model Parameters

MODEL PARAMETER	VALUE
Light-generated current IL (A)	7.8654
Diode saturation current I0 (A)	2.9273e-10
Diode Ideality factor	0.98119
Shunt resistance Rsh (ohms)	313.0553
Series resistance Rs (ohms)	0.39381

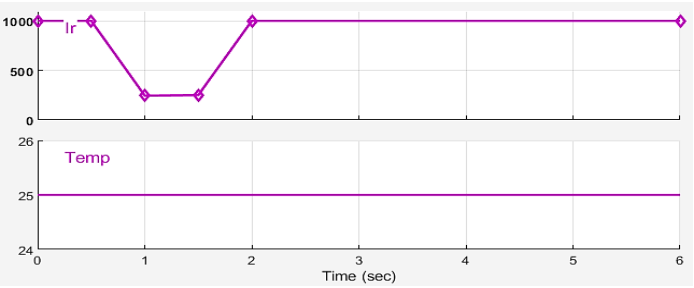

Fig 4: Input Irradiance and Temperature

The values for irradiances start from 1000 W/m2 initially and goes down gradually to express the continuous decrease in sunlight intensity keeping the temperature constant at 25°C. This is done to show variation and fluctuation in sunlight during the complete day.

The IV and PC characteristics of our PV array model are shown in Fig 4.4 for the three different values of irradiances that are 1000, 500, 100 W/m2 at 25°C temperature.

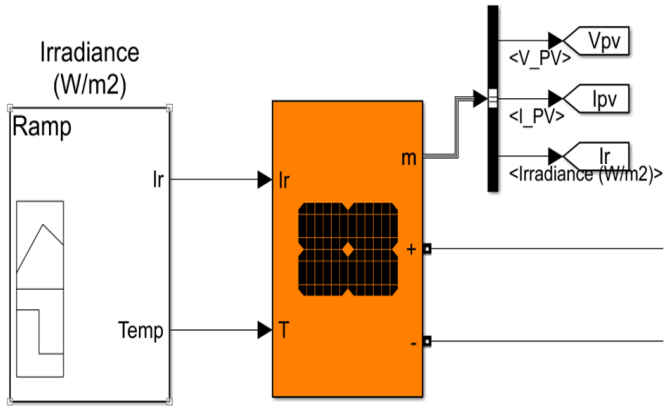

Fig. 5. PV Array Simulink Model

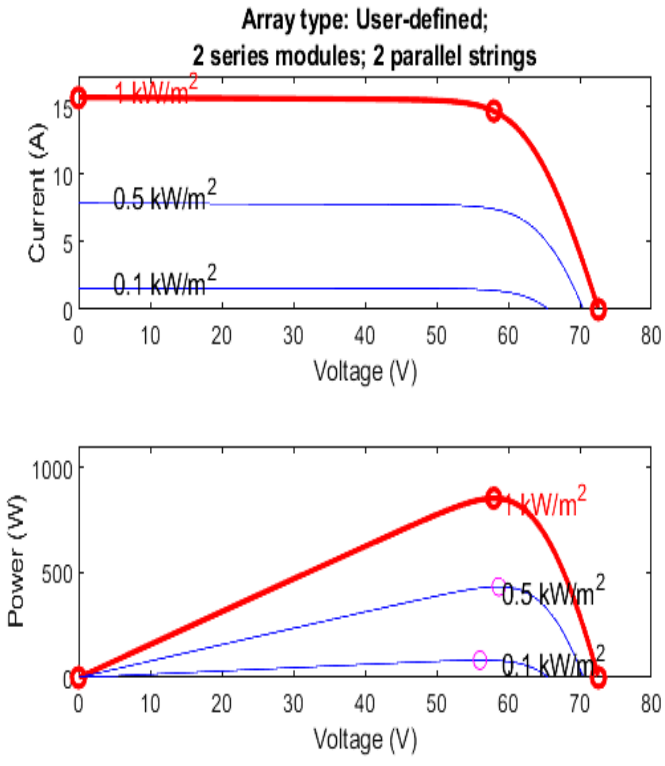

Fig. 6. IV and PV Characteristics

III. EFFECT OF VARIATION IN SOLAR IRRADIATION

The P-V and I-V bends of a sun based cell are profoundly reliant upon the sunlight based light qualities. The sun based illumination because of the ecological changes continues to vacillate, however control instruments are accessible that can follow this change and can adjust the working of the sunlight based cell to satisfy the necessary burden needs.

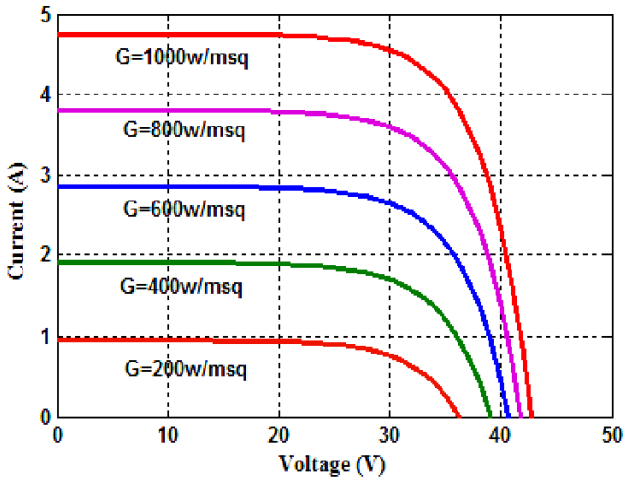

Fig. 7. Variation of I-V curve with solar irradiation

Higher is the sun oriented illumination, higher would be the sunlight based contribution to the sun based cell and henceforth power size would increment for a similar voltage esteem. With expansion in the sun powered light the open circuit voltage increments. This is because of the way that, when more daylight occurrences on to the sunlight based cell, the electrons are provided with higher excitation energy, consequently expanding the electron portability and hence more force is created.

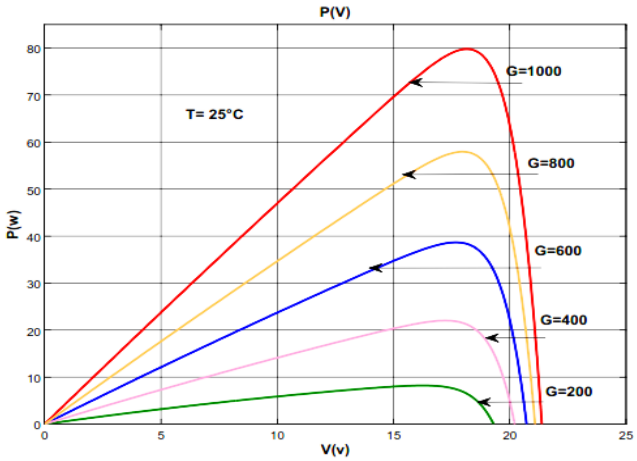

Fig. 8. Variation of P-V curve with solar irradiation

IV. EFFECT OF VARIATION IN TEMPERATURE

On the opposite the temperature increment around the sunlight based cell contrarily affects the force age ability. Expansion in temperature is joined by a reduction in the open circuit voltage esteem. Expansion in temperature causes expansion in the band hole of the material and consequently more energy is needed to cross this hindrance. Consequently, the proficiency of the sun powered cell is diminished.

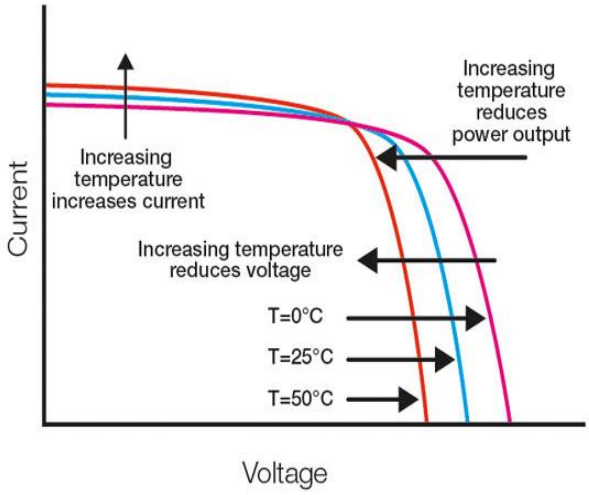

Fig. 9: Variation of I-V curve with temperature

V. INCREMENTAL CONDUCTANCE MPPT ALGORITHM

This procedure dependent on a perception of P-V trademark bend. It attempts to further develop the following time and to deliver more energy on a tremendous light changes climate. The condition for executing the INC calculation can be effectively gotten from the fundamental force condition.

The equation for power is given as:

$$P = V * I \ldots \quad (3)$$

Differentiating the above equation with respect to voltage yields,

$$\frac{dP}{dV} = \frac{d(V * I)}{dV}$$

$$\frac{dP}{dV} = I + V * \left(\frac{dI}{dV}\right) \ldots \quad (4)$$

The condition for the maximum power point tracking is that the slope dP/dV should be equal to zero. Substituting in the above equation,

$$\frac{dI}{dV} = -\left(\frac{I}{V}\right) \ldots \quad (5)$$

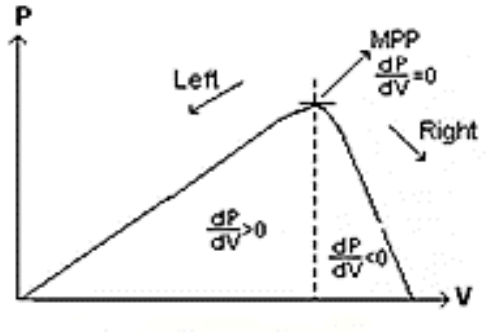

Fig .10. MPP Locations

The above equation is implemented in MATLAB m-files to track the Maximum Power Point of the PV panel. The flow chart describing the INC Algorithm is shown in the Fig 8.

In this flow chart, V(k) is the new detection voltage and I(k) is the new detection current, V(k-1) and I(k-1) is previous detection values. At the point when the new worth is perused in to the program, it works out the past esteem contrast and the upgraded one, and afterward decide the voltage differentials is zero or not, concurring the voltage differentials is zero, the current distinction not really settled zero or not. On the off chance that the two of them are zero, it shows that they have a similar worth of impedance and the worth of obligation proportion will continue as before as in the past.

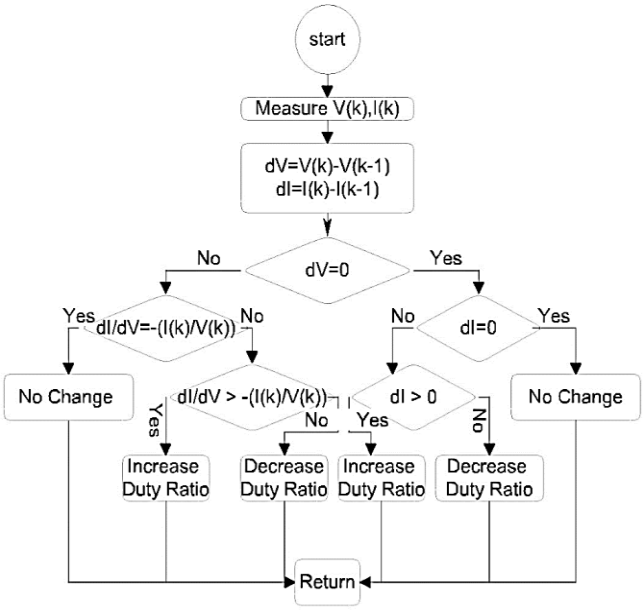

Fig. 11. Incremental Conductance Flowchart

In the event that the voltage differential is zero, yet the current differential isn't zero, it shows that the insolation has changed.

At the point when the distinction of the current qualities is more noteworthy than nothing, obligation proportion will increment, when the distinction of the current worth is under zero the obligation proportion will diminish. On the off chance that the voltage differential isn't zero decide it whether fulfill the eq. 5 or not, when eq. 5 is fulfilled the slant of the force bend will be zero that implies the framework is working at MPP, if the difference of conductance is more noteworthy than the negative conductance esteems, it implies the incline of the force bend is positive and the obligation proportion is to be expanded, any other way, it ought to be diminished.

VI. BOOST CONVERTER

A lift converter is probably the most straightforward kind of switch mode converter. As the name proposes, it takes an information voltage and lifts or builds it. All it comprises of is an inductor, an exchanging gadget i.e., MOSFET, a diode and a capacitor. Likewise, we need a wellspring of occasional square wave that we are getting from our PWM generator.

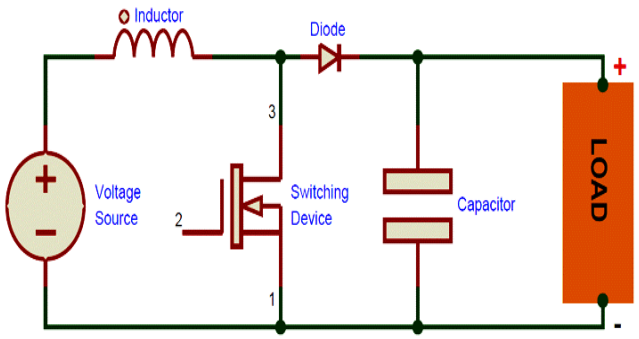

Fig. 12. Boost Converter

The greatest benefit support converters offer is their high productivity – some of them can even increase to almost 100%! At the end of the day, almost 100% of the info energy is changed over to helpful yield energy, just 1% is squandered as far as misfortunes because of latent components like inductors and capacitors.

TABLE 3: Passive elements of boost converter

ELEMENT	VALUE
Capacitor 1 (F)	100e-6
Capacitor 2 (F)	100e-6
Inductor (H)	2e-3
Load Resistance R_L (ohms)	20
MOSFET Forward Voltage V_f (V)	0.8

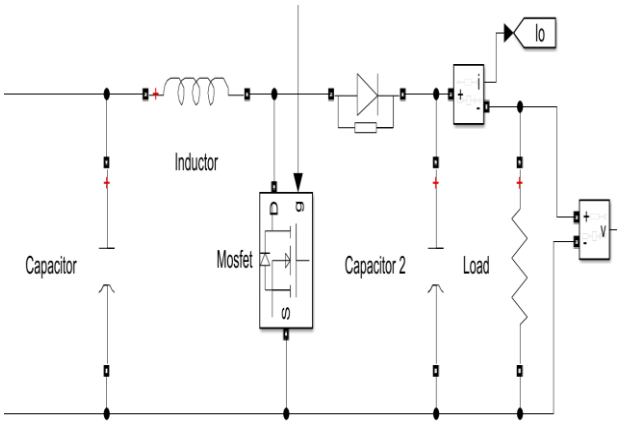

Fig 13: Boost Converter Simulink Model

VII. SIMULATION RESULTS

The simulation of a solar cell was done using MATLAB and SIMULINK. The input PV and IV curves of the PV array from simulation are as shown:

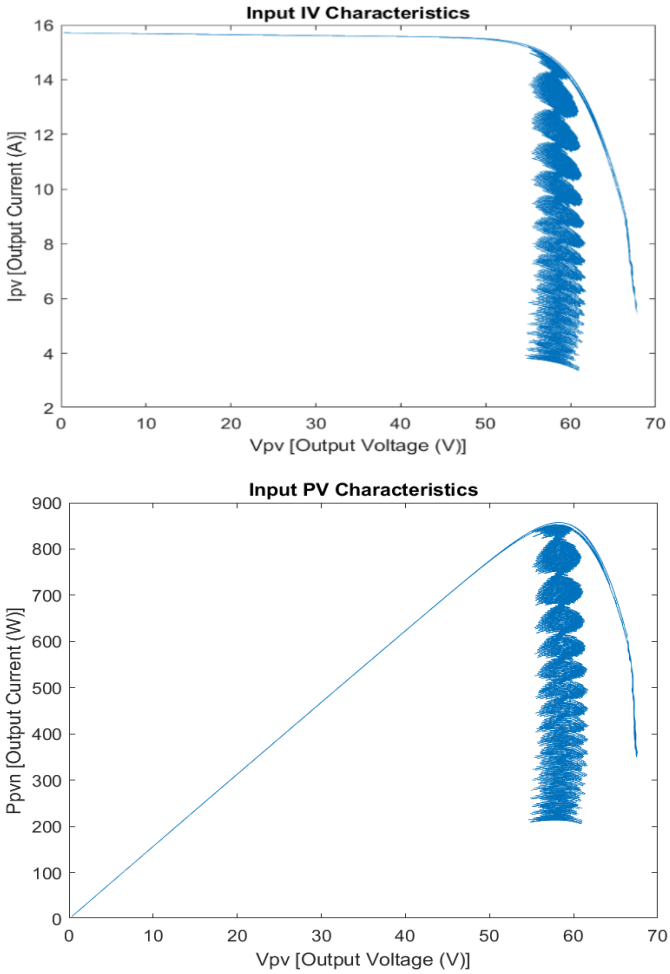

Fig. 14. IV and PV Characteristics of PV Array

The PV and IV curves of the output current, voltage and power from simulation are as shown in fig. 15.

To calculate the efficiency of the solar cell, it is necessary to know how much power the solar cell receives and how much power it produces. So, we build a branch in Simulink model to calculate the power efficiency of our Incremental Conductance Algorithm as per the given formula:

$$E = \left[1 - \left(\frac{p_0 - p_i}{p_i}\right)\right] \times 100 \quad \ldots \quad (7)$$

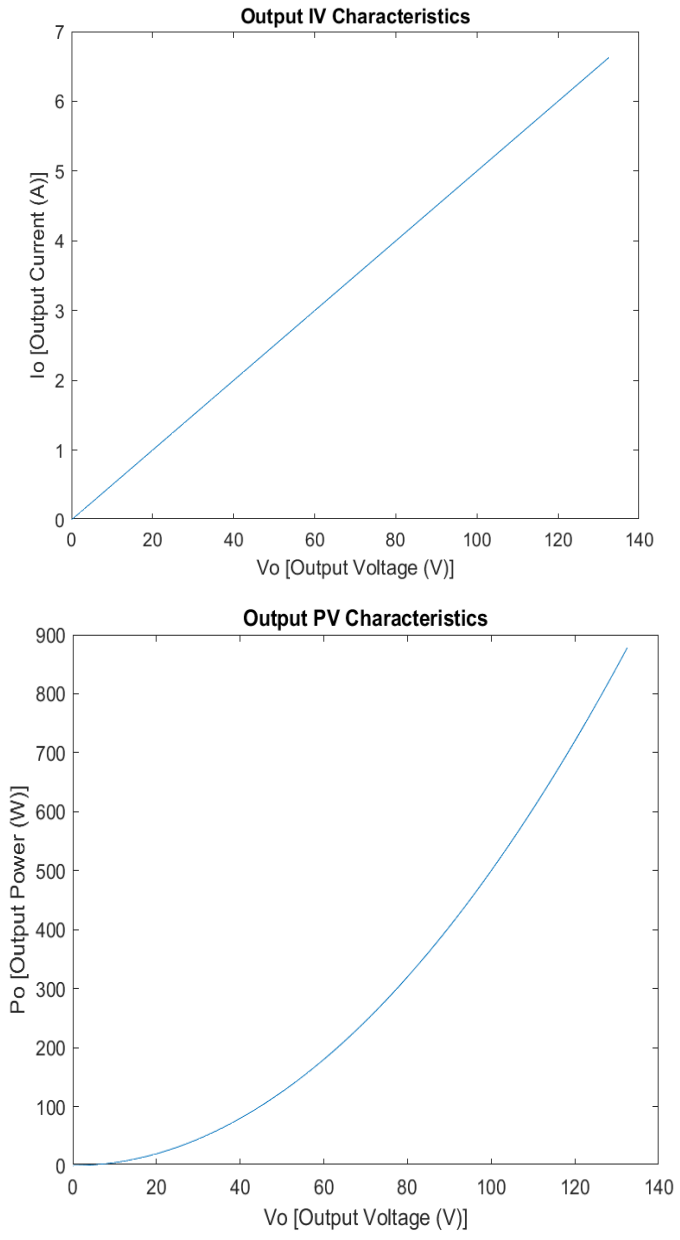

Fig. 15. IV and PV Characteristics of Controller

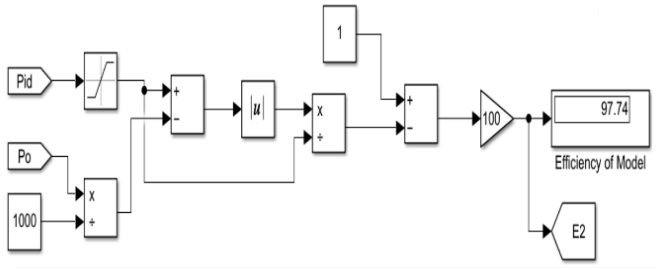

Fig. 16. Efficiency Simulink Model

The efficiency of incremental conductance algorithm using boost converter model is found out to be **97.74 %** which means this percent of input power is transferred to output incorporating voltages and currents at maximum power points.

VIII. CONCLUSION

The issue of impedance coordinating is effectively tackled to give greatest force move from contribution to yield. The Incremental Conductance MPPT Algorithm emphasizes and chooses the obligation cycle without anyone else concerning the sun powered illumination, making the total framework more effective and solid. This calculation permits framework to work at most extreme force guide and match load with the source impedance toward give greatest force at the yield. This MPPT model is more appropriate as a result of its less expense and simpler circuit plan. PWM Generator was used for creating the beat signal that was contrasted and the sign produced from the MPPT unit to give out the gating sign to the switch. Lift converter is effectively expanding the information voltage as indicated by the most ideal obligation proportion. There is a little loss of force from the sun powered charger side to the lift converter yield side. This can credit to the exchanging misfortunes and the misfortunes in the inductor and capacitor of the lift converter. The different waveforms were gotten by utilizing the plot system in MATLAB outlining wanted outcomes.

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Removal of Toxic Heavy Metal Ions using Modified Adsorbent

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Abstract: In recent years, removal of toxic metal ions from ground water and waste water streams has been a major concern . Water, being an excellent solvent is more severely threatened by pollution due to industrial waste and excessive inputs of population. Toxic metals like Hg, Pb, Cr, Cd, etc. are the necessity of many industries. The hazardous effect of heavy metal ions on public health and environment has prompted governments to implement legislation enforcing the treatment of effluent from toxic heavy metal based industries. In comparison to ion- exchangers and other adsorbents chelating ion- exchangers have received great attention recently in the field of preconcentration and separation of metal ions(1-4) . Iron (III) hexamine gel (IHA) was used as a new chelating material for separation and recovery of certain rnetals. Iron hexamine gel (IHA) is readily reproducible; fairly stable in water, acids upto I M and ammonia upto 4M and shows high sorption abilities based on the coordination with the lone pair of nitrogen. Industrial application of chelating materials is limited due to large capital investment and unmodified adsorbents as such are not much successful for the removal of toxic metal ions from effluents. The objective of study in this chapter is to increase the efficiency of removal of certain heavy metals by distributing iron(III) hexamine gel on sawdust.

I. EXPERIMENTAL

Chemicals:

Iron (lll) nitrate (BDH, India) and hexarnine (Loba, India) .

Apparatus:

Systronic digital pH meter and Perkin Elmer model 552 spectrophotometer were used for pH and spectrophotometric measurements .

Preparation of modified sawdust (MSD):

Saw dust sieved for the desired mesh size (60- 100) was stirred with hot demineralized water for 6h to remove the impurities, filtered and dried. 250 ml of 0.1M iron(Ill) nitrate solution was added to the weighed amount of sawdust and stirred for 2h. Then, 125 ml of 0.4 M hexamine was added and stirring was further continued for 12h. After aging for 24 h, the resultant material was filtered , washed with deionized water and finally dried at 60 °C in an oven.

Sorption capacity:

The sorption capacity of the adsorbent was determined by batch process. A quarter gram of adsorbent was shaken with 25 ml solution of 0.008M Cr(VI) at pH 6. The supernatant was analysed for unsorbed Cr(VI).

Sorption of metal ions as a function of pH:

The uptake of various heavy metal ions by modified saw dust has been investigated in terms of sorption capacity at different pH. The adsorbent (0.2g) was shaken with 25ml of 0.008 M metal ion solutions at different pH (adjusted using 0.25 M hydrochloric acid- 0.25M sodium acetate) in a glass stoppered conical flask for 4 h. The solution was filtered and analyzed for unsorbed metal ions. Pb(II), Mn(II), Ni(II), Zn(II), Cu(II), Hg(II) and Cd(II) were determined by EDTA titration and Cr(VI) was determined spectrophotometrically with diphenylcarbazide(5).

Rate of sorption:

Rate of sorption was determined by batch process. 25 ml of 0.008M solution of C'r(VI) (pH 6) was shaken with 0.2 g of modified dust (MSD 1) for different time intervals and the amount of unadsorbed Cr(VI) was determined in the filtrate. For comparison similar studies were performed on untreated saw dust.

Break through capacity:

The breakthrough behaviour of metal ions was studied by passing solutions of Cr(VI), Pd(II) and Hg(II) (1 mg/ 1O ml each, pH - 6) through a column (30 cm x 0.39 cm2) packed with 2g MSD. The flow rate was maintained at 1 ml/m. For comparision similar studies were made on untreated saw dust.

Standard procedure for the removal of metal ions:

The borosilicate column (30 cm x 0.78 cm^2) packed with 5g MSD was preconditioned with the proper pH buffer. Water samples containing metal ions in ppm concentration were passed through the column, at flow rate 2 ml/ m .

Effect of diverse ions:

1000 ml solution of chromium (VI) (10- 50 mg) or mercury(II) (10- 60 mg) containing foreign metal ions: Mn(II), Zn(Il), Hg(II) and Cu(II) (5 mg each) were prepared (pH - 2). The

removal of Cr(VI) or Hg(II) was carried out by standard procedure.

II. RESULTS

The results of sorption capacity of hexavalent chromium[6] on modified saw dust samples and iron(III) hexamine are presented in Tab le 4. 1. The results of breakthrough behaviour for chromium(VI), lead (lI) and mercury(II) are plotted in Figure 4.2.

The results of effect of flow rate on breakthrough capacity are plotted in Figure 4.3.

TABLE 4.1: PREPARATION AND PROPERTIES OF IRON HEXAMINE MODIFIED SAWDUST (MSD)

Adsorbent	Sawdust added (g)	Yield (g)	Sorption Capacity (mg per g MSD)	Sorption Capacity for Cr(VI) (mg per g IHA)
IHA	0.0	4.580	-	26.05
MSD 1	5.0	9.585	19.526	40.679
MSD 2	10.0	14.592	14.282	40.484
MSD 3	5.0	9.585	19.820	41.461

TABLE 4.2: REMOVAL OF METAL IONS FROM WATER SAMPLES

Sample	Metal ions	Volume of effluent (ml)	Con. of metal (ppm)	Approx. pH of water sample	Removal*
Distilled Water	Cr(Vl)	7000 8000 9000 14000 16000	10 10 10 5 5	6 6 6 6 6	100.0±0.6 95.8±0.8 86. 5±0.8 100.0 ±0.7 96.0±1.0
Tap water	Cr(VI)	4000 5000 5000 6000	10 10 10 10	6 6 2 2	100.0±0.8 92.3±1. 0 99.8 ± 1.1 93.8±1.2
Tap water	Hg(II)	5000 6000	10 10	3 3	l 00.0±0.6 l00.0±0.6
Tap water	Pb(Il)	3000 4000	10 10	6 6	100.0±1.2 89.3+1.6

* Mean and standard deviation for five measurements

TABLE 4.3: REMOVAL OF Cr(VI) AND Hg(II) IN PRESENCE OF FOREIGN METAL IONS Mn(II), Zn(II), Ni(II) AND Cu(II) AT pH 2

Metal Ion	Amount of metal ion taken (mg)	Removal* (%)
Cr(VI)	10 30 50	100 ± 0.5 100 ± 0.5 99.8 ± 0.8
Hg(II)	10 30 50 60	100 ± 0.5 100 ± 0.7 99.9 ± 1.0 91.6 ± 1.4

* Mean and standard deviations for five measurements.

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Analysis of Pyroelectric Behavior of Ba0.9Ca0.1TiO3 Ceramics

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Abstract - $Ba_{0.9}Ca_{0.1}TiO_3$ ceramic was fabricated via solid state reaction route. Frequency independent dielectric con- stant was observed in the range of 100 Hz-1MHz. Curie temperature was observed at 390K. Impedance studies were also conducted in wide frequency and temperature ranges. Temperature independent pyroelectric coefficient was ob- served below Curie temperature. Pyroelectric performance was also observed using alternate heating/cooling cycles. Periodic open circuit voltage of 0.5V was observed within the experimental conditions.

Keywords - Ferroelectric; Pyroelectric, Dielectric, BCT

I. INTRODUCTION

Exploration iof ilead-free iferroelectric imaterials ihas ibeen iex-itensively idone iin ilast idecade i[1]. iThese imaterials ihave ipotential iapplication iin ivarious isensing iand iactuating idevices. iParticularly piezoelectric imaterials isuch ias $iBaTiO_3$, $iK_{0.5}Na_{0.5}NbO_3$, $iBi_{0.5}Na_{0.5}TiO_3$ iand imany imore isolid isolutions ihave ibeen iexplored i[2,3]. iSome iof ithe imaterials ihave ieven idemonstrated isuperior ipiezoelectric iproperties ias icompared ito iexisting ilead-based imaterial i[4]. iFrom ithe iliterature, i iit i iis inow iexpected ithat ifew ipiezoelectric idevices icould ibe ilead- ifree iin inear ifuture. iOn ithe iother ihand, ipyroelectric imaterials ihave inot ibeen iexplored iso imuch. iPyroelectric imaterials ihave iapplications iin ithe ifield iof ithermal isensors, iimaging idevices iand ithermal ienergy iharvesting iapplications i[5]. iThere iare ivarious ireviews iwhich ideal iwith ipossible iapplications iof iferroelectric imaterials iusing ipyroelectric i iprinciple. A couple iof ilead-free iferroelectric imaterials ihave ibeen iidentified ifor ipyroelectric iapplications i[6]. iSome iof ithe imaterials ihave ialready iidentified iunder ireal ienvironment i[4]. iHowever, iexisting istudies iare inot isufficient ito iconclude ior ito idecide iop- itimum imaterials. iBaTiO3 iis ione iof ithe ioldest iferroelectric iceramics. iThere iare iseveral istudies ireported iwhere ivarious idoping/solid isolutions ibased ion iBaTiO3 ihave ibeen ireported. iBaTiO3-CaTiO3 isolid isolutions iare iwell iexplored ifrom isynthesis/structural iand ipiezoelectric iviewpoints. iHowever, ipyroelectric iperformance ihas inot ibeen ithoroughly iinvestigated iso ifar. iHence the ipresent istudy ihas ibeen iaimed ito iexplore ipyroe- ilectric ibehavior iof $iBa_{0.9}Ca_{0.1}TiO_3$ iceramic.

II. EXPERIMENTATION

The $iBa_{0.9}Ca_{0.1}TiO_3$ i(BCT) is iprepared ivia conventional isolid istate ireaction iroute. iFor ithis, iAR igrade iwith ihigh ipurity iraw ipowders iof $iBaCO_3$, i(99% ipure), icalcium ioxide i(CaO, i(>98% ipure)) iand ititanium idioxide i(TiO_2, i(99% ipure)) ihave ibeen iused ias iinitial imaterials. iStoichiometeric iamount i iof i ithese iraw ipowders iweighed iand isubsequently imilled iin ia iplanetary imill iwith iwetting iagent iin iacetone. iAfter i ithat i ithe i ipowder iwas isubjected ito icalcination iat i1250ºC ifor i5 ihours. iThe iob-itained ipowders iwere ire-milled iand ipressed iinto idisk ishaped ipellets iof i24 imm iin idiameter iwith i1mm ithickness iusing ipol- iyvinyl ialcohol ias ia ibinding ilubricant. iThe isintering iof ithese igreen isamples iwas icarried iout iat i1450ºC ifor i5 ihours iand idensity iof ithe iprepared isamples iwere iestimated iusing iAr- ichimedes iprinciple. iThe iphase ipurity iof isintered i imaterials iwas iconfirmed ithrough iX-ray idiffraction i(XRD) i(Rigaku iSmart iLab, iJapan) iand ia iscanning istep iof i2°/min ifor i2θ iranging ibetween i20° iand i80°. iThe imicrostructure iobserva- itions iwere idone iusing iscanning ielectron imicroscopy i(SEM) i(FEI iSEM iNOVA iNanosem i450, iHillsboro, i iOR). i iSilver ipaste iwas icoated ion iceramic imaterial iprior ito ielectrical imeasurements. iPellet iwas ipoled iat i3 ikV/mm inear iCurie item- iperature. iFerroelectric ipolarization-electric ifield i(P-E) ihyste- iresis iloops iwere irecorded i(50Hz) iat idesirable itemperatures iusing ia imodified iSawyer iTower icircuit i(Marine iIndia, iNew iDelhi, iIndia). iImpedance ispectroscopy i(IS) imeasurements iwere iconducted iusing ian iAlpha-A iimpedance ianalyzer i(No- ivocontrol iTechnologies, iMontabaur, iGermany). iImpedance ispectroscopy i(IS) imeasurements iwere iconducted iusing ian iAlpha-A iimpedance ianalyzer i(Novocontrol iTechnologies, iMontabaur, iGermany) ifrom i373 iK ito i573 iK iwith ian iampli- itude iof i0.1 iV iin ithe ifrequency irange iof i0.1 iHz-3 iMHz. i iThe i iIS idata iwas ievaluated iusing ithe iRelaxIS iprogram i(rhd iin- istruments, iMarburg, iGermany).

In ipresent istudy, ithe iBCT ipyroelectric iceramics iwere iex-iposed ito iinfrared ibulb i(Phillips i250W) ifor iheating iand icool- iing icycles. iIt iis ito inote ithat ioutput ifrom isuch

isetup iwas inot iaccurate ias ipyroelectric isample ihas inot iuniformly i iheating iand icooling. iHowever, isuch ikind iof isetup iare iused iby isever- ial iauthors iand ithe iperformance ifrom isuch isetup i iis i imore i iclose ito idevice iperformance iin ireal itime isituation i i[7,8]. i iOpen circuit ivoltage iand itemperature iwere irecorded iFluke i i287 itrue iRMS imultimeter.

III. RESULTS

Fig.1(a) shows a typical XRD pattern of BCT sintered ceramic pellet. Peaks positions are exactly matched with literature. No other additional peaks in XRD pattern revealed nonexistence of any impurity phases. Further, surface of BCT ceramic pellets was analyzed using SEM. Microstruc- tural image is shown in the inset of Fig. 1(a). SEM image depicts densely packed grains of uniform size which evenly distributed throughout the surface. Grains are almost inter- connected having no pores and voids. To compare the fer- roelectric switching for BCT sintered ceramic pellet, the P–E hysteresis loops were recorded for different temperature.

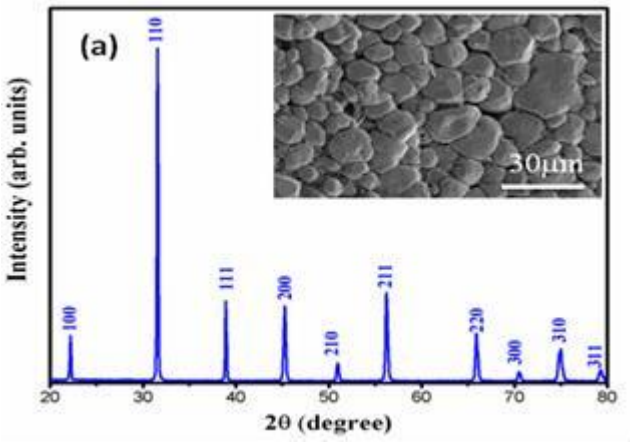

Fig.1. (a) XRD pattern of BCT

P–E loops of BCT sintered ceramic pellet are shown in fig. 1(b).

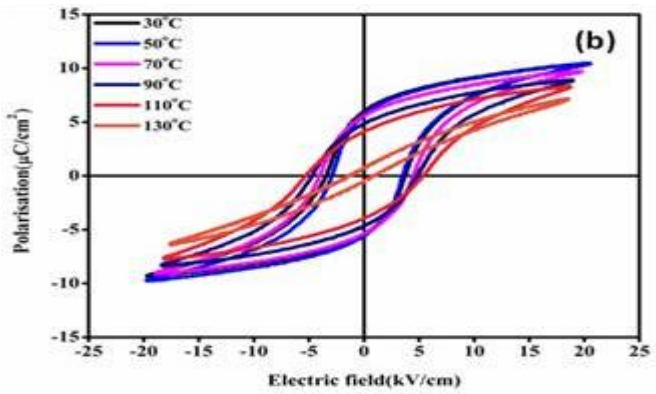

Fig.1. (b) P–E loops of BCT sintered ceramic pellet

Fig2(a) shows dielectric constant behavior with respect to temperature at various frequencies. Sharp peak was observed in this figure (figure2(a)).Which can be anticipated for Curie transition 390K.

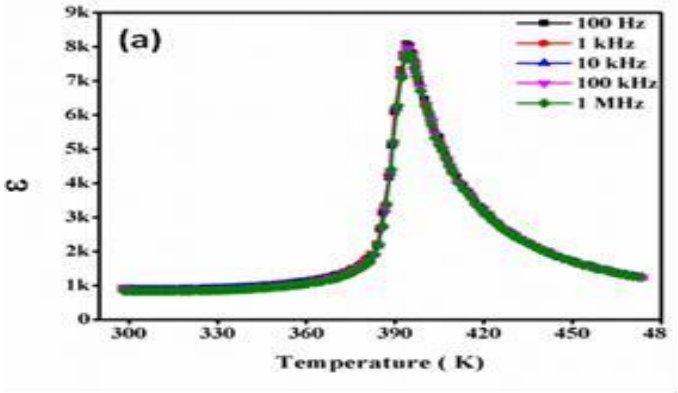

Fig.2. (a) Dielectric constant behavior

Similar pattern was observed in dielectric loss behavior (fig2(b)). However sharp increase in dielectric loss is attributed to thermal induced electrical conductivity.

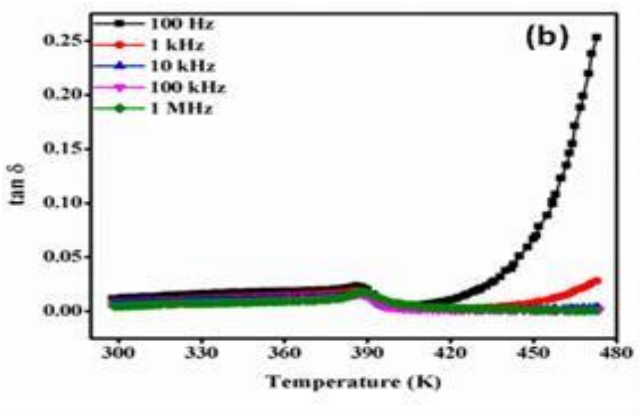

Fig.2. (b) Dielectric loss behavior

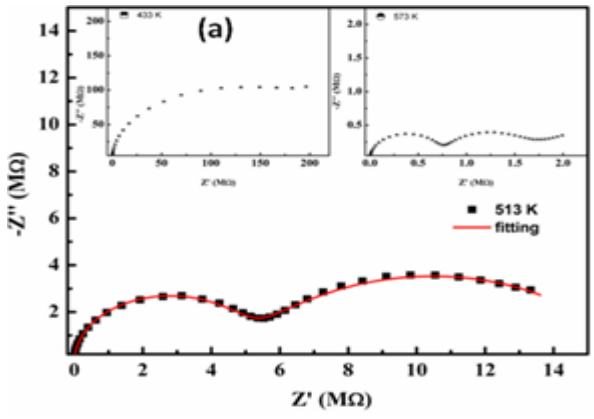

Fig.3. (a) Complex impedance plots

Figure 3(a) shows complex impedance plots of Z` versus Z`` (Nyquist plot) for BCT at a 513 K in frequency range of (0.1 Hz-3 MHz). Inset shows Nyquist plot at 433 K and 573 K. At lower temperature <403 K, the Z` versus Z`` shows linear response (not shown here) which suggests the insulating nature of the understudy composition. However, above 433 K, it gradually changes to a semicircle arc as shown in inset of figure3(a).

Further, ias ithe itemperature iincreases ito i513 iK, isingle iarc ican ibe iresolved iinto itwo isemicircles. iThese isemicircles ican ibe icharacterized iby itwo iparallel iequivalent iRQ ielements iin iseries, iwhere iR iand iQ iare ithe iresistance iand ithe iconstant iphase ielement iof ithe icircuit. iFrom ithe ifitting ibulk i(grain) iresistance i(R_a) iand icapacitance i(C_a), igrain iboundary ire- isistance i(R_{ab}) iand icapacitance i(C_{ab}) iwere iobtained. iIt ipro- ivides ithat itwo irelaxation iphenomena iare ipresented iin ithe imaterial iat i513 iK. iThe iarc iat ilower ifrequency iside ishows ithe igrain iboundary iresponse iwhereas ihigher ifrequency iside i ishows igain i(bulk) iresponse. iAs ithe idifferent icapacitances iof ithe itwo iprocesses iare iobserved i(by ifitting iparameters) ibe- icause iof ilow iconcentration iof ioxygen ivacancies iand itrapped ielectrons iat ithe igrain iboundaries. iFurther, i iabove i i573 i iK ithree irelaxation iprocesses iare iobserved idue ito igrain, igrain iboundary iand ielectrode icontributions iin isequence i(see iinset i iof ifigure3(a)). iThese irelaxation iprocesses iare ialready idis- icussed iin idetails ifor iBCT ibased imaterials itherefore icurrent iwork iis ilimited ito ishow ithe igrain iand igrain iboundary ipro- icess. iMoreover, iwe ihave ialso icalculated ithe idc iconductivity i(σ_{dc}) iof ibulk iand igrain iboundary ias ia ifunction iof itempera- itures iusing ithe ifitted ivalues iof iNyquist iplot ias:

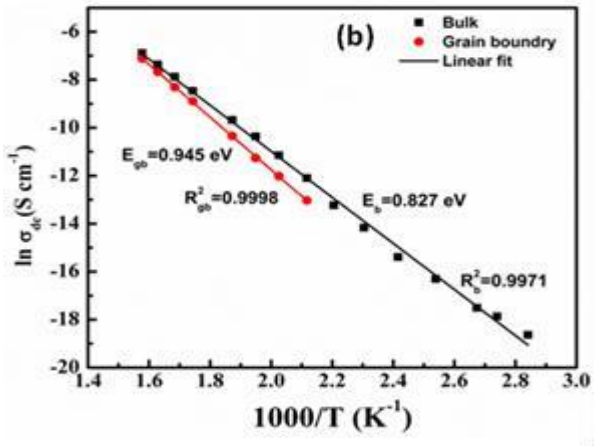

Fig.3. (b) DC conductivity

$$\sigma_{dc}=d/RA \quad (1)$$

where i*d* iand i i*A* iare ithickness iof ithe isample iand isurface iarea i iof ithe ielectrode, irespectively. iFigure i3(b) ishows iplots iof iσ_{dc} ifor ibulk iand igrain iboundary ias ia ifunction iof ithe iinverse i iof ithe itemperature. iIt iindicates ithat ithe ibulk iand igrain iboundary iσ_{dc} iincrease iwith itemperature.

The plots are fitted with the Arrhenius equation of conduction as follow:

grain boundary, respectively which are close agreement with that of oxygen vacancy conduction (~1 eV) in this kind of material system [9]. Hence, it can be said that the conductivity process is mostly governed by the oxygen vacancies in the BCT ceramics. In addition to oxygen vacancies, a small difference in grain and grain boundary activation energy

~0.12 eV indicates that a low potential barrier exists be- tween them. It can be concluded that both grain and grain boundary potential barrier tends to merge at higher tempera- ture. If temperature is further increases they can be inter- changed. However, present work is limited to show that two relaxation phenomena are presented in the material due to grain and grain boundary as generally observed in the ferroe- lectric ceramics.

Fig 4 presents measured pyroelectric coefficient in wide temperature range. Temperature invariant (300-380 K) pyroelectric coefficient was observed. A sharp peak at Curie transition was observed at 390 K which was also confirmed from dielectric data. The BCT ceramics sample was provid- ed external temperature (alternate heating and cooling) using an infrared bulb (Phillips 250W) by heating (ON) and cool- ing (OFF).

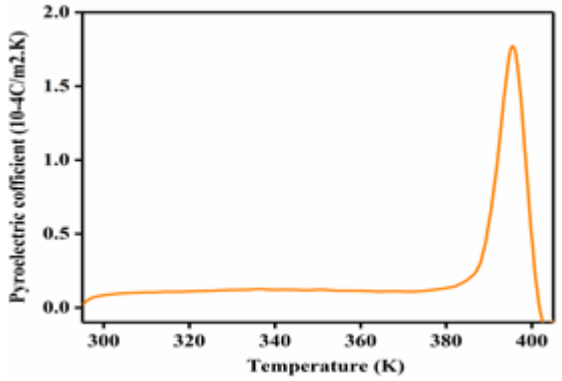

Fig. 4. Pyroelectric coefficient in wide temperature range

Figure 5 shows as pyroelectric experimental setup. It is not so accurate setup because sample may not be uniformly ex- posed for heating/ cooling. However, several authors have used such kind of setups and recorded results were more closed to real time situation [10-12].

$$\sigma_{dc}= \sigma_o \exp^{Ea/kBT} \quad (2)$$

where, E_a and σ_o are the activation energy and pre-exponential factor for *dc* conductivity. The activation

ener- gies are estimated as 0.827 eV and 0.945 eV for bulk and

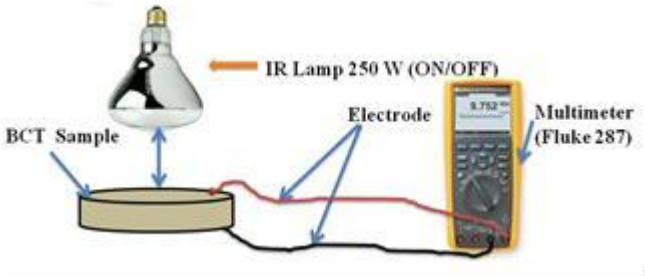

Fig. 5. Pyroelectric experimental setup

Fig 6 shows typically surface temperature profile of BCT sample for heating and cooling cycles. These trends in tem- perature have ripples which are due to alternating heating and cooling cycle. It is clear that pyroelectric output is de- pends upon temporal change in temperature and hence slopes of the temperature vs time plots govern pyroelectric output. It is to note that ideally temperature vs time plots should be periodic and temperature after each cycle as each cycle is the combination of heating and cooling processes.

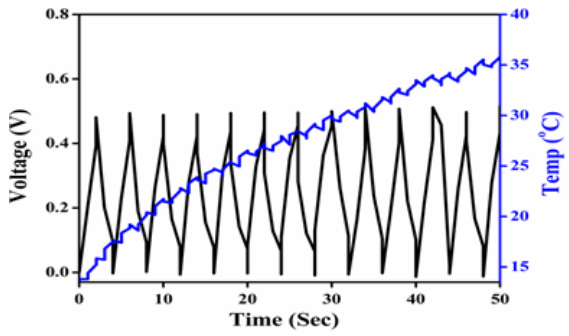

Fig.6. Surface temperature profile of BCT sample However in present experiments, one could observe increas- ing temperature trend. It is due to fact that for selected heat- ing/cooling cycle, sample is not able to dissipate heat during each cooling cycle. One can achieve initial temperature after each selected heating/cooling cycle only after implementa- tions forced cooling which has not been attempted in present article. In same figure, open circuit voltage is also shown. When the IR bulb switches on, it increases the temperature and create the thermal gradient with time. Due the thermal gradient, BCT ceramics generate the voltage across the elec- trode. When IR bulb switches off, it decreases the tempera- ture and creates the thermal gradient in opposite direction. At the switch off condition voltage start to decrease.

IV. CONCLUSION

$Ba_{0.9}Ca_{0.1}TiO_3$ was fabricated via solid state reaction route. Frequency independent dielectric behavior was ob- served upto 1MHz. Curie temperature was found to be ~390

Microstructural electrical characterization was further explored using Cole-Cole plot. Temperature independent pyroelectric coefficient was observed which has similar pat- tern as for dielectric constant versus temperature. BCT was

exposed to heating/cooling cycles in order to under- stand its behavior in real time application.

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Aesthetic Consciousness in Shiv K. Kumar's Poetry

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Abstract: When it comes to Indian English Poetry, Shiv K. Kumar is a prominent name to reckon with. His position among the stalwarts of Indian English poetry owes to his consistent outpouring of verses that began in 1970 from publication of his first collection of poems, Articulate Silences (1970), and continued till he breathed his last in the year 2017. In this span of 47 years, Kumar created poetic works such as Cobwebs in the Sun (1974), Subterfuges (1976), Woodpeckers (1979), Trapfalls in the Sky (1986), Woolgathering (1998), Thus Spake the Buddha (2002), Losing My Way: Poems (2008) and Which of my Selves Do you wish to Speak to?: Selected Poems (2011) Apart from his prolificity, it is the sheer quality and charm of Kumar's verses that sealed his reputation as a major Indian English poet, winning him honours such as Sahitya Akademi Award 1987 and Padma Bhushan (2001). Shiv K. Kumar's poems keep attracting readers for their tantalizing aesthetic consciousness; ingenuous style, and gratifying messages, the paper attempts to unravel and illustrate through textual analysis, employing insights from various theories of poetics.

Keywords: Indian English Poetry, Shiv. K. Kumar, Aesthetic Consciousness, theory of poetry

Aesthetic[1] consciousness may be understood as consciousness to art in terms of its effect or responses that it generates. In the context of poetry, it constitutes the elements that contain the aesthetic value [2] or beauty of poetic art.

Coleridge in *Biographia Literaria* chalks out four elements of good poetry; musicality (rhythm and rhyme), imagery / words modified by predominant passion, thoughts, and feelings. He also appreciates "aloofness of the poet's own feelings"; from those which he at once paints and analyses…"[3] Eliot also seems to prescribe objectivity of attitude in a poet when he stresses on an artist's need to escape from emotion and personality.[4]

I. A. Richards while addressing the question of "true places of the values of the experience (poetic)"[5] casts aside the study of imagery as they are "…the point at which two readings are most likely to differ".[6] He feels that "in the reading of poetry the thought due simply to the words, their sense it may be called comes first…."[7] In other words, Richards defines a poem as a group of words that evokes a particular experience that does not vary greatly when read by different sensitive readers. The experience of the readers counts crucially on the sequential arrangement of words. It is the meaning of the words that determine the success of rhyming and rhythm.

The views concerning poetic art expressed above may be summed up as indicating thoughts and emotions along with poetic language implying beauty of poetry.

Aesthetic Consciousness and Shiv K. Kumar's Poetry

Shiv K. Kumar defines poetry as "a skillfully structured artefact of both image and emotion, thought and feeling."[8] The view suggests the poet's awareness of poetry as a construct of the integration of intuition and art, vision and expression. The poet further elaborates: "… it is not language alone that makes a poem; it's the poet's perception, sensitivity and commitment to reality that lend beauty and power to his writing."[9]

Kumar's Poetic Vision

Shiv K. Kumar shows sensitivity and commitment to reality. The poet suggests that: "…it's only / through pain's eye that you can perceive truth." ('Bhishampitamah to Yudhister Dharamraj', ll.104-105, *Losing My Way*: *Poems*)). [10] This is why he refers to the aspects of human life such as birth; love; sex; marriage; aging and death as marked by suffering. The poet says: "There is pain at the thought of the misery of mankind. And through the yearnings I become a poet."[11] The poet's realisation that suffering underlies human existence is the source of his creativity and he believes that without a contemplation of suffering one can not understand the truth of life. In the poem 'Musing in a Park' (*Woolgathering*) [12]he observes:

> This place is a little universe
> not the Garden with one man
> and one woman— their movements
> monitored by the Big Brother
> whose omniscient eye wouldn't let them
> stray beyond the barbed enclosure (ll.18-23)

The "little universe" or "the garden", here, is representative of the society we inhibit. The lines show the poet's awareness of human life limited by moral, religious and social conditions denoted as "barbed enclosures". In the poem 'Returning Home' (*Subterfuges*) [13] the poet shows suffering due to discordance in marital life:

> We unlock the doors
> to antediluvian passages

cluttered with dented skulls The stalagmited silences
startle at our approaching shadows. (ll.1-6)

In the lines, the poet depicts husband wife relationship as marked by lack of emotional bond. "Passages" to the home "cluttered with dented skulls" signify the end of the relationship. The increasing detachment among them is indicated by the image "silence" and "shadow": "I always wanted to say. / But each time, / …, / you snapped me into muteness." (ll.12-15). Again in the poem 'Bedroom' (*Woolgathering*) the poet presents the sad end of the relationship: "Lying together in bed, though distanced / by daily wrangles, we've been engaged / since the first sunset / in a colloquy on love's doom." (ll.1-4).

In a 'Pet Shop for Puppies' (*Thus Spake the Buddha*) [14] the poet depicts the suffering of helpless puppies: "So many pairs of eyes, aching / for release from this orphanage." (ll.1-2) The description is marked by pathos. In the poem 'Putting an Old Sick Dog to Sleep' too the poet portrays the agony of a dying pet: "Tropical sun. Its spears, dipped in fire, / penetrating through the neem tree / in whose shade he lay gasping." (ll.1-3) One notes that the poet's depiction of suffering is both aesthetic and thought provoking. One also finds that pain is shown as resulting from the conflict between one's real nature and the contrived one. In other words, hypocrisy and sophistication are the root cause of pain and result from a flawed perspective to life with too much emphasis on good sense and rationality. Kumar approves of the power of "free act" and "intuition" rather than "reason" and "rationality" [15] that always imply contradiction: "The way / to see is to go blind, and to fly is to / crawl on your belly" ('Bhishampitamah to Yudhister Dharamraj', ll. 108-110). The poet, therefore, takes to expose the paradox of human rationale:

Self-control is the force
that keeps the sky's circus-tent
staid above the multitude.
Remember, my son, (Poem 'VII' Broken Column, ll. 25-28, *Woodpeckers*) [16]

The lines embody preaching of the value of self restraint by a father to his son. However, one notices that the son defies the ideals and gives up to temptation symbolised as "aroma of deodar": "But as I emerge from the netherworld /an aroma of deodar wells up / and a cluster of mynas hurls / defiance at the truth." (ll. 37-40)

To portray the contradicting and complex nature of human beings and life the poet amalgamates various experiences; personal, social, religious and erotic in a manner that each seems overlapping, complicating and explaining the other. In doing so the poet adopts a style adequate to his vision. He chooses images and words from vast and varied fields and puts them in scrupulous combination through which meaning can be sweated out slowly. His view regarding choice of words is a fine clue to his poetic style:

Words are straws picked up
by a sparrow from everywhere—
rose-garden, roadside, even dustbin.
But if beak and eye have a vision,
('Birth of a Poem', ll.11-17, *Losing My Way: Poems*)

In the lines, the poet suggests the importance of vision as key to the power of art as it is the vision that adds novel significance to the words chosen from varied fields.

Poetic Diction

Kumar chooses words from fields as diverse as, philosophy, literature, erotica, mathematics, biology, and medical science including names of diseases, geographical landforms, religion and others. He employs the words in newer contexts for special effects. For example, in the poem 'Suicide' the poet presents the broken self of a deserted individual in architectural terms; the depressed persona feels smothered like a "pillar" disintegrating into "cement and mortar" (*Articulate Silences*, p. 9).[17] In the poem 'Coromandel Beach' the poet outlines the ebb and flow of the waves in geometrical terms: "egg-beaten foam advance / in parabolas, ellipses, arcs" (ll. 3-4). In the poem 'Meeting an Old Friend after a Long Time' the persona, as he meets an old female friend, is reminded of the school days when the two flirted as "…teacher was wrestling / with binomial theorem on the blackboard" (ll. 8-9). The use of mathematical term in the lines not only presents the ironic picture of the teacher but also suggests the teacher's difficulty in handling the pair. In the poem 'My Mother's Death Anniversary', the speaker anticipates death and measures it with passage of time: "the clock-beat leaps / beyond the ECG's longitude" (ll. 4-5). Similarly in many other poems the poet uses biological and medicinal terms such as "postmortem" (*Woodpeckers*, p. 27) "anaesthesia", "stitches" (*Thus Spake the Buddha*, p. 14), "kaleidoscope" (p.57). The poet also applies terms specific to the filed of geography such as "hemisphere" (*Woolgathering*, p.15), "gorge" (*Subterfuges*, p.16), "dark continent" (*Thus Spake the Buddha*, p. 13), "icicles" (p.33). Besides, his verses are also enriched with references to geographical landforms; "Hudson" (*Cobwebs in the Sun*, p.22), "Volga", "Sahara" (*Woodpeckers*, p.5), "Bay of Bengal" (p.3); and distinguished spot; "Eiffel Tower" (*Articulate Silences*, p. 9), "Tussaud's" (*Trapfalls in the Sky*, p.60), "Gateway of India" (*Woodpeckers*, p.14), "Royal Albert Hall" (*Thus Spake the Buddha*, p.1), "Gulf Coast" (*Woolgathering*, p.9)etc. Apart from these, one also finds a predilection for indigenous terms such as "soma" (*Woolgathering*, p. 35), "*chador*" (*Losing My Way*: *Poems*, p.17), "nadam" (p.10), "*chavsar*" (p.32) "*damyata*" (*Subterfuges*, p.21), "Yama" (*Woolgathering*, p.2) "sastras" (p.24), "Om" (p.13), "neti" (*Thus Spake the Buddha*, p. 44) and others.

This heterogeneous vocabulary seems very much a part of the poet's thought process. The use of words from various fields testifies to his artistic skill and powerful imagination and remains a key factor of the aesthetic effect of the poetry apart from attributing intellectual appeal to them.

Further, Kumar's diction is marked by the abundance of formal words, for example, for the word lawn cart the poet uses "wheelbarrow" (*Subterfuges*, p.19) and for goggles "Polaroid" (p.23). Overall, such words create greater degree of unintelligibility which is further reinforced with the occasional use of foreign expressions such as "Le flux ininterrompu" (*Thus Spake the Buddha*, p.17), "Quo vadis" (p.30). The poet at times lapses into antiquated vocabulary as well. He deploys archaic words such as "genesis" (*Articulate* Silences, p.16) "lingua" (*Woolgathering*, p. 3), "spake", (*Thus Spake the Buddha*, p. 5) "mendicants" (p.56) etc. The word "spake" in the title of the poem 'Thus Spake the Buddha' is used to introduce the ideals of Buddha but the form of the word symbolises the outdatedness of the Buddhist ideals in the present context and evokes irony.

Most of the words in Kumar's verses are multi-syllabic which breed a sort of magnitude, seriousness, and heaviness in the poems. Also, the employment of such vocabulary helps the poet avoid "lapsing into easy communication"[18] and makes his work "highly commendable." However, the choice of words in Kumar is scarcely without purpose. Rather, his poetic diction functions at all the four levels: they sound, articulate, mean, express feelings and evoke images. [19]

Rhythm and Sound

The poetry of Kumar exhibits the poet's sensitivity to sounds. The following poem illustrates the point:

> The sinister eye has chosen me
> for desecration.
> The hooked beak pecks
> into my nascent guilt.
> Dismembered kidneys, tendons
> and lungs quiver on the postmortem
> table in mute vulnerability.
>
> Like a blue-blooded virgin raped
> by a larrikin, I totter
> on the pavement— ('At the Customs Counter', ll. 1-10, *Woodpeckers*)

Here one notices that words have been carefully chosen with a keen sense of sound. The poet skillfully employs the device of alliteration that occurs in almost every line. In the first line, for instance, in the words, "hooked" "beak" and "peck" /k/ sound is repeated; in the fourth line /n/ sound occurs twice in "into" and "nascent; words "dismembered", " kidney" and "tendons" are marked by the repetition of /d/ sound. A. K. Srivastava finds words in Kumar as "dictated by a subtle ear for euphony".[20] However, one notices that sounds in Kumar has far greater a purpose than merely creating euphonic effect; It is hugely suggestive of sense or the attitude in a particular context. For an instance, /d/ and /t/ sound in the lines suggests action implied in the rude questioning against the speaker at the custom counter. The sound /b/, which is an explosive sound, suggests quickness, movement, triviality and scorn[21] that mark the situation in the poem.

Words as symbols

Shiv K. Kumar often uses words symbolically; "cleansed" and, "baptized" before they are "strung into verse" (*Losing My Way*: *Poems*, p. 55). An instance is the use of the word "rampart" which means an embankment built around a castle for defense purpose". In the poem 'I Was Old Before My Birth' (*Thus Spake the Buddha*) the word has been used for womb. The comparison is unusual; however, it strikes the reader with its suitability. One agrees that Kumar's "… words strike finality, and show immediacy, depth and eloquence which are flashes of happily tuned intellect."[22] Like in the poem everywhere in Kumar, words are integrated to the images and also act as images.

Imagery: Essence of Kumar's Aesthetic Consciousness

Imagistic style is the core of Kumar's aesthetics. The poet's style of creating imagery is unique and develops from a distinct ability to combine picturesque description, striking analogies, and allusion of various places, myths, and incidents. The first effect Kumar's verses is that, they make us see. An example is the description of Eve in the poem 'Birth of Eve'(*Trapfalls in the Sky*)[23]: "a bosom with two moons, / shoulders like mute doves, / lips like two petals peeled of a goldcup," (ll.6-8). Further, in the poem 'Dal Lake: Srinagar' the poet creates pictorial effect: "The sunlight now caresses the camel –caravan / of hilltops, their necks drooping, / their humps bobbing up and down / like the cardiograph of some stout heart." (ll.16-19) The lines exemplify the vivid effect produced as a result of the poet's employment of concrete images even for the abstract ideas. The poet, for example, imagines "Body's appetite" as "crocodile's belly" that can "...hold rock, metal / and a virgin's thigh." ('Thus Spake the Buddha', ll.6-7) "Depression" is seen as "some ominous tidal wave / that hits a lone island." ('Depression', ll. 2-3) In 'Eunuchs' the poet depicts eunuch as "Strange creatures— sphinxed, / forged out of fire and water—" (ll.9-10). Imagery is said to be the primary asset of his writing.

Kumar also uses auditory and visual images to dramatise and crystallise the abstract. Some examples of auditory images are: "We spout chants from Gita" (*Woodpeckers*, p. 4), "Incessant din of beggars and chants" (p.19), "Knock, knock,

knock!"(*Woolgathering*, p.1), "pee-hoo, pee-hoo," (p.3), "Thump, thrush, swish" (*Thus Spake the Buddha*, p. 26).

The poet often comes up with startling comparisons in the manner of the metaphysical poets. To depict a picture of penury of India, Kumar has to just forward an analogy: "a beggar's sunken belly / the map of India" (Broken Column 'II', ll. 16-17). Other examples of sensational analogies occur as the poet presents death as "electric chair" that is "neutral" to all; anger to him appears as "a feeble tremor / on the Richter scale" ('Anger', ll.1-2, *Thus Spake the Buddha*); striking balance in life is like "equipoise of a call-girl…". In the poem 'Mango Grove' mangoes are depicted as "clusters of virgin breasts" (p.20). Further, "the mirror" is considered as "a spy." (*Trapfalls in the Sky*, p.18) This way his images divulge what the artist tries to conceal.

In the poem 'Images' (*Articulate Silences*) Kumar talks about two kinds of images: "Images drafted into action / are always dodgers, / snarling restively/ like circus lions." (ll.1-4). The poet implies that the images which are consciously executed may prove deceptive and add to complication. However, the images "… that come down / epiphanically are / like hail on a / placid summer afternoon, / from cumulonimbus clouds" (ll.9-12). By implication, the flow of imagery in a poetic mind is either automatic or forced; however, the poet makes it evident that the former has greater aesthetic effect. In his poems one finds instances of the use of both kinds of images. In the following lines the poet depicts an ebb and flow of sea tide. The images appear to be contrived and contain intellectual appeal: "Clusters of blank eyes /caught in ringlets of sizzling / egg-beaten foam advance / in parabolas, ellipses, arcs, / ('Coromandel Beach', p. 1-6). However, in another poem the poet presents a beautiful and young nun as "a swan on mute waters" (*Woodpeckers*, p. 36). Here, the choice of images strike with freshness and aptness.

Scholarly Allusions

The poet shows expertise in his employment of complex imagery. The projection of "desire" in the poem 'Thus Spake the Buddha' is a suitable example in this regard: "Desire— an unbridled stallion, / mane incensed like Medusa's hair, / hooves sparking on a cobbled cross- / road, signaling restraint." (ll.1-4). Here, the poet depicts desire through the image of "unbridled stallion" suggesting that desire is uncontrollable. The suggestion is further layered with the reference of "Medusa's hair" implying the intensity of desire and its destructiveness. Some other examples of allusions in Kumar are "Noah's ark" (*Woolgathering*, p. 5), "Pharaoh of Hadad" (*Thus Spake the Buddha*, p. 3) and "Emmaus" (*Woodpeckers*, p. 22).

One finds that the presentation of ideas in association to mythical references and allusions in Kumar's verses appeal; however, it requires considerable literary and intellectual awareness on the part of the reader. Kumar's allusions generally succeed because of they portray "mix of events." [24] with outstanding evocativeness and freshness. The poet also creates place specific imagery as; "Mississippi-long hair" (*Cobwebs in the Sun*, p. 4)[25,] "Basra pearls" (*Woolgathering*, p. 7), "Chinese house of dreams" (*Thus Spake the Buddha*, p. 13) etc. Talking about Kumar's imagery Sachidanand Mohanty opines:

Images and metaphors, sharp and corrosive, collide and coalesce. Insights come in a flash of illumination, somewhat like the metaphysical conceits. By bringing together diverse ideas, the poet sets up an irony of contrasts. "These ideas," … "give rise to a multiplicity of vision."[26]

Apart from the poet's dropping of myths one also encounters references to places, cities, and geographical landforms. This reflects the poet's "cosmopolitan spirit" [27] and establishes his skills in using imagery is peerless.[28]

(b)Imagery of Decay

With his use of imagery of decay Shiv K. Kumar underscores his presentation and attitude to the hardships and ugliness of life. In the poem Broken Column 'XI', for example, the husband expresses his contempt to his wife by projecting her as "a fungal seed" that "breed(s) hydras" (*Woodpeckers*, p. 10); of himself the speaker feels as "a snail carrying stoically its burden of darkness." The images reveal the breach in the conjugal relationship. The lepers in the poem 'Mother Teresa feeds her Lepers at her Home for the Destitute, Calcutta' experience "The air seethes with worms." (*Trapfalls in the Sky*, p.13). In the poem Broken Column 'VII' (*Woodpeckers*), one finds a priest's projection of a woman's body as "A sewer runs through the dark / foliage…" (ll.31-32). Further, the poet presents crematorium at river side where he finds "A skull rolls out of a drainhole" (p.19). One also comes across; "murky evening", "alleyways" (*Thus Spake the Buddha*, p.3) and "niggardly stream and a fetid drain." (*Woolgathering*, p. 13)

(c) Erotic Imagery

Erotic imagery is another feature of Shiv K. Kumar's aesthetics. Images like "a frank swivel of the hips" (*Woodpeckers*, p.30) "…mouth" holding "scarlet throat" (*Trapfalls in the Sky*, p. 21), "…doves of … breasts" (p.55), "swing in bed", "…nectar" from "navel", "… hips, thighs and calves sway" (p.55) "to suck" and "mate" (p.55) are evocative. Phrases such as "taut nipples"(*Cobwebs in the Sun*, p.7), "leery eyes" (p.32), "forespent thighs" (*Subterfuges*, p. 27), "…riotous sea of navels, breasts and lips" (*Subterfuges*, p. 28), "supple breasts" (*Woodpeckers*, p. 22), "wanton eyelashes upon (…) cheeks", "impetuous osculation" (*Articulate Silences*, p. 13), "flourishing (…) maxi breasts"(p. 27),

"Bridge of Sighs" also add to the charm of his poems and arouse the reader both sensuously and sensually.

Besides, in his poems many asexual objects occur with erotic connotations. Images such as "the inner shrine", "door", "the oyster's silver gullet" (*Woodpeckers*, p. 22), "the meek earth" (p.37), "back- yard" (*Trapfalls of the Sky*, p. 21) are indicative of female genitals / body whereas that of the "key" (p.18) and "horns" (p.21) are phallic symbols enhancing suggestiveness of the poems.

Kumar also uses animal imagery such as "Arabian horses", "riderless horses" (*Cobwebs in the Sun*, p.13), "all the horses" (*Subterfuges*, p.36), "Giraffe" (*Cobwebs in the Sun*, p.13), "doves" (p.46), "rhino" (*Woodpeckers*, p. 22), "tigers" (*Trapfalls in the Sky*, p. 21), "bull" and "mute doves" (p.71) effectively in erotic contexts.

The display of woman's body in terms of nature imagery goes well with the poet's poetics of implicitness. His depiction of bosom as "the two moons" (*Trapfalls in the Sky*, p. *71*); "two white moons" (*Cobwebs in the Sun*, p. 30), "lips" as "two petals" (*Trapfalls in the Sky*, p. 71) shoulders as "mute doves" are not only adequate but also picturesque and striking.

B. K. Das finds sex imagery in Kumar's verses creating a transcendental effect and a "hint of the possibility of mystical union with the ultimate through it." [29] The idea, nevertheless, can be said to have only partial validity; it is true that sex imagery possesses a universal appeal, however, in Kumar it does not work to suggest anything more than a possibility of a sumptuous intimacy between human beings. Sex imagery used in the context of the issues related to sexuality is often only suggestive. However, the poet uses explicit sexual expressions and images when he desires a cruel revelation of human nature and society. The poet, thus, presents a balanced use of explicit and implicit sex imagery and creates appeals of shock and surprise. The artistic use of images, further, helps the poet to evoke pity, satire, humour and irony.

Irony

Irony is ubiquitous in Kumar's verses. It is one of the principal features of his poetry. The poet is ironical to everything that he looks at. This sense of irony originates from an acute awareness of the fact of life and its situations as essentially unpredictable and paradoxical. The poet realises that hypocrisy marks each level of human life and behaviour, can be exposed only by means of an ironic outlook. The poet admits: "Irony (…) is the only way to see life in all clarity….It is only through irony the artist can see through the chinks…." [30]

An example is poem 'IV' of 'Broken Column' (*Woodpeckers*) where the speaker projects the contradiction between assumed and actual with reference to the *Gita*:

'Feed not thy desire
on objects of sense.
But like a tortoise
folding up its limbs within the shell
withdraw into supreme wisdom.' (ll. 4-8)

The lines appear highly ironic as they parody the idea of restraint. Here, irony is directed at the father who highlights the value of restraint with the image of "tortoise" and inadvertently projecting restraint as an excuse to withdrawal and inaction. The phrase "supreme wisdom" does not go with the word "withdraw" and produces irony. One finds choice of words and imagery playing a crucial role in creating the ironic effect. The poet mocks at the unnecessary emphasis on the ideals of restraint having sparse practical following as children succumb to wanton imagination soon after the father finishes his counsel on restraint: "A puff of deodar rustles / through a girl's skirt / and two tender legs / gyrate the air into fuzzy yearnings." (ll. 9-12) One finds that irony is inherent in the poet's perception; Kumar agrees that "…irony as a mode of perception is there" [31] in all his poems.

Another example where the poet debunks intellectualism, pragmatism and religious posturing with the device of irony occurs in the poem, 'On Reading Dostoevsky's 'Notes from Underground.' In the poem a priest is shown promising divinity to the persona and motivates her to renounce the practice of prostitution, subsequently, however, he indulges in an utter pursuit for the gratification of physical urges. The lady realises the discrepancy and protests against the advances of the priest in an ironical manner:

"No further, sir, lest I stumble into a manhole" (l.37)
…
… you promised
me the light on Mount Sinai.
(*Sighs again*) Never again shall I
swallow the scriptures….Time to
return to my drainpipe—
cold, dust-layered, but safer. (ll. 45-50)

Here, irony lies in the priest's behaviour which contradicts his own words. Irony is sustained in Kumar with devices of dramatisation, comparison and contrast, allusions and exaggeration. In the poem 'A Stray Bitch Abandons her Litter at Dusk' (*Woolgathering*), the observer finds a bitch stealing: "…away like the Buddha / to explore other worlds." (ll. 12-13). Here, irony on the Buddhist ideal of renunciation becomes evident with allusion to Buddha parallel to a bitch.

Humour

Humour is another marked feature of Kumar's verses. Often invariably integrated to irony, it makes his verses more

amusive. The poem 'Lord Krishna to Arjuna' implies humour in its playful retelling of Krishna's explanation to Arjuna:

> That's man's ultimate frailty , O Warrior,
> to know what lies beyond the horizon,
> to know the end even before the beginning,
> to know if seed would sprout
> into a leaf, and the leaf into a bud—
> if a traveller would reach his destination
> before sunset. No, you'd never know
> what lies ahead because I hold this card
> close to my chest. Or, to put it differently,
> the future lies in a sealed capsule, under the ocean's
> bed, inaccessible to man. Though I know it all, (ll.70-80)

The wordiness and boastfulness in the lines evokes humour.

Dramatic Quality

Humour and irony in Kumar are integral to a dramatised context. In the poem 'On Reading Dostoevsky's 'Notes from Underground' (*Losing My Way*: *Poems*) there is a dialogue between an underground man and Lisa, seemingly a prostitute. The underground man claims a deep spiritual predilection and promises the girl enlightenment in a high flown language: "In each soul there are corridors— / dark, wet, narrow and circuitous. / But at every curve stands a Moses / to lead one to Mount Sinai." (ll.1-4). The depiction of soul is funny and so is the assumption that a Moses stands at every curve. The girl seems impressed of the priest's piousness: "Is it your voice, sir, or a seraphim's beckoning / me to a land where cherubs dance / amidst flower-beds, and water- / snakes sing to some angel in the cloud?" (19-22) However, the underground man soon succumbs to the temptation to have the girl. The revelation makes the entire conversation amusingly ironical as mere verbosity. Other samples are 'A Letter from New York' (*Subterfuges*), 'A Pregnant Woman in the Queue' (*Woodpeckers*), 'An Indian Mother's Advice to her Daughter before Marriage' (*Trapfalls in the Sky*), 'Bhisampitamah to Yudhister Dharmaraj'(*Thus Spake the Buddha*)) etc.

The poet begins such poems dramatically with expressions such as "Now hear me first" (*Woodpeckers* 22). Also he employs the technique of rhetoric questions. Some examples are "…When I am / immanent in both the axe and the tree's / bare trunk, / then who is the wood- / cutter?..." ('Lord Krishna to Arjuna', 16-19) Other examples may be found in the poems such as 'Thanksgiving', 'Young Maidservant' (*Woodpeckers*), and 'To a Young Beautiful Woman Aspiring to be a Poet' (*Woolgathering*). Use of hyphen and ellipses also helps the poet to switch from one poetic idea to the other.

The poet implies uncertainty, paradox, and irony as central elements of life as he invests a common incident, situation, emotion or feeling with multiple associations and novel images that at once shock, surprise, and startle. However, to a common reader these poems appear hard nuts to crack as their nature is essentially academic and literary. His dwelling on "wider range of themes and diverse images"[32] tends to earn more complexity for his poems. However, one finds that the complexity contains beauty and originality of Kumar's poetry. Further, with the style Kumar plays a dual role, on the one hand he depicts the complexities of life and on the other he disapproves the same.

For Kumar poems are concerned with "intuited truth not with what is discursively explicable by the reason." [33] The mechanical can be measured in its own way, but in him one only finds aesthetic related to approximations. He presents ideas as "intensive manifold" (144). He reflects an attitude that is areligious, amoral, and apolitical and essentially humanitarian.

To sum up, to Shiv K. Kumar, dynamism and depth are integral to the beauty of life and art. His poetic ethos and artistic techniques testify to the dynamism with an open engagement with pertinent matters of life and society by means of riveting words, phrases, and images. The charm of his verses owes to the complete concordance between the thinking mind of the poet with his performing mind.

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Bitcoin Price Prediction Using Twitter Sentiment Analysis with Notification System

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I. INTRODUCTION

A cryptocurrency is a word that describes a particular type of currency that is digitally present and that can be used to buy services and goods, it is brought into useful means by an online ledger. The thing that sets Bitcoin apart from any other currency in the world is that Bitcoin is not issued by any bank or governed or even any other financial institution. It is a very volatile market that makes Bitcoin investments rare and full of risks. There is no authentic or viable information regarding Bitcoin and other crypto currencies. Here we intend to forecast the future value of Bitcoin in USD by using various advanced machine learning algorithms. We have used two techniques to predict the future prices of Bitcoin those are recurrent neural networks (RNNs) and long short-term memory (LSTM). In addition to this we have also added the sentiment analysis of tweets from twitter which shows the users and the market sentiment for Bitcoin i.e. either it is categorized as positive or negative.

II. LITERATURE SURVEY

In [1] Niels Degrandea, Vytautas Karaleviciusa, Jochen De Weerdt conducted a research in which they aimed to find the correlation of sentiment analysis while predicting the interday Bitcoin price movement. They used lexicon based sentiment analysis for their research. They have claimed that the sentiment of people is highly responsible for the fluctuations in the prices of Bitcoin and conducting a sentiment analysis and using its finding while making interday trades will yield benefits to the investor since this analysis can predict the volatility of the Bitcoin market.

They concluded their research by claiming to have found a direct correlation between the sentiment of the investors and the fluctuations noticed in the Bitcoin market.

In [2] Dibakar Raj Pant, Prasanga Neupane, Anuj Poudel, Anup Kumar Pokhrel, Bishnu Kumar Lama have used recurrent neural networks for predicting the future Bitcoin prices and they have integrated twitter sentiment analysis into this to make their finding more accurate. They conducted a research in which they gathered tweets related to Bitcoin from different sources and classified them into positive or negative and they integrated this sentiment analysis of tweets into their machine learning model and tried to find out a better prediction of the future prices. They have claimed to have generated an accuracy of 77.62 % while making the predictions.

In [3] Franco Valencia with his team used some common ML tools and the vast available social media datasets in forecasting the value of multiple crypto-currencies. They compared the utilization of multiple techniques such as Neural Networks, Support Vector Machines, Random Forest with addition to the Twitter and market dataset available. The result was that neural network worked far better than any other technique.

In [4] S M Rajua and Ali Mohammad Tarifb worked on determining the predictability of the value direction of Bitcoin. They used sentimental analysis and the data was backed from Twitter and Reddit. They worked on RNN with LSTM due to the difficulties faced by them in ARIMA. They similarly analysed the co-relation between the movement of price of the crypto-currency and the sentiments. The RSME they received was 198.4 for LSTM and 209.2 for ARIMA.

In [5] Zeynep Hilal Kilimci has utilized deep learning models namely ‘recurrent neural networks’ (RNNs), ‘long-short term memory networks’ (LSTMs), and ‘convolutional neural networks’ (CNNs) to predict the direction of Bitcoin. To make his predictions more accurate he integrated sentiment analysis into his study and claimed that sentiment analysis of tweets from twitter and other social media platforms will result in providing accurate results since these can have adverse impact on the direction of the Bitcoin market. To get further precise results he utilized word embedding models into his research and claimed that his word embedding model was able to generate a stunning accuracy of 89.13% for predicting the direction of the market.

In [6] Anirudha Datta and his peers used various machine learning models such as Simple Neural Network (NN), LSTM with dropout, GRU, GRU with a recurrent dropout and GRU with dropout and recurrent dropout for their study to predict Bitcoin prices. In their study they found that the LSTM models performed better than the simple NN architecture due to memory retention capabilities.Also the GRU model with a recurrent dropout had an RMSE of 0.014 on the training set

and 0.017 on the test set. So in conclusion, the RNN-GRU model performed better than LSTM.

In [7] Patrick Jaquart, David Dann and Chirstof Weinhardt have analyzed the Bitcoin market namely its predictability across a range of 1-60 minutes. They tested different machine learning models to predict the Bitcoin price and its associated changes and while doing so they utilized different features like sentiment and technical features like blockchain based features that can affect the volatility of the market. They found out in their research that technical features were the most useful ones in predicting the price. They also found out that the short term trading strategy didn't prove to be fruitful since the transaction costs resulted in nullifying the returns generated and hence they claimed that a long term trading strategy is optimal.

In [8] Luisanna Cocco, Roberto Tonelli and Michele Marchesi have used different machine learning based frameworks to make predictions on Bitcoin future prices. They have mentioned different methods and frameworks that they used while making these predictions and also produced and mentioned the respective results that they were able to generate while conducting their research. They have claimed that the Bayesian Neural Network was seen to perform the best with its error produced while computing being in accordance with the recent literature works.

In [9] Mrs. Vaidehi with her students worked on a paper where they used the LSTM with RNN to forecast the value of Bitcoin. They initially defined the economics of Bitcoin, followed by defining a clear dataset which included stock market indices, sentiments. They worked on Bitcoin pricing prediction ranging from 30 to 60 days in future.

In [10] Alvin Ho and his team explained the complete working of the MSTM and linear regressing model to predict the price of the Bitcoin. As Bitcoin is becoming popular it has made it quite difficult to predict its price so with the help of ML algorithm and Artificial Neural Model, they tested this model. They found ML model to be 99.87% accurate and the LSTM model showed very less error of 0.08%. They worked on a small GUI that allows user to input High, Low ad Open features and they it forecasts the price.

In [11] M. Kabir Hassan and his members worked on an automated system of web scrapping using Rstudio that collected over 15,000 tweets with the term cryptocurrency. Their sentimental analysis was done suing machine learning to test the emotions. They over looked the complete ML algorithm which gave them a score of 53,077 from the data of fifteen thousand tweets, which broadly categorized the emotions in 8 different aspects. They used this data and score to describe the social implications of various cryptocurrencies.

In [12] U Raghvendra Swamy and his peers used Linear Regression, Lasso Regression and Decision Tree algorithm to find the bitcoin prices. According to them the Lasso Regression model had an accuracy of 98.6% and LInear Regression had 98.7%. They forecasted the result using the decision tree and linear regression in which the decision tree gave the accuracy of 97.5% and the linear regression had 97.7% accuracy.

In [13] Sara Abdali and Ben Hoskins did a study in which they tried to predict the bitcoin prices using the tweets from Twitter. They used SVM, Naive Bayes and BERT models to predict bitcoin prices. In their study they found that Naive Bayes as well as BERT models had an accuracy of 59% whereas SVM model had an accuracy of 63% which was highest among all the models.

In [14] Siripurapu Mounika, Podila Anjali Yadav, Tulluru Yashaswi, Chalimadugu Yamini Krishna, Dr. Vuyyuru Krishna Reddy used CNN and LSTM models to predict the prices of Bitcoin. Their study results suggested that the Convolutional Neural Network(CNN) got better accuracy than the Long Short Term Memory(LSTM) model. They showed the price projection for five days which can be increased to any number of days to show optimal results.

In [15] Abhirami P Kumar and Shoby Sunny attempted to predict the price of bitcoin using three machine learning models which are ARIMA, Facebook Prophet and XGBoost. They pre-processed the information and applied these models for time series forecasting. The Facebook Prophet model performed the best with MAPE of 3.2% and R2 of 0.99 whereas ARIMA had MAPE of 14.3% and R2 of 0.48 and XGBoost had MAPE of 17.4% and R2 of 0.155.

III. FUTURE PLANS

In the upcoming future we intend to improve on our machine learning model by using more complex algorithms so that we can make even further accurate predictions and achieve better forecasts of future prices.

IV. CONCLUSION

We also intend to upscale our project so that it we can make future price predictions not just for Bitcoin (BTC) but for all the major Cryptocurrencies like Ethereum(ETH), Dogecoin(DOGE), Litecoin (LTC), Cardano (ADA) etc. thus helping the investors to invest in all the possible avenues which can give them high return on investments.

We also intend to bring an advancement to our project by conducting a sentiment analysis on datasets from cryptocurrency insight providers, news websites and major social media platforms other than twitter to achieve better sentiment analysis of the mindset of the investors.

Achieving the forementioned plans will result in the creation of an even better and highly useful project which will prove to be beneficial for investors all around the world.

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Fuzzy Controlled AGC of Two-Area Interconnected Thermal Power System with SMES

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Abstract: This paper proposes Fuzzy gain scheduled PID (FGSPID) based Automatic Generation Control of interconnected thermal power systems with Generation constraint constant (GRC). Energy sources like Super Conducting Magnetic Energy Storage System (SMES) help in improving dynamic performances of power system. Initially, FGSPID is designed for AGC of two area interconnected thermal power systems with GRC. Each control area is of equal rating in thermal power system. Afterwards, SMES is applied and FGSPID is explored for power systems with non-linearity. Moreover, superiority of SMES is demonstrated by comparing the results of the FGSPID controlled power system with / without SMES in two area power system incorporating non linearity. Performance of power system is demonstrated in terms of transient response and settling and rise time value at 1% step load perturbation. However, in case of nonlinearity, the sluggishness is minimized considerably in interconnected power system incorporating SMES.

Keywords: Thermal Power System, SMES, GRC, Fuzzy controller, AGC .

I. INTRODUCTION

In order to provide reliable electric power with acceptable quality, AGC is critical in power system [1]. For better performance of electrical equipment, it is necessary to provide good quality of electric power by generators. We have to maintain the balance between active and reactive power during the transportation of electricity which results in proper balance in generation and utilization. These two balances correspond to two equilibrium values of frequency and voltage in power system. If there is improper balance between these two equilibrium point, then it will results in bad quality of electric power [2-4]. Generally in a power system, frequency depends on active power and voltage depends on reactive power. So, it is necessary to control the load frequency in AGC strategy. The major purposes of AGC strategy can be summarized as maintaining frequency at transient power load and regulation of tie-line power exchange between interconnected power systems. Various control techniques, controllers, use of auxiliary system and problems like load dispatch problems [5-7] are studied for four decades by the researchers to tackle ambiguities in the power system models and variations. Load frequency control in single area power system was explored by Bhatti [8]. Fast acting energy devices, such as SMES, battery energy sources (BES), capacitive energy sources (CES) currently deliver energy to the K.E., which decreases oscillation and deviation [9-19]. SMES has evolved as one of the most efficient energy storage technologies for the AGC strategy.

Effect of SMES in an interconnected multi–area power system has been studied in [13-19]. Different artificial technique has been used for AGC with nonlinearity [20]. Fuzzy controlled PID controller for interconnected power system has been simulated [21]. Very less work on the use of SMES to Fuzzy controlled AGC of interconnected power system with nonlinearity has been done.

The objective of this paper is to :

a) Design FGSPID controller for AGC of two-area interconnected thermal power systems including non-linearity like Generation constraint constant (GRC) at 1% step perturbation in control area 1.

b) Explore Fuzzy gain scheduled PID controller (FGSPID) for AGC of interconnected power system including non linearity like Generation constraint constant (GRC) after incorporating SMES at 1% step perturbation in control area 1.

c) Analyze the performance in terms of dynamic responses produced by assimilation of SMES in AGC of two-area interconnected power system at 1% step perturbation.

The remaining paper is chronicled in the following headings. Next section, investigate about the considered power system. Section 3 defines the fuzzy rules for designing of FGSPID. Section 4 involves modeling of super conducting magnetic energy sources. Results and simulation of the present work are accumulated in Section 5. The conclusion is presented in section 6.

II. POWER SYSTEM UNDER CONSIDERATION

The investigated power system is a two-area thermal power system with or without SMES. As illustrated in Fig. 1, the control areas of the proposed power system model are initially connected by tie lines. The transfer function block diagram of

the investigated power system without / with SMES is depicted in Fig.2 and Fig. 3 respectively for simulation purposes. Fuzzy gain scheduled PID controller for power system is presented in Fig.4. Thyristor controlled SMES diagram is depicted in Fig.5 and it's block diagram is given in Fig.6. Investigation of power system is accomplished by considering non linearity as GRC in a turbine as given in [20]. Parameters of power system and SMES are taken from [18, 21] and given in Annexure A.

The state space equation for generalized system of two area thermal power system can be written as:

$$\dot{x} = Ax\ BU + \Gamma P_D \quad (1)$$

$$Y = Cx \quad (2)$$

Where, A, B, C and Γ are real constant matrices of compatible dimensions.
System State vector:

$$[x]^T = [\Delta F_1\ \Delta P_{G1}\ \Delta X_{E1}\ \Delta F_2\ \Delta P_{G2}\ \Delta X_{E2}\ \Delta P_{tie}\ \int ACE_1\ \int ACE_2] \quad (3)$$

System Control vector

$$[U]^T = [\Delta P_{c1}\ \Delta P_{c2}] \quad (4)$$

System Disturbance vector

$$[\Delta P_L]^T = [\Delta P_{L1}\ \Delta P_{L2}] \quad (5)$$

Where, the symbols are defined in Nomenclature.

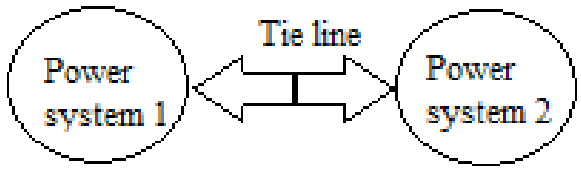


Fig. 1. Block diagram of power system

$$ACE_i = b_i\ \Delta F_i(s) + \Delta P_{tie}(s) \quad (6)$$

Where, ACE is area control error and considered as e is defined in Fig. 4. And i= 1 to 2 for area 1, area 2

III. FUZZY LOGIC CONTROLLER

Firstly, designing of FGSPID for two area power system model without SMES are cultivated by using Fuzzy controller. Principle elements of fuzzy logic controller are Fuzzification module , Rule-base and inference engine and De-fuzzification module.

Variables error (e) and change of error (e.) are assumed as controlled operator of system. Fuzzy control [5] depends on fuzzy logic which is similar to human thinking than classical logical system. The fuzzy logic control handles nonlinearities in power system [19]. This work proposes a fuzzy controller with up to 25 rules with 5 membership function Positive-Big (PB), Positive-Small (PS), Zero (ZZ), Negative-Small (NS), Negative-Big (NB), Small (S), Medium (M), Big (B), very-Big (VB), very-very Big (VVB).

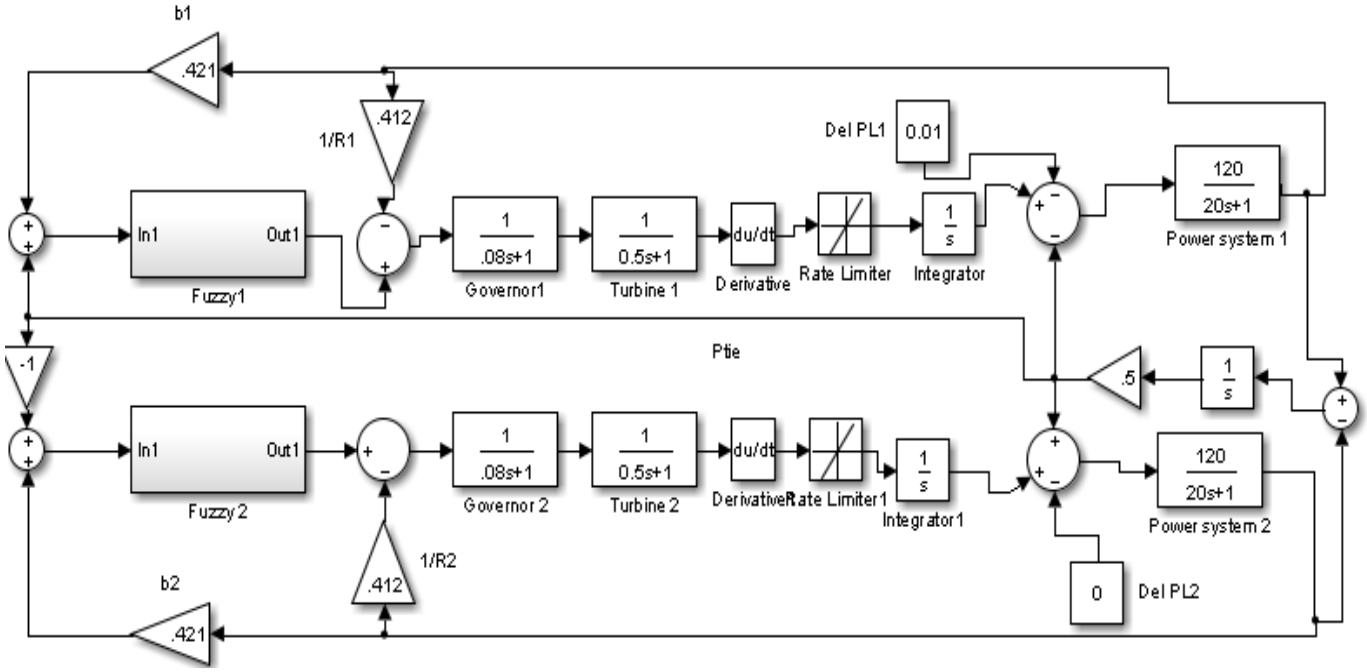
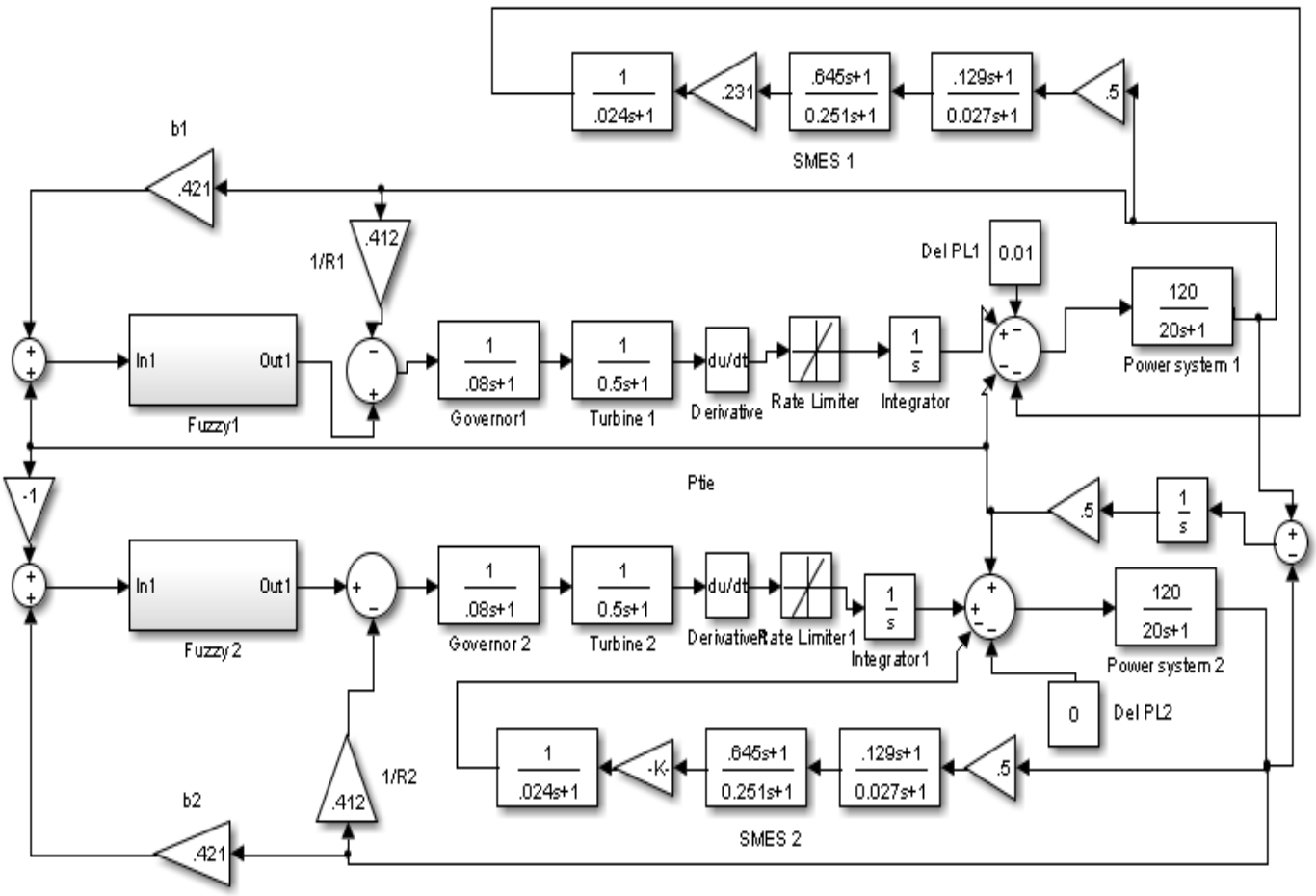
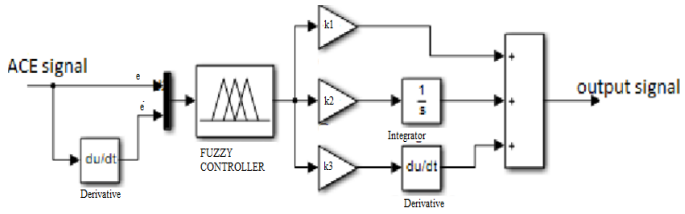


Fig. 1. Power system without SMES.



Power system with SMES .



Fuzzy gain scheduled PID controller

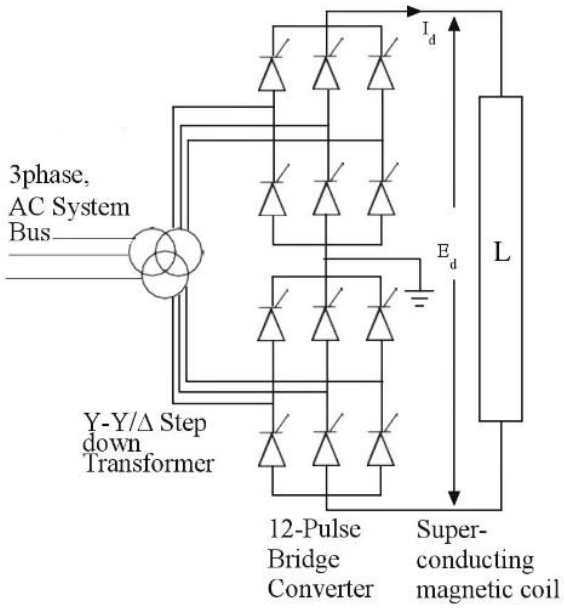
TABLE 1: Fuzzy rules for FGSPID.

		ė				
		NB	**NS**	**ZZ**	**PS**	**PB**
e	**NB**	S	S	M	M	B
	NS	S	M	M	B	VB
	ZZ	M	M	B	VB	VB
	PS	M	B	VB	VB	VVB
	PB	B	VB	VB	VVB	VVB

The considered model without SMES is given in Fig.2. The dynamic stability of system is demonstrated as transient responses and parameters values in terms of settling time and rise time. The investigation is further extended by designing FGSPID for two area power system model with SMES as given in Fig.3. On comparing, the parameters values of power system with / without SMES are shown in terms of settling time and rise time in Table I.

IV. MODELLING OF SUPERCONDUCTING MAGNETIC ENERGY STORAGE SYSTEM

Thyristor controlled SMES unit configuration is represented as a layout in Fig.5. To maintain at cryogenic temperature superconducting coil is placed within the helium vessel. When the load increases the stored energies are given away with the power system. The super conducting magnetic coil quickly charges to its maximum value absorbing a little more than nominal energy within the system but the system reverts by going back to its steady state. This energy is, then, released resulting in nominal value of the coil current.

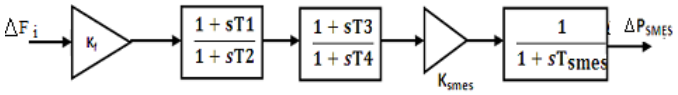


Thyristor controlled SMES unit configuration

Having a control on firing angle leads to deviation of the DC voltage which is present across the inductor, again and again from the positive, negative values. Application of a relatively less positive voltage leads to the initial charging of the inductor [14]. DC voltage (E_d) is assumed as:

$$E_d = 2\ E_{d0} \cos\alpha - 2\ I_d\ R_D \quad (7)$$

The SMES unit is displayed in Fig. 6.



Block diagram representation of SMES unit

The increase in load executes storage of the current provided by the negative feedback of the system. Inductor current should attain its nominal value very fast right from when the power system experiences disturbances, so that it enables the coming load situation.

Power flow can be given as:

$$P_{SMES} = E_{do} \cdot I_{do} \quad (8)$$

The deviation is given as:

$$\Delta P_{SMES} = \Delta E_d\ (\ I_{d0} + \Delta I_d) \quad (9)$$

$$Ew = (LI_d^2\ ) / 2 \quad (10)$$

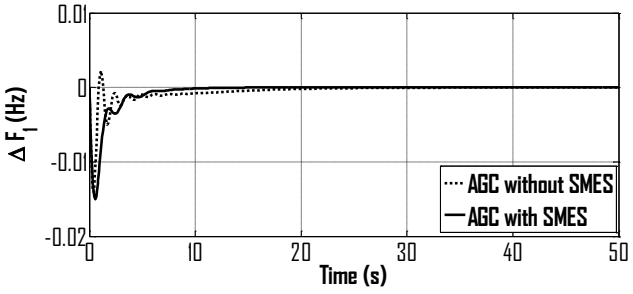
where, Ew is inductor stored energy.

V. SIMULATION AND DISCUSSIONS

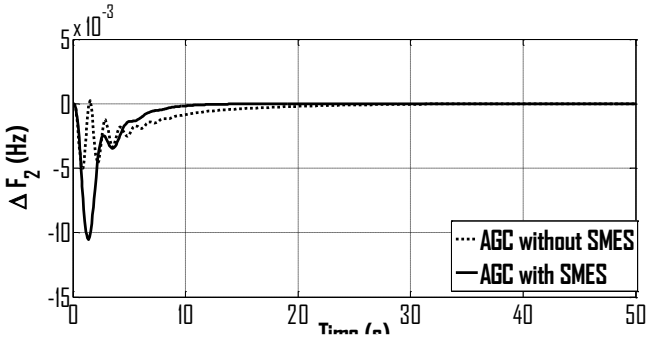
Designing of FGSPID for power system with / without SMES is accomplished by using fuzzy rules as given in Table 1. The dynamic stability of power system is evaluated on the basis of transient plots, settling time (ST_V) and rise time (RT_V). The transient plots of Fuzzy based system with / without SMES are obtained with 1% step load perturbation in control area are shown in Fig 6. The comparative parameters values of power system on the basis of ST_V and RT_V are compared in Table 2. ST_V and RT_V in case of AGC with SMES gives reduced values as compared to AGC without SMES. Moreover, transient responses of AGC with SMES gives better responses as compared to AGC without SMES as shown in Fig. 7.

TABLE 1: Comparative Parameters Values Of Power

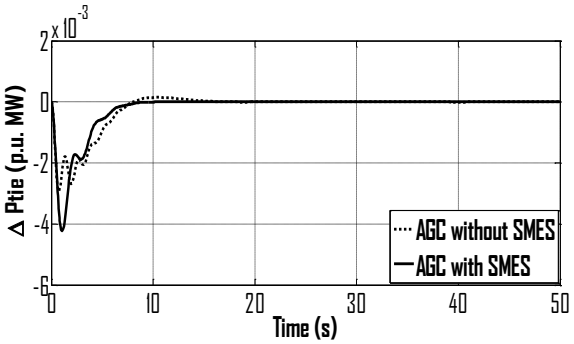
	AGC without SMES			AGC with SMES		
	ΔF_1 (Hz)	ΔF_2 (Hz)	ΔP_{tie} (p.u. MW)	ΔF_1 (Hz)	ΔF_2 (Hz)	ΔP_{tie} (p.u. MW)
ST_V (s)	17.74	24.61	13.78	7.87	9.35	7.7
$RT_v \times 10^{-4}$(s)	0.44	153	28	2.8×10^{-8}	6.3×10^{-5}	8.7×10^{-7}



(a)



(b)



(c)

Transient responses (a) ΔF_1 (b) ΔF_2 (c) ΔP_{tie} Vs Time

VI. CONCLUSIONS

Fuzzy gain scheduled PID based AGC of interconnected thermal power systems including Generation constraint constant (GRC) with / without SMES is investigated. At first, FGSPID based AGC of two area interconnected power systems including Generation constraint constant (GRC) is examined. The simulation results of power system with / without SMES are compared. Upon comparison of the result, it is concluded that dynamic stability of two area interconnected thermal power system incorporating SMES provides favorable transient responses and parameter performances in terms of ST_V and RT_V. It is also observed that

the inclusion of SMES in power system with non-linearity highly suppressed oscillations in responses.

APPENDIX A

NOMENCLATURE

ΔF_i Frequency deviation

R_i Speed regulation

P_{ri} Rated power system

T_t Time constant of thermal turbine

T_P Power system Time constant

x State vector

U Control vector

Y Output vector

ACEi Area control error

P_{SMES} Initial power flow

b_i Bias constant of i^{th} area

ΔX_E Governor valve position change

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APPENDIX A System Data

General Power System	Thermal	SMES
Pri=2000MW, f=60Hz, R_i= 2.4Hz/p.u. MW , b_i=0.425p.u.Mw/Hz, Kp=120, T_p=20sec, P_{tie}=200MW	T_t=0.3sec, T_g=0.08sec	30MJ,L=2.65H,Tdcs=0.03s,Kso=100kV/unitACE,KIds=0.2kV/kA,Idso=4.5kA,Idsmin=4kA,Idsmax=4.9kA.

Analysis of Telecom Experience in India

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Abstract: ***This paper captures insights on telecommunication experience of customers in India to analyse the performance of various competitors in the market as well as identify the pin points in the Indian telecom industry that need attention and improvement.***

Keywords: Indian telecom industry; Analytics; Data analysis; Competitor analysis; Geospatial analysis; Customer feedback

I. INTRODUCTION

Customer feedback is crucial to businesses for understanding flaws in their products or services in order to drive customer satisfaction and succeed in the competitive market. For this, companies often utilize data available through social media, surveys, voice recordings of customer interactions, and feedback systems to make more accurate and effective plans for product development and marketing. The intent of this paper is to curate an analysis from customer feedback and experience over the last year that can be profitable for the telecom service industry in India.

The introductory section provides a brief overview of the literature on the quality of service provider service and the measures formulated to assess it. Research methodology with expected consequences is mentioned. Further, a detailed report of the findings along with explanations and ideas for the telecom industry in India based on the findings from the gained knowledge is given. In the end, a case study comparing Reliance Jio and BSNL is done using SWOT analysis to bring a greater understanding of the market competitors based on their positioning, marketing strategies and customer feedback.

II. METHODOLOGY

A. Contextual information

The telecommunication sector has always been studied through various perspectives to understand the quality of the service as provided by the market and its correlation with the provider's internal and external performance that can ultimately pinpoint the cause of customer churn and retention.

A study carried out by Abd-Elrahman et al. [1] reviews the telecommunication service quality defined from customers' perspective and attempts to examine different service quality (SQ) models and hence formulate a model that can be used to measure telecommunications SQ better than the previous model. The study uses different survey data to compare how various measures can assess the quality of a telecom experienced by a customer.

Another study of measuring service quality by Ali [2] helps to understand customers' satisfaction levels from the telecommunication sector in Saudi Arabia and India. The comparative study is done using a survey with similar questions and answered by customers in Saudi Arabia and India. The study concludes with an understanding that factors like low population density, high income and high subscription do not directly imply better service quality, while high population, which can be a representation of the market size, can be associated with better service quality.

The telecom industry has also been analyzed based on customer expectation and perceptions of service quality as done by Pankaj Sharma et al. [3]. The analysis uses the SERVQUAL model to measure service quality and show how the expectation and perceptions of customers differ. This model captures customer expectations from a survey questionnaire and compares them with the notion of the offerings delivered by the telecom industry in India [4-5]. The findings in this study reveal that there is a huge deficit in meeting customer expectations.

B. About the dataset

The data is extracted from the Open Government Data (OGD) Platform India, which is an open data initiative by the Government of India open for public use [6]. The OGD platform acts as a portal for Government of India ministries, departments or organizations to publish datasets, documents, services, tools and applications for the benefit of the public.

The desired catalogs and datasets on the OGD Platform can be accessed easily with the least amount of filtering sector-wise. Some sectors available on the platform are Education, Finance, Agriculture, Judiciary, IT, etc.

TABLE I - DATASETS

Voice Call Quality Customer Experience	
Content	A dataset of customers' feedback captured using TRAI MyCall App wherein customers

	rate their experience about voice call quality in real time and help TRAI gather customer experience data along with Network data
Released Under	National Data Sharing and Accessibility Policy (NDSAP)
Contributor	Ministry of Communications, Department of Telecommunications (DOT) & Telecom Regulatory Authority of India (TRAI)
Sectors	Telecom, Information and Communications
Columns	Operator, In Out Travelling, Network Type, Rating, Call Drop Category, Latitude, Longitude, State, Month, Year

MySpeed (Crowdsourced Mobile Data Speeds)	
Content	A dataset of crowdsourced mobile data speeds and other network information measured using TRAI MySpeed App
Released Under	National Data Sharing and Accessibility Policy (NDSAP)
Contributor	Ministry of Communications, Department of Telecommunications (DOT) & Telecom Regulatory Authority of India (TRAI)
Sectors	Telecom, Information and Communications
Columns	Service_provider, Technology, Download_Upload, Data_Speed (Kbps), Signal_strength, Service_Area, Month, Year

III. RESULTS & DISCUSSION

Once the data is extracted, cleaned and prepped, analysis of telecom experience in India is done on an (a) statistics level, (b) competitor level and (c) geo level. The results are discussed in the section below.

A. Exploratory data analysis

(1) 69% of voice calls were of satisfactory experience, whereas the other 31% were unsatisfactory owing to the poor voice quality of calls and call drops.

(2 70% of the calls were made from indoors, 23% from outdoors and 7% while traveling.

(3 The majority of the calls captured used 4G technology. Only 2% of the calls captured during the past year used 2G technology.

B. Competitor analysis

Following questions are answered using the data:

(1) Which operator suffers the most call drops?
It is found that Airtel and Jio customers experienced the most amount of call drops and poorest voice call qualities. Idea and Vodafone seem to provide the most satisfactory voice call experience with the least call drops, high signal strengths and good customer rating.

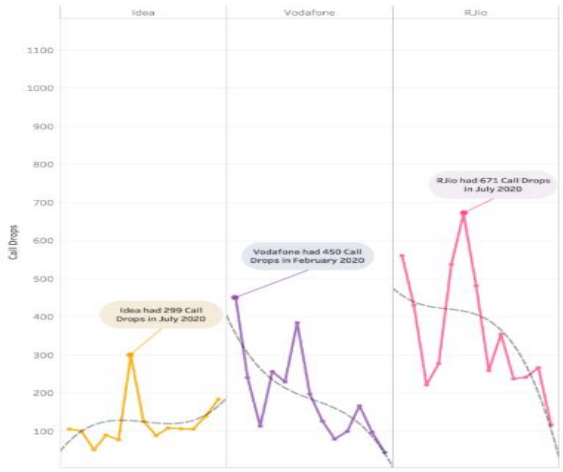
(2) Which is the most preferred operator for voice calls during traveling?
While traveling, BSNL, MTNL and RJio emerge as the best operators. This has a direct relation to the fact that these operators have the most extensive network lines and towers present in the country, hence making switching between stations easier.

(3) How do 3G and 4G services vary with different operators?
For 3G networks, the highest average data speed is delivered by Dolphin (MTNL) at a download speed of 6933 Kbps, 3 times the average speed offered by other competitors.

For 4G networks, the highest average data speed is delivered by RJio at a download speed of 17763 Kbps, 2.5 times the average speed offered by other competitors.

Vodafone is a strong data service competitor with a high data speed in the case of 3G and 4G services boh.

(4) How have operators performed over time?
Tableau is used for establishing trend lines using the polynomial mathematical model, as shown in Fig. 1.



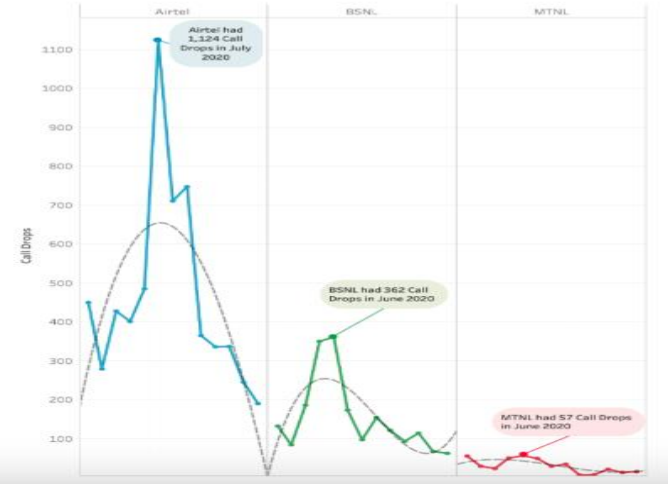


Fig. 1 Call drops of various operators over time

Idea is trending towards an increase in the rate of call drops even though Idea's rating has increased over the year from 3 to 4.5. Vodafone, Jio and Airtel reduced their rate of call drops and saw a marginal increase in their ratings over the year. BSNL had many call drops during June 2020 but has reduced the drop rate after that. MTNL's ratings however see a downfall over the year owing to its poor voice call quality, frequent call drops, low data speeds and low signal strengths.

C. Geospatial Analysis

Following observations about telecom service in various states of India are made using the data:

(1) Call drops

The number of call drops in India is found highest in the states of Maharashtra and Uttar Pradesh. These are also the two most populated states with a population of 11.2 crores and 19.9 crores respectively [7]. Telecom service providers have an opportunity to cater to this large population with a better overall voice call experience that can help increase their business as well. For this, operators need to continuously invest in networks and set up more cell towers and optical fiber cables. Additional corrective measures that can be taken include installing towers, creating additional capacity, network optimization and installing jammers, boosters and repeaters.

(2) Signal strength

The weakest signal strengths are captured from Orissa. Madhya Pradesh, Rajasthan and Gujarat also have low signal strengths. Network congestion is a common issue in urban areas. If operators continue to grow their network user base and drive higher data usage faster than they can improve their network capacity, the overall user experience gets impacted, especially at peak times. In a country with the sheer geographical size and population, where the landscape ranges from huge cities to high mountains and vast agricultural plains, network optimization is still a work in progress.

(3) 3G data service

Jammu & Kashmir users experience the lowest 3G data speed in the country. Jammu and Kashmir suffered a ban on 3G and 4G services at the beginning of 2020 following the repealing of Article 370. Since then, the state hasn't recovered its telecom services. Parts of the northeast and southern India also experience low 3G data speeds. With the rolling out of 5G service, 3G is expected to be deprecated soon into the future and operators must take this as a market opportunity to build a customer base in these states by offering them unmatched user experience while increasing their revenues at the same time.

(4) 4G data service

The 4G data service isn't as satisfactory as the 3G service. Except for the states of Rajasthan, Madhya Pradesh and Orissa, all states experience low 4G data speeds. On average, 4G offers 6 times more than 3G data speed. As the network requirements increase, more and more customers would be switching to 4G. To improve 4G service, operators have expanded their footprint in the 2300 MHz band spectrum to cater to the rising mobile broadband usage, thereby translating into a need for improving their network capacity [8]. As the user base is gradually increasing, operators are also forging content deals to attract subscribers and drive data use. High levels of competition have already put a lot of price pressure on India's operators. Airtel, Vodafone and Idea are talking up their 4G network improvement plans, while RJio has gone one step further with a pledge to bring 5G to India before its rivals [9].

D. Reliance Jio's SWOT analysis

The following section explores the market position of Reliance Jio using SWOT analysis.

TABLE 2 - JIO'S SWOT ANALYSIS

Strength	Backed by Reliance Industries Weighty customer acquisition strategies Robust customer retention strategies Various attractive offerings to customers Quick adaptability to new technologies
Weakness	Pricing controversies[10] Poor data connection Poor voice call quality Overabundant freebies SIM activation issues
Opportunity	Infrastructure for 5G and 6G technologies

	Forthcoming consumer technology: IoT Cutthroat Pricing Strategies
Threat	Loss in customer base Unethical business practices Critique and negative image Eradication of unpaid services

E. BSNL's SWOT analysis

The following section explores the market position of BSNL using SWOT analysis.

TABLE 3- BSNL'S SWOT ANALYSIS

Strength	Backed by the Government. of India Advantage over private competitors Alliances with big corporations Huge customer base Vast network coverage
Weakness	Failed in innovation Poor customer acquisition strategy Limited brand visibility Weak customer support Poor service bundles

TABLE 4

Opportunity	Adoption of NGNs Marketing opportunities via strong alliances Untapped rural customer base
Threat	Loss in customer base Low customer loyalty Cutthroat pricing by competitors

IV. CONCLUSION

This paper utilizes analytics to assess the quality of telecommunication services in India through customer feedback and recorded data. The analysis hence derived has been used to identify the strengths and weaknesses of the system to enable operators to design a framework for their product development.The future scope of this analysis is to look at a bigger sample of data with more features that can help to deep-dive and diagnose the root cause of the poor telecommunication experience in India.

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Self-Generating Automated Street Model

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ABSTRACT: In this paper, an efficient method is presented for the Self Generating Automated Street Model optimally. The proposed method is a heuristic approach to optimally derive formulas for calculating the rating of the inverter, batteries, solar panel, and Area required for installation by selecting the optimal component for each stage without violating the constraints. Then using the generated power efficiently to power different electric components in the street using controlling techniques .The proposed method is based on the law of conservation of energy. The datasheet is designed to set up solar panels by using the known load consumption methodology.

I. INTRODUCTION

As the world's looking forward for clean resources and efficient energy growth and as we cannot avoid the fact that natural gas ineludibly decline, understanding the demands and scarcity of resources, implementation of renewable resources to ensure our future has never been more important. [1] Plenty of renewable resources are available but only some of the are cost effective and can be used on large scale and solar powered panels are one of them .There is a need to use solar panels is its advantage over conventional power generation methods of generating power without releasing greenhouse gases. [5] Union of Concerned Scientists stated thatUsages of fossil fuel during the past 150 years has result in atmospheric inflation of CO_2 levels by 25 percent. Noticeable

Hike in levels of various gases i.e. methane and nitrous oxide. [2] As we are developing as society our power demand is increasing so not only we have to generate power sustainably buy also use it efficiently that is we have incorporated technology in street light to us it only during night or when a vehicle is approaching and installed automated solar panel to produce more electrical energy instead of existing system.

The objective of the paper is to propose method for the generation of solar energy and utilizing it efficiently without causing any harmful effect to human or the environment.

The paper is organized in following sections: In section 2, methodology is introduced In section 2, preliminaries as nomenclature, assumptions and important terms are introduced. Section 3 presents the proposed heuristic approach to optimally derive formulas for calculating the rating of the inverter, batteries, solar panel, and Area required for installation Section 4 the Designing and installation problem for the Solar PV module to maximize the Set-up Requirement Calculation rapid for any load system/network .In the last, paper is concluded in section 5.

II. METHODOLOGY

Generation Section-

Solar band based power generation-:solar energy converted to electricity by using technology called photovoltaic. The principle behind the technology is the photovoltaic effect. By the absorption of photons free electrons are released by certain materials. Photovoltaic effect allows to produce direct current as per the principle of the photoelectric effect. In this generation we use the solar tracking system. The tracking system will control the movement of solar panel to ensuring the angle of sun rays fall perpendicularly. It will generate up to 25% more energy than which solar panels are without tracking.

Storage Section-:

This electrical energy will be stored in the battery connected. We are using conventional battery charging unit also for giving supply to the circuitry.

Control Section-:

We are making this self generating automated street light model, with the help of Arduino Uno and other generating sources. This section consists of further sub section as follows:

i) Smart street light using photodiode-: Street Light is one of the major power consuming factor. So we will use the smart street system to overcome the wastage of energy. When vehicle is passing through streets, Streetlight will glow. **IR sensors are used for detecting the position of vehicle**, each IR sensor controls 3 LED's. IR sensor it senses the position of vehicle and send signal to the Arduino board which transmit signal to LED to glow.

ii) Automatic Street Light using LDR: Automatic Street light controlling ensure the energy consumption reduction and eliminated the manual operation of street light. It automatically switch ON light when the range sun radiation goes below set level of brightness for our eyes and switch OFF the light under illumination by sunlight. This is done by a sensor called LDR. LDR sensor will

sense the brightness level of sunrays and send it to Arduino. Arduino will compare if the received value is above the threshold level and LEDs will remain OFF, if the received signal value below the threshold level, Arduinowill consider it as a night.

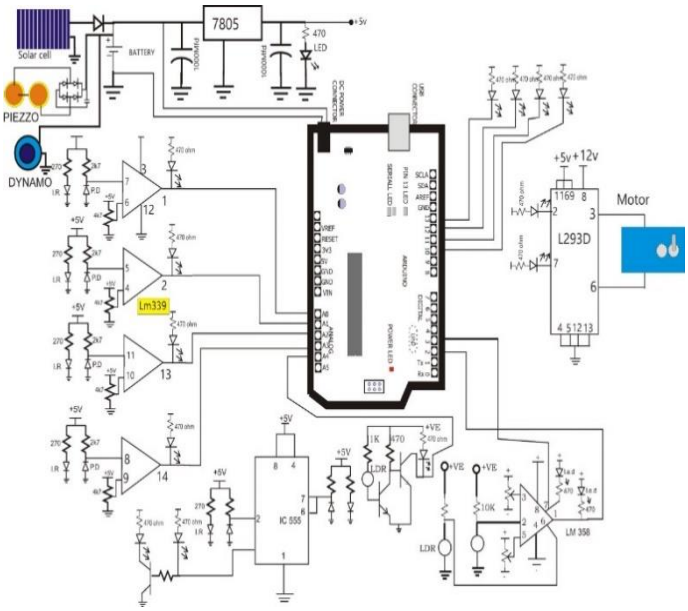

Fig. 1. Circuit Diagram of Hardware Model

III. PRELIMINARIES

Nomenclature

A few important terms in the area of Designing of solar panel set up which are used in the paper are described as follows:

D.O.D: Depth of Discharge is defined as the ratio of total energy discharge through battery to nominal capacity.*D.O.D* is normally expressed as a percentage [2].

G.H.I: Global Horizontal Irradiation/Irradiance (GHI) is defined as the summation of direct and scattered radiation. It is also vital parameter for calculation of radiation on an irregular plane.

Solar Irradiance: The solar irradiance is radiation transmitted by the sun in form of light energy, measured at the Earth surface. Thespectral irradiance of solar is a measured by pyrometergive reading of brightness of the entire Sun at a wavelength of light.

Conversion Efficiency: This efficiency can be defined as the percentage of the solar energy radiated on a PV panel which is converted into electricity.

Hours of solar radiation: It is a ratio of G.H.I and solar irradiance.

Assumptions

Following assumptions are made for the data calculation under consideration:

1. The load consumption by user
2. The internal and external constraints, power losses among components
3. Annual GHI (Global Horizontal Irradiation) in delhi =5.5 kwh/m2/day. Varies from region to region[4].
   a) Solar panel's solar irradiation rating is 1000w/m2 (standard test condition).
   b) Hours of solar radiation is 5.5h/day
4. Battery voltage and ampere hour Rating (variable as per user requirements), DOD: depth of discharge of lead acid battery
5. Power rating of the solar panel given by manufacturer (variable as per load requirements).

IV. PROBLEM FORMULATION

This Work Proposes A Heuristic Approach To Optimally Derive Formulas For Calculating The Rating Of The Inverter, Batteries, Solar Panel, And Area Required For Installation. (Variable as per user requirements)

Inverter Rating [Kva]

Power consumption = [Load + Load*.25] W
For Kva Rating = Power / (1000*Power Factor)

Note: Load consumption table –Appliances and their practical rating taken in calculation.

Battery Sizing

Energy Required From Battery (Kwh/Day) = Energy Consumption Per Day [Kwh/Day] + Loss In Inverter*Energy Consumption
Battery Storage [Kwh/Day] = Energy Required From Battery [Kwh/Day]/ Dod
[DOD: Depth of Discharge] Of Lead Acid Battery

Single Battery Rating

TABLE 1: Details of the Appliance used

Voltage Rating(V)	Ampere Hour Rating(Ah)	Power Rating(Kwh)
12	200	2.4

No. Of Battery = Battery Storage Per Day/ Single Battery Power Rating

Note: Even No. Of Batteries Prefer

Solar Panel Rating

Input Energy To Battery Unit [Kwh/Day] = Output From Batteries +(Total Loss In Batteries*Output From Batteries)

Internal Losses In Controller And Inverter = 4%
Internal Losses In Panel= 25%

Power Rating Of Solar Panel [Kw] = Total Energy From Panel (Must Generate)/Hours Of Solar Radiation

No. Of Panel= Power Rating Of Solar Panel [Kw]*1000/Power Rating Each Panel In Watt

Note: Take Round off Value Larger than required as in Our Example 46 Panel Required

Area Required [M2] = [No. Of Panel *Power Rating Of Each] / [Solar Irradiation * (Conversion Efficiency % /100)]

V. CHARGE CONTROLLER

Charge Controller sizing in Amperes = Short-Circuit Current (I_{SC})PV × 1.25 (Safety Factor).

3.1. Designing of Solar Panel Measure

The energy consumption of the load can be determined by the product of power rating of load to its hours of operation. Thus, the unit can bedefined as watt × hour or (Wh). The daily total energy demand in which is calculated by summation the load demand of appliance per dayindividually.

Total energy demand (Wh) = ∑ (Power rating in Watt × hours of operation in hour).

Inverter & Converter (Charge Controller) Ratings

Let's consider 3.059375 KVA in our case an inverter with power handling capacity of 20-30% more than the power required by the load chosen from the market. In the case of the converter, the charge controller is rated in current (I) and voltage (V) ratings. Its (I) rating is calculated by using the I_{SC}rating of the PV module. Nominal voltage of batteries considered for values of voltage. Let's see the calculation of inverter rating our inverter should be greater than load by 25%. Here our load is 1958 watt and then add more 25% of load then it will be 244.5 watts and then get KVA rating of inverter divide it by power factor of 0.8 (assumed) as inverter is considered as unity power factor.

Converter and Charge Controller Sizing

Rating of charge controllershould be 125% of the short circuit (I_{SC}) current of PV panel. In other words, it should be 25% greater than $I_{SC}$of solar panel.

Charge controller sizing in amperes= $I_{SC}$of PV panel × 1.25 (Safety factor).

Solar Charge Controller Rating = (19 PV panels x 8.95 A) x 1.25 = 212.56A so you can use the next closest rated charge controller which is 212.56A (MIN)

Sizing of the Batteries

Parameters need to consider while sizing of batteries as follows:

Depth of Discharge (DOD) [2] of the battery. Voltage and ampere-hour (Ah) rating of the battery. The number of days of backup (which user will decide) required backup power without solar panels during Shady or rainy days.

Let's look at the calculation the energy supplied to the inverter or the energy required/supplied from the battery. For this, we use the law of conservation of energy. Here formula used to calculate the energy required from the battery in kwh/day:

Energy Required From Battery (Kwh/Day) = Energy Consumption per Day [Kwh/Day] + Loss in Inverter*Energy Consumption

(Note: We Are Assuming Loss in the Inverter Is 20%)

Battery Storage [Kwh/Day] =Energy Required From Battery [Kwh/Day]/ DOD

[DOD: Depth of Discharge] Of Lead Acid Battery

SNO.	APPLIANCE	POWER RATING (W)	UNIT	DAILY USAGE (HRS)	TOTAL AC LOAD (WATT)	TOTAL ENERGY CONSUMPTION
1	Traffic light	12	2	24	24	576
2	Street light	150	10	12	1500	18000
3	CCTV camera	35	10	24	350	8400
4	Speed indicator	10	10	24	100	2400
5	Temperature indicator	15	3	24	45	1080
6	LED sign board	20	10	24	200	4800
					2219	35.256

No. Of Battery = Battery Storage per Day/ Single Battery Power Rating

Note: Even No. Of Batteries Prefer

Now, one point to be notice here is that all the energy stored in the battery is not available to us and this energy which is available to us by the battery is determined by the depth of discharge (D.O.D) of the battery.

Considering lead-acid battery whose D.O.D is 50% so total battery storage is given by per day energy supply divided by D.O.D of lead-acid battery. Total Battery system storage requirement is 34kwh/day (considering DOD 50%) to supply energy to load of 14.169kwh/day to obtain 17kwh/day energy supply from the battery system. Batteries are available in the market in volt and ampere-hour ratting now multiply voltage and ampere-hour, here we have used 12V and 200ah so we get Power Rating of single battery 2.4kwh lead-acid now to figure out how many batteries are required we need to divide per day Total Battery system storage requirement by Power Rating of single battery 2.4kwh lead-acid. Number of batteries obtained is 72 batteries

AS we didn't get an integer value from our calculation, we can take 71 or 72 batteries but even no. Of batteries are easier to connect because sometimes we connect batteries in series when our inverter rating is 24 V but out the battery is 12V but in this example, we are using a 12-volt inverter so all the batteries are parallel. Number of batteries calculated for one-day storage to get 'n' no. Of day storage then multiply no. Of days by no. Of one-day battery require.

Sizing of the PV Array

For panel calculation, first, calculate input energy to the battery from the panel and for that use law of energy conservation.

Major losses occur due to following (in %) :
Angle of sunray fall on solar panel (5%)
Variation in energy received by MPPT charge controller (4%)
Dust and debris on solar panels (5%)
Aging of PV panels and variation in specification (10%)
Temperature above 25°C (15%)

Total battery internal losses- 15%. The total energy that should be generated by the panel is 63.2 kwh/day. In the case of solar radiation, the unit is kwh/m2/day .In this example, we are taking GHI 5.5kwh/m2/day

Sun radiations are varying from morning to evening and also our solar panels are rated for 1000w/m2 we need to divide GHI [4] by solar irradiance and we get hours of peak radiation 5.5 hr.Now to find out the power rating of the solar panel divide the total energy that the panel must generate by hours of solar radiations. Power Rating of Solar Panel [Kw] = Total Energy from Panel (Must Generate)/Hours of Solar Radiation here we get 4.6kw .To calculate no. Of solar panel required (here we are using a 250watt peak power rating of each panel) divide the required power of the solar panel by the power of each panel so in our case 19 panels are required .At last, to calculate the is required Area to set up this much no. Of the panel, we are using the given formula:

Area Required [M2] = [No. Of Panel *Power Rating Of Each] / [Solar Irradiation * (Conversion Efficiency % /100)]

VI. NUMERICAL RESULTS

To demonstrate proposes a heuristic approach to optimally derive formulas for calculating the rating of the inverter, batteries, solar panel, and Area required for installation.The computation of the optimum results is done according to the steps given in the and is **Designing of Solar panel Measure shown in Table below**.

VII. LOAD UTILIZATION

SNO.	APPLIANCE	POWER RATING(V UNIT		DAILY USAGE(HRS)	TOTAL AC LOAD (WATT)	TOTAL ENERGY CONSUMPTION
1	Traffic Light	12	2	24	24	576
2	Street Light	150	10	12	1500	18000
3	CCTV Camera	35	10	24	350	8400
4	Speed Indicator	10	10	24	100	2400
5	Temperature Indicat	15	3	24	45	1080
6	LED Sign Board	20	10	24	200	4800
					2219	35.256

LOAD

TOTAL AC LOAD [WATT]	TOTAL ENERGY CONSUMPTION PER DAY [KILO WATT-HOURS]
2219	35.256

INVERTER RATING [KVA]

FORMULA USED: [LOAD + LOAD* .25] W FOR KVA RATING = POWER /(1000*POWER FACTOR)

LOAD	EXTRA POWER 25%	TOTAL POWER (W)	POWER FACTOR	FOR KVA RATING
2219	554.75	2773.75	0.8	3.4671875

INVERTER RATING (KVA)
3.4671875

BATTERY SIZING

FORMULA:
ENERGY REQUIRED FROM BATTERY [kwh/day] =
ENERGY CONSUMPTION PER DAY[KWH/DAY] + LOSS IN INVERTER*ENERGY CONSUMPTION

ENERGY CONSUMPTION	LOSS IN INVERTER (percentage)	ENERGY REQUIRED FROM BATTERY
35.256	20	42.3072

FORMULA:
BATTERY STORAGE [kwh/day] =
ENERGY REQUIRED FROM BATTERY[KWH/DAY]/ DOD

ENERGY REQUIRED FROM BATTERY	DOD (percentage)	BATTERY STORAGE
42.3072	50	84.6144

SINGLE BATTERY RATING

VOLTAGE RATING(V)	AMPERE HOUR RATING(Ah)	POWER RATING(kWh)
12	200	2.4

FORMULA:
NO. OF BATTERY =
BATTERY STORAGE PER DAY/ SINGLE BATTERY

BATTERY STORAGE PER DAY	BATTERY POWER RATING	BATTERY UNITS [1DAY]
84.6144	2.4	35.256

STORAGE FOR REQUIRED NO. OF DAYS	BATTERY UNITS FOR 1DAY	REQUIRED BATTERIES
2	35.256	70.512

NOTE: EVEN NO. OF BATTERIES PREFER

SOLAR PANEL RATING

FORMULA :
INPUT ENERGY TO BATTERY UNIT [KWH/DAY]
= OUTPUT FROM BATTERIES +(TOTAL LOSS IN BATTERIES*OUTPUT FROM

INTERNAL LOSSES IN CONTROLLER AND INVERTER = 4%
INTERNAL LOSSES IN PANEL= 25%

OUTPUT FROM BATTERIES	LOSS IN BATTERIES	INPUT ENERGY TO BATTERY UNIT
42.3072	15	48.65328

INPUT ENERGY TO BATTERY UNIT	INTERNAL LOSSES IN CONTROLLER AND INVERTER (PERCENT)	ENERGY REQUIRED FROM PANEL
48.65328	4	50.5994112

ENERGY REQUIRED FROM PANEL	INTERNAL LOSSES IN PANEL(PERCENT)	TOTAL ENERGY FROM PANEL (MUST GENERATE)
50.5994112	25	63.249264

NOTE: Annual GHI (Global Horizontal Irradiation) in delhi =5.5- 6.6kwh/m2/day . Varries from region to region

Solar panel's solar irradiation rating is 1000w/m2 (standard test condition) .
Hours of solar radiation is 5.5h/day

FORMULA:
POWER RATING OF SOLAR PANEL [KW]= TOTAL ENERGY FROM PANEL (MUST GENERATE)/HOURS OF SOLAR RADIATION

TOTAL ENERGY FROM PANEL (MUST GENERATE)	HOURS OF SOLAR RADIATION (H/DAY)	POWER RATING OF SOLAR PANEL [KW]
63.249264	5.5	11.49986618

FORMULA:
NO. OF PANEL= POWER RATING OF SOLAR PANEL [KW]*1000/POWER RATING EACH PANEL IN WATT

POWER RATING OF SOLAR PANEL [KW]*1000	POWER RATING EACH PANEL IN WATT	NO. OF PANEL
11499.86618	250	45.99946473

NOTE: TAKE ROUND OFF VALUE LARGER THAN REQUIRED AS IN OUR EXAMPLE 46 PANEL REQUIRED

FORMULA:
AREA REQUIRED [M2] =
[NO. OF PANEL *POWER RATING OF EACH) /(SOLAR IRRADIATION * (CONVERSION EFFICIENCY % /100)]

NO. OF PANEL	POWER RATING OF EACH	SOLAR IRRADIATION	CONVERSION EFFICIENCY[PERCI	AREA REQUIRED [M2]
46	250	1000	25	46

VIII. CONCLUSION

The results obtained by calculation performed with other modified methods are shown in Table above and figure 1 for wiring setup. The following observations are noted from the Datasheet total System requirement depicted in table above:

1. LOAD ENERGY REQUIRED [PER DAY] =35.256 KWH/DAY
2. INVERTER POWER RATING =3.467 KVA
3. BATTERY STORAGE [PER DAY] =84.614 KWH/DAY
4. NO. OF BATTERIES =72 BATTERIES OF 12V, 200AH
5. SOLAR PANEL RATING =250W
6. SOLAR PANEL UNITS =46 PANELS OF 250W
7. COMPLETE AREA COVERED =46 m²

Here, in the paper, the Designing and installation problem for the Solar PV module to maximize Set-up Requirement Calculation rapid for any load system/network has been well implemented. The proposed heuristic approach for designing is based on load consumption flexible Requirement. The problem of Designing has been successfully demonstrated for 84.614 kwh/day load. The advantages of the proposed method are as: [5]

Solar power is the new product in renewable market with it's sun tracking feature it can efficiently be used in open areas, waste land and high highways which get high sun exposure for electrical power generator.Nothing is complete if we cannot conserve what we created and to make efficient use of power generated we have setup smart street lights which only glows during nighttime without human intervention thus saving lot of energy which can used with street lights or roads and also on banners on placed near roads and also traffic light traffic light control which senses the traffic and then only light glows.

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