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Radar maneuvering target classification using Deep learning

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Abstract: ***Classification of warhead and decoys is one of the challenging processing ballistic missile defense system, proper classification of target from the decoys determines the anti-ballistic missile is successful or not. Deep learning is the new technique used for classification of radar target****. Convolution neural network as a deep learning technique used to classify the target in the pool of decoys. Classification results suggests that the deep learning technique is efficient and assist in swift decision making in tactical environment*

Keywords: Convolution neural organization (CNN), SqueezNet, Radar Cross Section, target classification

Many countries have spent significant resources to countermeasure research and development in order to condense the efficacy of defense mechanism of Ballistic Missile systems. [1]. Using decoys in large number, or fake targets, to ambiguous defense systems is one of the most prevalent tactics. Various decoy tactics, such as replica decoys, signature diversity decoys, and anti-simulation decoys, are currently accessible [2]. Because the weight of payload determines missile's warhead size and range, lightweight decoys are a very interesting choice in contrast to exo-atmospheric defenses. As a result, missiles can carry lightweight decoys in larger number without compromising the maximum range of the payload. [1]. Long-range BM travel on sub-orbital trajectories, and their ranges are primarily determined by the height attained with the use of one or more boosters. In exo-atmospheric in which mid-course phase of a BM flight occurs is the longest part of the journey. Since warhead and decoys travel on comparable trajectories due to same physics a large number of decoys are deployed in midcourse phase. [3] Missiles can release accompanying debris and hardware, such as missile launch boosters, which can cause further radar interference. Since anti-ballistic missile systems are equipped with few number of interceptors, In the absence of accurate target identification, it is challenging for anti ballistic missile system to avoid the warhead from reaching its intended target .The classification challenge of Targets , which involves recognizing the warhead among a larger number of decoys and debris, is critical. So the need of the hour is to have the desired classification algorithm with high efficiency, low computational complexity and swift decision times for ground based and sea-based defense station. Furthermore, once the target has been classified and located, the seeker on the interceptor must regulate the target location on the Re-entry Vehicle (RV) for successful lethal guidance and control during the engagement [4]. It is crucial to highlight that decoy can have a significant impact on the efficiency of a defense system in two ways.

If a decoy is mistakenly categorized as a warhead (false alarm), the defense may run out of interceptor ammo too soon. Misclassification (leakage) of a weapon, on the other hand, may result in its destruction.

The ability to categorize between warheads and decoys is an issue that has received a lot of attention in the literature, thanks to the established target credentials system based on the different micro-motions exhibited by Ballistic targets. The stability of warheads is maintained normally to ensure that they organize their intended ballistic trajectories, while also displaying precession and nutation motion due to the gravitational impact of the Earth [4]. On the other hand, due to lack of spinning engine and also due to gravity decoys flip when launched by missiles [5][6]. In order to obtain the target's micromotion, Doppler and range analysis of the radar signals are used. V. Chen initially characterized the phenomenon in the Doppler domain in [7], and it is now known as the micro-Doppler effect. Neural network algorithms are extensively used for classification, in [4] Convolution Neural Network (CNN) for classifying aircraft target using LeNet was presented and compared with SVM.

The author[5] describes the classification of target using recurrent neural network (RNN).

The paper is organized as follows: Section II. Radar cross section concept is described, Section III: describes CNN for classification of target, Section IV presents simulated results, finally conclusion is drawn in section V.

Section II:

Radar Cross Section

The radar cross section (RCS) of a target is the area that the radar signal intercept. Mathematically, it is written as:

$$\sigma = \lim_{R\to\infty} 4\pi \frac{|E_s|^2}{|E_i|^2} R^2 \qquad (1)$$

Where: R=Distance travelled by the radar signal to target

E_s=Electric field strength scattered at target

E_i=Incident electric field strength at target

RCS of cylinder and cone:

The aspect angle, wavelength of operation and polarization are few parameters determines RCS of a target . When the dimension of the target exceeds the wavelength, the RCS of a conducting plate is approximated by σ.

The product is given by:

$$\sigma = G_e . Ap = \frac{4\pi Ap}{\lambda^2} . Ap = \frac{4\pi A^2}{\lambda^2} \qquad (2)$$

The approximate formula for the RCS of simple cylinder and cone is given by:

Cone RCS:

$$\sigma = \frac{\lambda^2}{16\pi} tan^4\theta;$$

$where\ \theta cone\ half\ angle$ (3)

Cylinder RCS:

$\sigma = \frac{2\pi a L^2}{\lambda}$ where a: Radius; L:Length (4)

Section III: Convolution Neural Network

CNN consists of large number of layers with various parameters that are adjusted as per design requirement. CNN is a deep learning model which is fully connected, layered structure, possessing non-linearity and pooling feature and has many degrees of repetitions inside the model. CNN comprises various architecture models such as AlexNet, Inception, Xception, SqueezeNet, MobileNet etc. Training of CNN could be a challenging with

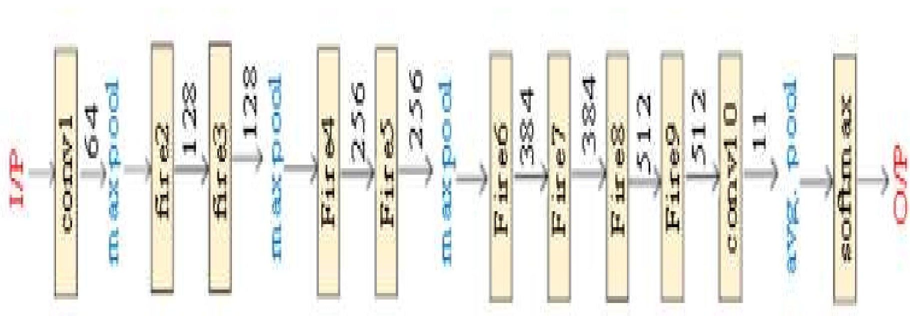

Fig 1: SqueezNet framework.

respect to time as well as resources required. So to solve this problem, we have used transfer learning with fine tuning technique through pre-trained SqueezeNet model for classification of shape of target.

Different activation functions could be used within non-linearity layer like ReLU, tanh and sigmoid. Here, ReLU has been employed after each

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convolutional layer to boost the performance (Krizhevsky, A., 2012).In this work we have chosen SqueezeNet model to train for RCS return target classification which results in less computational time.

SqueezeNet CNN Architecture which is designed to classify images, therefore radar returns are converted into images by using time -frequency representation. In order to utilize the squeeze net, we transform the radar return time series results into image

using wavelet transform. Wavel et transform captures the slowly varying signal structure and enhance the performance of the classifier. Then converted images are fed to squeezeNet's input layer and we control Squeeze Net to classify the resulting images.

Section IV: Simulation results:

In our work we created RCS synthesized data for cylinder and cone to train the learning algorithms. For cylinder with radius 1m and height of 10m with operating frequency of radar is 850MHz is considered. For cone synthesized data is generated similar to cylinder. In order to generate the training set, synthesized data is repeated for 5 times and randomly selected cylinder radii. By varying incident angle 10 motion profiles followed by 10 sinusoid curve around boresight are randomly generated to create training data set. Each motion profile consists of 701-by -50 samples. The process is repeated to generate 701 -by 100 matrix of training data set. For testing 25 profiles of each target profiles are used. The training has been performed on GPU. Its immediate result and entire training process is exhibited in the table 1. The figure 2 shows RCS of a cylinder-shaped target with dimension one meter radius, ten meter height with operating frequency of the radar is 850 MHz. Figure 3 shows radar return for one of the motion profiles of target. The plots shows variation the RCS values over time for both the incident azimuth angles and the target returns. Table 1 exhibits the training accuracy and training loss. From table 1, we observe that loss is decreased and accuracy increased.

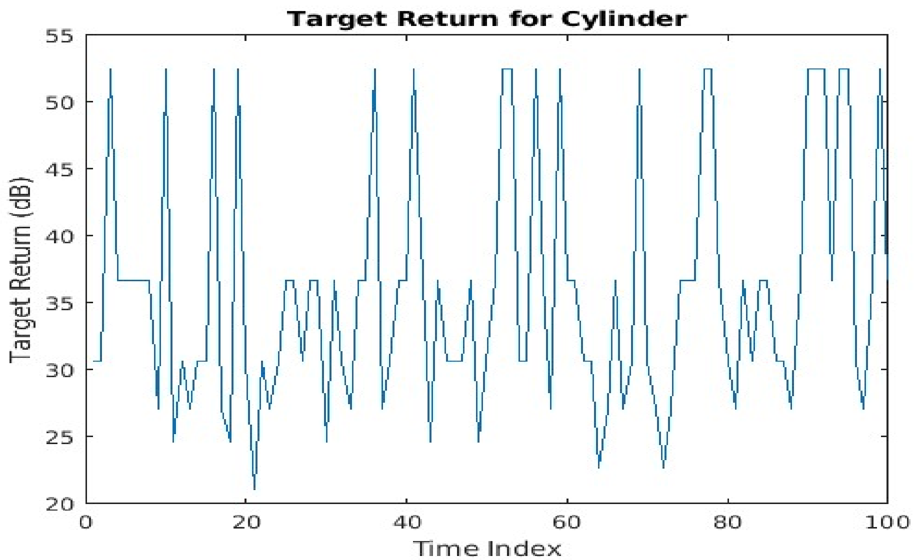


Fig2: Radar return of Cylinder.

Table 1: Result of accuracy and loss at every epoch with learning rate $1.0e^{-04}$.

Epoch	Iteration	Accuracy(in %)	Loss
1	1	60	2.6639
5	50	100	0.0001
10	100	100	0.0002
15	150	100	$2.2264e^{-05}$

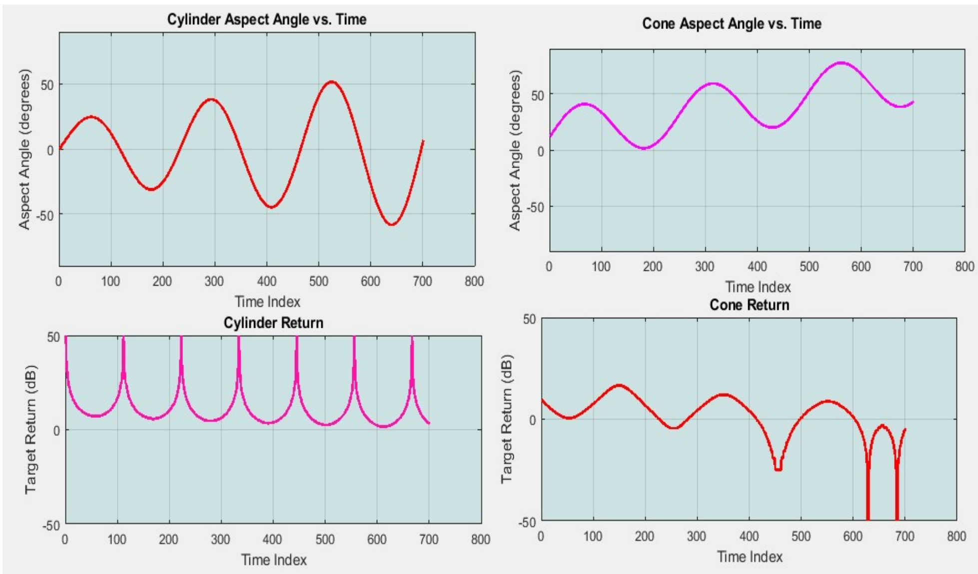
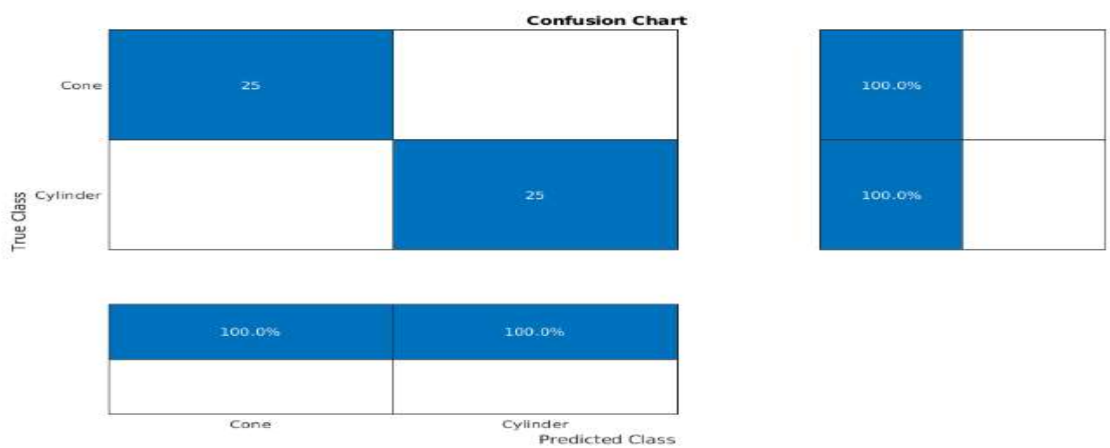


Fig 3: Shows radar return for one motion profile of cone and cylinder target



The fig 4: Shows the confusion matrix of test samples for proposed radar target classification model using the CNN/Squeeze Net

The figure 4 shows the confusion matrix of test samples for proposed radar target classification model using the CNN/Squeeze Net. All the classes contribute the best recognition accuracies i.e 100%.

Section V: Conclusion

In this paper, we synthesized the radar returns data for cylinder and cone shaped target. On synthesized data we perform classification of target using CNN. As the epoch increase the accuracy increases and

loss decreases. The results are obtained by propagating radar RCS through wavelet transform to convert into one dimensional time frequency representation and fed to SqueezeNet to classify the target. This work can be extended to accommodate real radar returns.

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Design Engineering

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Comparative Analysis on Fall Detection of Elderly People

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ABSTRACT:*Accidental falls have been one of the most serious issues concerned with the elderly and an important research area in the life signs domain. The injuries can have a serious effect on their lives. Furthermore, if the elderly remain lying down for a long period post-fall, then there is a chance of suffering from serious complications which increases. Such complications should be avoided beforehand. Thus, in the field of life signs, it is important to achieve a methodology to study fall detection and prevent it. This paper reviews the work as to how to detect movement of the human beings which causes a change in radar signals and then produce corresponding Doppler signatures. These Doppler estimations acquired are utilized to recognize the diverse human movement utilizingmicro-Dopplersignal. Themeasurements which are obtained will yield the results of the various human motions at different ranges and simulate thesame.*

KEYWORDS:*Doppler estimation, fall detection, Life signs, micro-Doppler signals. radar echo signal.*

1. INTRODUCTION:

Maturing is an incredible association which fuses natural and mental changes. India which is viewed as the second-most populous country on earth and has seen a gigantic extension in the number of people in senior age and it has been projected that it would rise to around 324 million by 2050. The quantity of people over the age of 60 years is quickly developing, particularly in a crowded nation like India. The significant worry with this age gathering of individuals is the unplanned falls which happen offers ascend to various direct wounds which may cause hurt as of now or sooner rather than later. Following the fall which happens clinical mediation ought to be followed up to decrease the drawn-out results. Albeit many fall discovery calculations and gadgets have been presented, it is in its beginning phaseof improvement, it conveys extraordinary potential to be one of the main advancements sooner rather thanlater.

2. EXISTINGFALL DETECTIONTECHNIQUES:

2.1 Micro-Dopplersignature

Four key highlights removed from the micro-Doppler signature short-time Fourier transform analysis change the investigation coming about that include vectors which are utilized as individual, pairs, trios and all togetherbeforecontributing to various sorts of classifiers dependent on the discriminant examination strategy. The

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Issue: 5 | Pages: 1143 - 1147

presentation of various classifiers and distinctive element combinations examined targeting distinguishing the most fitting highlights for the unarmed against equippedpersonnel grouping, just as the advantage of joining multi static information as opposed to utilizing monostatic information as itwere [1].

2.2 Linear Predictive Coding(LPC): Linear predictive coding is one of the methodswhich is used widely in the areaof signal source modeling in signal processing. LPC is put forward to bring out the features of Micro Doppler that are the combination of different frequencies. This method not only represses the time frame that is essential to capture the Doppler signatures of human motion but also retrench computing time for extracting its features for real-time processing. Some of the human activities like running, boxing, bending, walking, crawling, sitting, and more, are the data extracted from 12 humans performing different activities using Doppler radar. A supporting machine is trained using these outputs of LPC to classify the activities. Extraction of the Micro Doppler signatures includes the effect of several LPC coefficients, size of sliding time window, and decision time framewindow [2].

2.3 Convolutional NeuralNetwork:

To build up a fall identification framework, two significant issues must be addressed the first is a classification of exercises and the other is analyzing the attributes of a fall addressed by a consecutive change in the present. Based on these two clues along with speed fall event can be identified the block of input frames represent input images and label block contains information about the pose representing a different type of activitiesand the block of subtraction extracts human silhouette.The block of the convolutional neural network takes input as the result occurring from the background and their corresponding label.An event of fall can be considered as series of change of poses and therefore recognition of all these poses in consecutive frames which indicates that the fall event might have occurred within those frames.With the help of background subtraction detection of human silhouette can be done, the mean values of pixels of both RGB and Depth images are used as a threshold [3].

2.4 Wireless Sensor Network:

It is a planned and actualized care framework that can recognize and confine the fall of a human. It is coordinated into existing low-tech homes, to empower Ambient Assisted Living conditions, where programming and equipment gadgets endeavor to encourage a protected and proactive autonomous living. The proposed framework design is comprised of a versatile gadget like a cell phone or a tablet, Zigbee, and an end-client cell phone. The versatile gadget consequently identifies the fall of a subject and sends an alarm message to the nursing place through the Zigbee passageway. The proposed framework accomplished a normal fall identification precision of 99.9%. Moreover, the framework could decide the area of the fall occurrence dependent on the triangulation strategy to help clinical staff locate the patient rapidly. The proposed framework was effective as far as fall precision and force utilization, as the framework could turn out ceaselessly for a multi-month without the requirement for a battery change and could send fall and area data overmultiple times [4].Table 1 list the key focus in pioneering papers.

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Issue: 5 | Pages: 1143 - 1147

Table 1: Key Results of Pioneering

S l no	METHOD	AUTHOR	TECHNIQUE ADOPTED	ADVANTAG E	DISADVANTA GE
1	**Micro-Doppler signature**	Raja syamsul, Azmirraja Abdullah,AsemAhmad Salah,AduwatiSali,AliAlnaeb	Discriminantanalysis method	100% accuracy achieved when ST-FT features are extracted and implemented	Complex installations
2	**Linear Predictive Coding**	Rios Jesus Javier and Youngwoo kKim	Linear predictive Coding for features extraction of Micro Doppler	The classification results are over 85% accurate	Interference on this method is more
3	**Convolutional Neural Network:**	Kripesh Adhikari, Hamid Bouchachia , Hammadi Nait - Charif	CNN trained with background subtracted RGBD	74% overall accuracy was accomplished.	System should have been generic.
4	**Wireless Sensor Network**	V.Sreenithi Nithya Selvabala , A.BalajiGanesh	Wireless network architectures; PIC18LF4620 wireless module	Precision up to 99.9%	Replacement cost is high

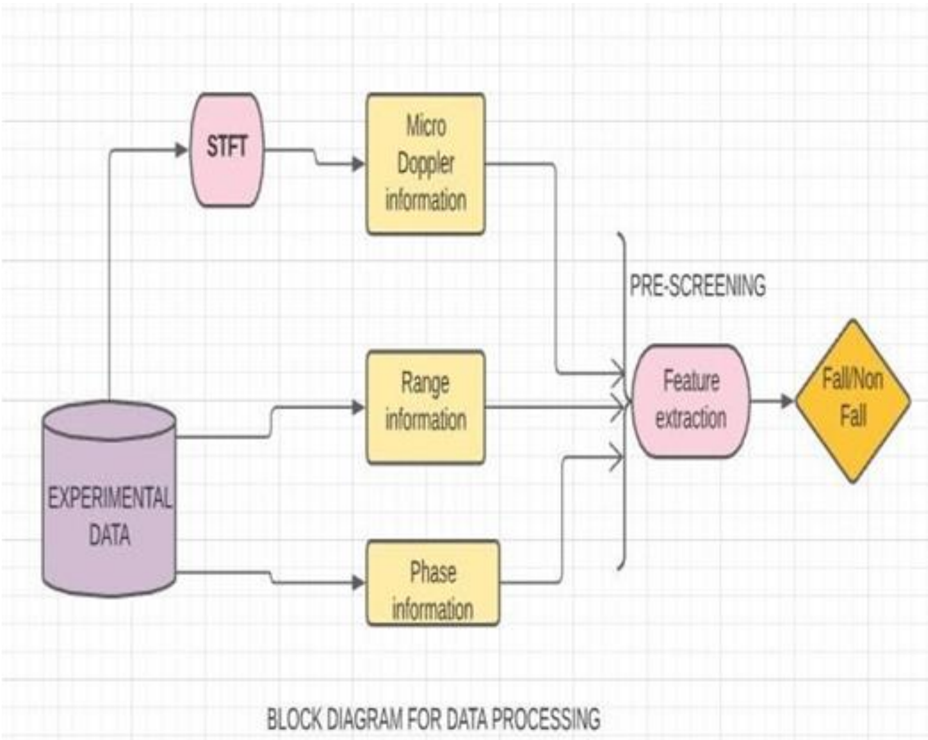

Figure 1: Data processing mechanism

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Issue: 5 | Pages: 1143 - 1147

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3. BLOCK DIAGRAM

The block diagram implementation of data processing for fall detection is described below. The trial information is first changed to a fitting area, trailed by a prescreening step which decides if a significant occasion may have happened and, provided that this is true, its time area. When an occasion is identified by the pre screener, an arrangement interaction is started to recognize whether such an occasion is a fall or a non-fall.

3.1 Experimental data

The initial stage is the collection of theavailable data set to improve the arrangementexecution.

3.1 Feature extractionmethod

To separate the highlights from the exploratory information it tends to be done in different space for example range area, stage space or Doppler space. On account of miniature Doppler data, an appropriatetime-recurrence change, like Short Time Fourier Transform (STFT), is applied totheinformation before the element extraction step to get the Time-Doppler example of the development of the objective.

3.2 Pre-screening

The element extraction step can bejoined with a pre-screening step to at select the information which can be utilized else dispose of the undesirable information.

4. Conclusion

In this review we give a holistic point of view on fall detection systems that includes data collection, data management, feature extraction method. In particular we compare methods that rely on individual sensors and micro doppler radar signatures the survey provides a description of the different method on fall detection and it is aimed to give a comprehensive understanding of working principles and techniques, that concern fall detection systems. Sensor fusion seems to be the way forward.It provides more robust solutions in fall detection systems but come with higher computational costs when compared to those that rely on individual sensors. The challenge is therefore to mitigate the computational costs. Using micro doppler signatures method for fall detection using discriminate analysis technique 100% accuracy can be achived. In this paper focus is on the detection of elderly falls since it is one of the many factors of autonomous health monitoring

systems. While the focus here was on elderly people, the same or similar systems can be applicable to people with mobility problems.

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A Comprehensive study of divergent technologies applied in Unmanned Ground Vehicles Surface Disinfectant Rover

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ABSTRACT

India is a country with a population of three-fourths in agriculture and most of the country covered in farmlands. But, some technical abilities along with technological assistance are necessary to achieve high output and excellent quality. The management of pests and insects is a critical component in the field of agricultural production. The agriculture fields face dramatic losses due to the diseases. The WHO (World Health Organization) estimated as one million cases of illness, when spraying the pesticides in the crop manually. The Unmanned aerial vehicle (UAV) – are used to spray the pesticides to avoid the health problems of humans or farmers when they spray manually. The goal of this paper is to analyze the various technologies and to find an alternative to the manual and conventional methods currently being employed in the field of agriculture. This paper provides a comparative table of 20 papers which were thoroughly surveyed to draw conclusions from their automated methodologies' final outcomes. This paper can be useful in the future for knowing which methods gave the best and highest accuracies, and further advancements can be done based on the inferences made from the literature survey done in this paper.

Keywords: WHO, UAV, methodologies, agriculture, pesticides, literature survey

I. INTRODUCTION

The pesticides have a vital influence on the agribusiness. Nearly 35% of crops have been safeguarded from the insects using pesticides. The pesticides are needed for agriculture to increase the efficiency but they are also injurious to humans and also to the environment [3]. The Economic Survey says that there is a need to improve farm mechanization in the nation. Increasing Pest infestation productivity control plays a significant role. The farmers are facing significant issues in managing pest infestation. Farmers are currently spraying pesticides around their fields using conventional methods which are time consuming,t. Moreover, they are manually spraying the pesticides and fertilizers in the field which in the long run might affect the health of the farmer as well.

The unmanned vehicle navigation showed rapid development in the science of robotics. Unmanned vehicle refers to a vehicle that operates without an on-board human presence. The vehicles which generally have a set of sensors installed on it to observe the environment, using the data from its sensors UGV either takes a decision itself using some intelligent algorithm or relays that data to a human operator to some other location who, given the data controls the UGV accordingly. Remote controlled UGV which doesn't plan it's path for itself, but it is an automated machine which sends the data to a human operator, then acts on human decisions. According to Association for Unmanned Vehicle Systems International (AUVSI), the unmanned vehicles were widely used in military projects, civil and commercial sectors.

Agricultural sector has attracted a lot of attention for drones. It is the purpose of this paper to explore the past efforts to utilize unmanned aerial vehicles (UAVs) in an agricultural setting, to discuss the camera technologies used by these UAVs and to find any possible future uses for UAVs with regards to agriculture. To collect the data necessary to perform this research, two interviews were conducted: first with UVIRCO, a developer and manufacturer of specialized camera equipment and second Aerobotics, a South African company that builds drones specifically for agricultural purposes. Drones can have a significant impact on the agricultural industry, as they can monitor several aspects of farming that humans cannot accomplish on their own. Drones can perform aerial mapping, giving a clear image of the total size of a crop field, as well as showing possibly underutilized areas of land. They can also, if equipped with the appropriate camera equipment, monitor the health of plants in terms of temperature, chlorophyll levels, foreign contaminants and even leaf thickness. This information allows the farmer to adjust the necessary parameters required for their agricultural process so as to address the problems before they become more widespread. This, in turn, results in higher crop yields, as many of the common agricultural problems can be identified and dealt with earlier than with conventional means of detection.

II. LITERATURE REVIEW

In paper [1], the authors give the architecture and a flowchart of the robot they have used in achieving the spraying robot. The main body of the spraying robot comprises the vehicle body framework, wheels, speed reducer, driving voltage, storage battery, sensing system, control system, and spraying mechanism. A reasonable mechanical structure design for the spraying robot can provide reliable stability, safety, and flexibility for the spraying robot during operation.

Regarding the turning mode of a crawler body, the track driving wheel on one side is braked to create different running speeds of the two tracks in order to turn. The braking devices for the tracks on both sides are controlled by a cable pulling mechanism, respectively, i.e., the brake cables. The robot uses a sprayer luffing and wagging mechanism as plants are in different sizes, the up-down amplitude of the sprayer must vary with the spray target.

Processing done on the images from the camera lens of the robot can distinguish about the obstacles ahead. The electronic compass detects the direction of the obstacle, the ultrasonic detects the distance of the obstacle, and when the detected distance is about 100 cm, the ultrasonic signals transmit to Arduino to steer the left and right wheels.

Final Outcome: The tracked spraying robot must be selected for a sloping or complex environment. The spraying mechanism contains the spray rise and fall driving mechanism, as well as the rotating mechanism of the spray platform. The spraying robot is an outdoor mobile robot able to detect fixed and moving obstacles, and uses its working parameters, such as coordinates, direction, speed, and acceleration signals, to judge potential hazards and determine corresponding countermeasures. A perfect and safe spraying robot with path planning and obstacle avoidance mechanisms is constructed, where the spray system design has up-down and left-right automatic spray functions in order to reduce areas of missed spraying and respraying.

In paper [2], the authors present a technological solution to the current human health hazards involved in the spraying of potentially toxic chemicals in the confined space of an atmosphere. This new approach mainly benefits from the existing technologies like the Global Positioning System (GPS), Global Information System (GIS), miniaturized IC, automatic control of various parts, remote sensing, mobile access, and control, advanced information processing, and telecommunications.

The main challenge faced in this paper was to design an adjustable chassis that could carry a load of 20-25 Kgs, so they came up with an aluminium chassis. Two D.C. motors are fixed in the backside with a torque of 30Kg.cm. The robotic arm is fixed in the center of the front portion of the robot to facilitate smooth spraying of pesticide in any direction. For the spraying mechanism, a DC motor pump is used which is commonly found in cars and for the storage device, a 4ltr container is chosen.

Final Outcome: The following points explain in brief the result achieved: -

1. Wireless operation will eliminate the health hazards and would even save the farmers from tedious work.
2. The use of manpower can be reduced.
3. Remote sensing operation leads to an efficient and health-conscious approach.
4. The device being an all-terrain robot can facilitate the farmer to control the robot remotely using the wireless communication technology.

In paper [3], the proposed system in this paper is an advancing exploration expected to override the standard spraying procedures with a cultivating mechanical sprayer. The robot investigates self-rulingly along with the vineyard, pushes and performs express spraying toward distinguished targets. A movable spraying gadget (ASD) was structured and worked as a trial instrument to execute the One Target-One Shoot (OTOS) spraying strategy. The gadget is mounted on a versatile mechanical sprayer and supplies pressurized pesticides.

The operational idea of the ASD is as per the following:

• Direct the siphon spout to confront the harvest (opposite to the yield)

• Calculate the separation of harvest object

• Find the objective's positions and widths remove;

• For each objective play out the accompanying daily practice. Direct the ASD toward the objective focus;

Pesticide spraying systems alongside the present mechanical technology innovation is the fundamental motivation behind their undertaking which would help the rancher in his everyday spraying action. This task is fundamentally achieved by a robot with a joined spraying instrument.

Final Outcome: The central duty of this endeavor is to structure up a novel spraying contraption that ensures full incorporation of the recognized article with the least shower. Pesticide application is decreased by spraying every goal independently. This is cultivated by planning the spraying device toward the point of convergence of the goal and setting the thin detachment of the spraying as demonstrated by the shape and size of the goal.

In paper [4], the authors explain how pests and microbes have induced plant diseases resulting in a huge post-effect scenario and how the quality and quantity of agricultural products decrease significantly. This scheme is based on two pistons filled with pesticide alternatively. Solenoid valves are under precise control of the inlet and outlet valves which offers a constant pesticide flow and precision that varies fluid characteristics without affecting flow conditions.

The robot web camera scans the crops up to a height of 3 feet. This live feed from the acquired plant is sent to the Video processor via Wi-Fi to Raspberry Pi. The algorithm analyzes automatically the number of pests on the plant, particularly the leafy region, using a video processing technique. To enhance its characteristics, the video undergoes pre-processing and segmentation by suppressing unwanted distortions and removing noise; it is also split into various components to identify the acquired picture.

Morphological operations are performed to process the video based on forms that help the robot spray various pesticides depending on the pest type. Noise removal takes place in two erosion and dilation steps. The algorithm code indicates the time to spray pesticide based on the number of plagues. The instructions for controlling robot motion are supplied via the L293D Motor Control Board, which is used as a driver circuit for the Robot DC Motor and Peristaltic Motor. DC Motor is used for the motion of the wheels and in turn the movement of the device and peristaltic motor is used for pesticide spraying. To detect pesticide levels, a Float sensor is linked to the microcontroller board.

Final Outcome: The use of machine learning and image processing helped to overcome the plant disease diagnosis. By achieving this, they minimized diseases within leaf, stem, plant by efficiently spraying pesticide. Since this can be controlled from anywhere without working in the field and being exposed to pesticides, it will be a profit for the farmer. He will stay unaffected by his health condition. Apart from that, it does not require any supervision for operating. It only needs pesticide level refilling and recharging the battery. It can be operated with a rechargeable Mobile Power bank. This paper suggests the effective use of technology to meet agricultural growth.

In paper [5], the design is done using Solid work software and the development of the autonomous pesticide spraying system based on the design. The development of the autonomous pesticide sprayer prototype consists of two parts: the navigation system and the spraying system. The interconnection between the selected components in the designed robot is crucial and plays a major role to make sure the robot functions as desired.

The navigation system consists of an ultrasonic sensor, microcontroller, four units of brushless DC motor with a motor driver for each motor, and a 24 V DC rechargeable battery. As the autonomous pesticide spraying robot needs to be able to execute both of the operations simultaneously, the sequence inside of the programming code plays a critical role in the designed project. The main components that consist of the spraying system are the reservoir tank, pesticide pump, 2-channel relay circuit, tube, and some mist nozzles for spraying under the crop leaves. The reservoir tank which is used in the autonomous pesticide spraying robot will be filled with pesticide incapacity of 10L although a maximum of 20 kg of the payload can be carried out.

Final Outcome: All the subsystems such as navigation systems and spraying systems are included and the autonomous pesticide sprayer robot can self-navigate by turning at the junction by using the obstacles detection concept inside the fertigation farm. The ultrasonic sensors were used which for the front sensor it was adjacently facing forward at 90° while the other two left and right both facing forward with deflection 45°. The ultrasonic sensor could detect the obstacles and stop without hitting the obstacles, respectively.

In paper [6], This study provides an overview of low-cost remote-controlled unmanned ground vehicles (UGVs). The data from different sensors, including as an ultrasonic rangefinder, magnetometer, infrared sensor, motion sensor, and GPS, is collected and processed by the microcontroller placed on the UGV. It delivers the data back to the base-station through the XBEE module linked to it after assembling the data in a certain pattern. A wireless IP camera with pan/tilt and night vision is connected to the UGV. This camera can be connected to the internet, allowing users to view footage from the UGV from anywhere on the planet. The computer receives the data from UGV through XBEE and displays it on a graphical user interface (GUI) for the operator to understand the environment easily. This is a full duplex communication. The computer receives data from the UGV through XBEE and displays it on a graphical user interface (GUI) so that the operator may readily comprehend the surroundings. This is a two-way conversation. The operator may provide commands from the PC at any moment, which the microcontroller mounted on the UGV receives over the same XBEE module and processes before sending the commands to the motor drivers. These modules then interact with one another using various protocols: the microcontroller connects with the GPS and wireless XBEE modules through serial protocol, while the magnetometer is linked to the microcontroller. The NMEA hashes are sent to the microcontroller through the serial port by the GPS. After extracting the longitude and latitude information, the microcontroller analyses the data and sends the coordinates to the base station. These coordinates are also saved in a text file on the base station in order to map the UGV's route.

Final Outcome: The low-cost remote-controlled ground vehicle mentioned in this study was successfully constructed, demonstrating the vehicle's potential use. The focus of the research was on cost-effectiveness; all of the equipment utilised in the creation of our UGV was picked after careful cost and performance analysis. We conclude from this study that current research on remote controlled vehicles proposes cost-effective techniques such as simplex communication, and that military/industrial level remote-operated vehicles require a significant amount of money in development. The design method proposed in this study is cost effective and suited for applications such as military exploration and surveillance, as it uses full duplex transmission.

In paper [7], Ground mobile robots, which are equipped with modern technologies for location and orientation, navigation, planning, and sensing, have already shown their benefits in outdoor applications in industries such as mining, farming, and forestry, according to this article. The commercial availability of GNSS has made it simple to design autonomous cars or navigation systems to help drivers in outdoor situations, particularly in agriculture, where a variety of extremely precise vehicle steering systems are now available. This platform was built for agricultural activities in wide-row crops, with considerable ground clearance and a 1-meter wheel separation. The platform is made up of four-wheel modules that are all the same. Each one has a cordless electric motor that provides direct-drive power, as well as a separate motor for steering. This is a platform with two front fixed wheels and two rear caster wheels that follows the skid steering system. It's designed to function independently on large-scale and horticultural crops, providing fertiliser, identifying and categorising weeds, and physically or chemically destroying weeds.

Final Outcome: The agriculture industry should take a proactive approach to developing the smart farm idea. This session looked at the history and current advancements of UGVs for agriculture, as well as some of the qualities that these robots should have in order to meet the needs of smart farms. To that aim, this chapter discussed and criticised two tendencies in the development of UGVs for smart farms based on commercial vehicles and purpose-built mobile platforms. The former is important for assessing the benefits of UGVs in agriculture, but the latter provides additional benefits such as enhanced agility, improved crop adaptation, and improved terrain adaptability.

In paper [8], The UGV control system may be divided into an on-board control subsystem and a remote-control subsystem, according to the paper's physical system architecture. The behaviour decision layer, trajectory tracking layer, motion control layer, and environment sensing module of the hybrid architecture correspond to the on-board control subsystem. A job planning layer, GIS module, and human-machine interface module are all part of the remote-control subsystem. Hierarchical control layers include the task planning layer, behaviour choice layer, trajectory tracking layer, and motion control layer, which serve as the system's primary body. The task planning layer decomposes macro tasks into subtasks that may be completed using Task Oriented domain knowledge. The task elements and task flows are extracted from the subtasks by the behaviour determination layer, which then creates the appropriate behaviour sets based on the geographic data. The trajectory tracking layer uses information about the surroundings and the produced behaviour to generate actions that the UGV can do. The motion control layer completes the mapping of platform actions to the underlying servo control instructions. The human machine interaction module, which serves as an interface between the operator and the UGV's control system, allows the operator to easily run each level of the control system in order to achieve remote control at various autonomous levels.

Final Outcome: They built a tracked UGV control system based on hybrid architecture and tested it on an unstructured route, taking into account the necessity for autonomous manoeuvring and teleoperation. The verification results show that the control system can meet the task-oriented autonomous manoeuvring requirements of UGVs and has good fusion ability for machine and human intelligence.

In paper [9], The paper describes the design, construction, testing and implementation of a UGV for security applications using the latest wireless computer communications and carefully designed mechanical and electronic systems for effective control and maneuvering. A 2-mm thick steel sheet was selected to be used as base to support the computer and electronic equipment as well as the poles and pan and tilt systems for cameras and gun and ammunition system. The plate is attached to the base via non-permanent connections, allowing for simple installation and removal. The sheet's front-end corners are chamfered to allow the improved steering system to move as far as possible, and the plate's side edges are rounded for safety. The rear and front cameras are mounted on commercial pan and tilt systems with 360° and 180° tilt rotations, respectively. The rear pan and tilt mechanism is mounted on an antenna-style pole with heights that may be adjusted manually. The height is adjusted to provide a clear view of all obstructions in front and to the sides. Rather than delivering a working product, this initiative attempts to demonstrate the technology transfer process and local capabilities. As a result, testing has been limited to simply the functional aspects. There have been two test periods. Many modular and functional testing were carried out while developing the UGV. Each component of the vehicle was put through its paces. The braking and acceleration modules, as well as the communications, steering, and visual systems, are all tested in the lab. The observations are then used to tune and modify these modules. The braking and acceleration modules, as well as the communications, steering, and visual systems, are all tested in the lab. The observations are then used to tune and modify these modules. The mechanical systems were designed in a straightforward yet effective manner, with all parts integrated into the vehicle and only minor alterations made.

Final Outcome: Unmanned Ground Vehicles (UGVs) have been built and manufactured using commercially available components. The control system was created utilizing a methodical methodology that is effective in the setting of rapid prototyping. The major gateway for controlling and connecting with the vehicle has been a server PC. Aside from the PC, two microcontrollers were employed in a master/slave configuration to control the various actuators that aid in vehicle control. As a communication medium, standard wireless LAN technology was used. Both in the lab and in the field, functional testing was conducted. The key conclusions were that power usage and battery life might be improved.

In paper [10], This article created an InSAR prototype for off-road scene perception using a UGV. The radar is installed on two tripods with a height equivalent to that of ordinary UGVs, despite the fact that it is not mounted on a UGV. A rough meadow field with a man-made mound (positive obstacle) heaped and a pit (negative obstacle) dug was chosen to test the InSAR's obstacle identification capabilities. Because the platform of the InSAR differs from that of previous ones, the essential signal processing flow is identical. A unique, forward-thinking design The ground plane is used to produce the complex image pair in the SAR signal processing loop. When a positive obstacle faces the radar, the leading edge will have strong backscatter energy, but the trailing edge of the positive obstacle obstructed by the leading edge will have weak backscatter energy. When a negative obstacle presents, on the other hand, the leading edge of the negative obstacle that faces the radar will display strong backscatter energy, while the trailing edge of the negative barrier that is blocked by itself will show weak backscatter energy. This one-of-a-kind ability to recognize positive and negative impediments will improve the unmanned ground vehicles' survivability.

Final Outcome: This paper introduces a unique InSAR that can give autonomous ground vehicles and off environment awareness. The scattering image, coherence image, and slope image can all be output by the radar at each scan position. The scattering image, coherence image, and elevation image are all valid indicators of obstacles and topography in the scene ahead of the UGV, according to the results of the experiments. The InSAR can detect positive and negative obstacles based on image properties of positive and negative obstacles.

In paper [11], This paper describes how to implement smart farming and agriculture with drones. The sensing technology presented in this paper is meant to be used as part of a robotic assessment system composed of an aerial vehicle, an RGB-D sensor and a software interface responsible for the navigation phase and the post-processing of the acquired data. Many different avionics could be used to achieve the terrain assessment. In particular, in the literature and in the market domain, many aerial system producers propose both fixed and rotary wings alternatives. As an example the sense Fly company proposes an advanced drone with autopilot capabilities that can handle take-off, flight, and landing autonomously. The drone is also packed with a high-resolution camera that might be useful for 3D maps with 5-10 cm accuracy. The proposed system employs a commercial low-cost RGB-D camera, an Asus Xtion Pro, for the visual analysis of the soil and thus it can be employed both in a fixed-wing drone or in rotatory wings like a multi-rotor system. Localization, navigation and mapping has been a very active area of research lately and many works. Apart from the need to use sophisticated techniques, for the purpose of navigation of our system it is necessary to use the old system of sensor integration that includes GPS integration with Inertial Navigation Systems (INS). In fact these two sensing modalities are extremely complementary: the GPS module provides a slow update of positional information with bounded error, while the INS system provides unbounded integration error, but with a fast update rate. Combining the two, it is possible to achieve a high level of local reliability. For the purposes of our goal, this technology is sufficient and the use of a standard Extended Kalman Filter solution for the navigation problem is advised. Several software solutions are freely available for download over the Internet for the automatic navigation control of drones equipped with a GPS module. In order to collect topological data for the surface analysis of the different fields, a point cloud representation of the three-dimensional structure of the field has been created. The AUV should be distance controlled with respect to the terrain; to do so a simple PID controller can be implemented using, as sensing technology, a camera (video based) or an ultrasound/infrared distance measurement sensor. Next we would sample the mesh with an evenly distributed grid.

Final Outcome: The presented work describes a vision-based technique for the analysis of soil characteristics. In particular the method has been employed in the plowing type discrimination and the solution has been tested on field. The experimental results prove the feasibility of the proposed approach as a terrain classifier. The software is able to discriminate among three different plowing depths which are in this case plane, 25cm, 50cm.

In paper [12], This paper describes the application of drone systems in precision agriculture. The flight controller is the main board in the UAV, is embedded with the most advanced firmware and responsible for the actual flight. Flight controller controls a lot of things simultaneously during the flight or UAV. It is built with a micro controller and communicates to the four brushless motors. BLDC motors connect with the rotors in directions of the UAV configuration model. Electronic speed controllers are used to control the BLDC motors. The UAV is controlled by the Radio channel transmitter and receiver. Every RC transmitter has a number of channels for individual activity to control the UAV. A sample block diagram shown. Various modes, controllers, load and speed of UAVs are displayed

Final Outcome:

In the past decade latest technologies are included into precision agriculture to improve the productivity of the crop. These technologies are used where human presence is not possible for spraying of pesticides and fertilizer on crops and non-availability of the labor. It also helps the spraying job easier and faster. The proposed system defines plant leasing with a multispectral camera. In one flight the camera takes pictures and analyzes the geographic indicator. These results can be used to find where to spray the pesticides. The UAV sprinkling system auto navigated with the GPS coordinates to spray the pesticides on the infected areas where no vegetation was identified by the NDVI. This could also reduce the wasting of water and chemicals.

In paper [13], the authors present a technical report on drones for smart agriculture. Agriculture Wonder Drone System using microcontroller 8051 The proposed system is an embedded system which will closely monitor and control the microclimatic parameters of a greenhouse in interval basis round the clock for the growth of crops and plants and also maximizing the production over the whole season of the growth of crop, reduce the difficulty of production by avoiding human contact as much as possible. The system comprises sensors, Analog to Digital Converter, microcontroller and actuators.When any of the climatic parameters safety threshold is crossed, which are used to maintain and protect the crops, the sensors sense this change and the microcontroller reads this from the data at its input ports in digital form using ADC converter.

The microcontroller then performs the needed actions by using relays until the out-of-range parameter is back to the normal range. Since a microcontroller is used as the main part of the system, this ensures it is low cost and also reliable to use. The system employs an LCD display for regularly alerting the user about the condition inside the greenhouse, the entire setup becomes user friendly. Thus, by using this system, we can remove the drawbacks of the existing set-ups which are also designed in a way that is easy to maintain, flexible and low cost.

Final Outcome:

The agriculture drone can be used to improve the crops yields and quality. It can help the farmers to transform the agriculture industry. Nowadays farmers use a hand pump for spraying pesticides. Human beings take a large amount of time to spray the crops and they don't uniformly spray the pesticides. But by using drones we can complete the spraying work in less amount of time as compared to humans. Human beings charge 100/- to 200/- rupees per day for pesticides spraying, as compared to the drone that takes 3 watts of power then it will charge 10/- rupees only for electricity. Drone will save the time of spraying pesticides and also it will reduce the diseases caused by fertilizer to the human body such as skin diseases as per the research of World Health Organization (WHO). Hence, drones will minimize the efforts of farmers for agriculture purposes.

In paper [14], the authors discuss the influence of drone monitoring on crop health and harvest size. Aerobotics Figure below shows an example of a vineyard that has been surveyed by a drone and subsequently shown as an orthomosaic. Each white square seen in the image is a single picture taken by the drone, and software has been used to stitch these together by using the GPS coordinates of each picture to obtain the farmland as one image.

One of the other data outputs of the software used is a Digital Elevation Model (DEM), which shows a 3D version of the terrain, which can be used to determine where there's a flat ground which can be used to plantation, or where mountainous terrain which can be used to provide shade and where there are riverbeds.

Final Outcomes:

The camera on the drone can be used to view from multiple angles. It is a much more accurate way to monitor a farm than doing it by foot. Drones can create a digital map of the field, find problems with plant health, find lost livestock, find leaks in irrigation systems, find the size and spread of fires and potential pesticides. Drones provide some form of benefit to almost all the farmers who use them. They can make good use of their land, eradicate pests before destroying all crops, improve soil quality to improve growth in problem areas, improve irrigation of heat-resistant plants and track fires before they emerge from power. There are simply too many benefits to using a drone for agricultural monitoring and management for farmers to ignore it.

In paper [15], the paper is about soil sampling with drones and augmented reality in precision agriculture. The variations in the soil plot are visible in RGB. Thus, a drone is equipped with an RGB camera for aerial imaging. Aerial imaging was used with autopilot. The smart glasses chosen for this application (ODG R-7 Smart glasses, Oosterhout Design Group, San Francisco, USA) are seen. The glasses are equipped with a small android-based computer. The glasses use optical see-through technology, as the virtual content is shown on two see-through displays in front of the user's eyes. Augmented reality software can be developed using a software development kit (SDK) providing functionalities needed for AR. The input data for the smart glasses software from the previous phases contains the latitude, longitude, altitude and the region number for each sample point. An ID is created for each sample point in the region. This data is stored in the AR module of the software along with the collect status.

Wikitude's action range is used for collecting a sample point. If the user's GPS location is within the radius from the GPS location given to the action range, the user is registered as inside the action range. This is used to image the area of interest in a AR manner

Final Outcomes: In this article, a complete chain of actions from ploughing to soil sample analysis was presented to create a top soil map with management zones for precision farming purposes.

In paper [16], a novel method is introduced that uses an FSM to work out the relative position of the robot with reference to a marked path. A major advantage of this approach with respect to the previously proposed methods, is that complex paths can be identified and handled appropriately without the need of sophisticated or customised sensor configurations. We assume that a collinear array of N IR-reflectance intensity sensors is placed at the front side of a differential drive robot, perpendicularly to the line and that the distance between individual sensors is equal or but the road width

A transition between states occurs if the current input X = V¯i satisfies the condition cond. |X| indicates the number of consecutive appearances of X on V¯ up to the examined sensor i. 2.1 Line visibility Primarily, the FSM determines whether the line is visible to the robot. The line Visible state flag declares that at least one sensor detects a line according to: lineV Visible = N i=1 (Vi ≥ av) which denotes the logical OR operation. We can enumerate three distinct cases where the robot does not detect the line (line Visible = false): • Robot lost the line after a right-angle • Robot lost the line during a curved part • Robot lost the line on a dashed line part.

Final Outcome: In this paper a novel FSM for real time state estimation is introduced to identify measurement irregularities caused by false or noisy sensor measurements. Depending on the states of the FSM, the robot switches between a proposed variable-gain PD controller for accurate line following and a predetermined open loop controller that handles special cases such as when the robot sensors have lost the line. As proved in the experiments this approach improves the performance of the robot by identifying and discarding confusing sensor inputs that could cause deviation from the desired path. The proposed controller outperforms classical P and PD approaches as well as other line following control methods from the literature.

In paper [17] We study a Line Following robot Using Arduino And Its Applications Block Diagram of Line Follower Here firstly, we chose a configuration to develop a line follower only using two infrared sensors with connection of Arduino Uno through motor driver IC. We followed a block diagram in this regard. The diagram illustrates the connection for the event of the road follower which follows a black line on white surface.

PROCEDURE OF SENSING THE LINE

The line follower robot is a kind of a design which is similar to a light follower robot. Here, besides sensing the light, the sensor is used for detection of a line. Therefore, by individualizing the colour of line and its enclosing, any light sensitive sensor could be used for navigation of the robot to follow its designated track. The design of the robot was made like; it had one pair of Infrared ray sensors fitted underneath the robot. So infrared ray sensor will first be sending a wavelength for detecting black line and then other infrared ray sensor will be receiving the information and take decision for following a black line on white surface. With the supply from an 9V DC power adapter the whole sensor and the motor driver IC and the motors and Arduino are powered. Making the setup less prone to power failure The outputs of the sensor circuits are connected as in the analog inputs of the Arduino board.

ALGORITHM 1] When both sensors see white both wheels spins at same speed and the robot goes straight.

2] When the "Left" sensor sees black and the "Right" sensor sees white robot moves left.

3] When "Right" sensor sees black and "Left" sees white robot moves right

Final Outcomes: The Robot follows a specific line path simultaneously. This line follower robot with multiple modes compatibility works perfectly fine as it is designed to do and thus an attempt will be made to solve the unplanned and unauthorised parking problems in the resident area using prototype valet parking robot. The slot type and state of the slot will be identified using Sharp IR Sensor. And simultaneously we can perform the Buzzer beep operation, object identification, Lcd display, robot direction control operation and will finally execute parking near to the end.

In paper [18] We study about the consistent with the primary National student's Robotic Competition of the University of Tabriz, IRAN in 2009. The scales and angles of the trail are often different in each ground. Actually each ground or competition has its rules and perhaps it's different from the others. We explain some path rules with them below: Usually the bottom color is white and therefore the path color is black and line width is variable between 15 to 20 mm. The line color and ground color are often exchanged together. There is some unwanted change in line width.

Final Outcome:

In its current form the robot is capable enough. It can follow any curve and cycle. We must build a robot that has light weight and high speed because points are awarded based upon the distance covered and the speed of the overall robot. Therefore, we used two high speed motors and a high sensitivity sensor circuit. The body weight and wheel radius have effects on speed, too. The weight of the designed robot is around 300 gram and it is often lighter. To get better maneuver, we must build a robot that uses two motors and two wheels on the rear and a free wheel on the front. The power supply is 12 with a regulator. The designed robot has eight infrared sensors on the bottom for detection. Microcontroller ATMega16 and driver L298 were wont to control direction and speed of motors. The robot is controlled by the microcontroller. It changes the motor direction by giving a signal to the driver IC according to the received signals from sensors.

In paper [19] Evaluation of antibacterial activity of silver nanoparticles and peroxide Antibacterial activity was evaluated for PVA-AgNP and PAH-AgNP by constructing survival curves which measure the amount of surviving bacterial cells over treatment time. With each type of AgNP, three different treatments were investigated including 1.0 mM AgNP alone, 10 mM H2O2 alone, and combination of 1.0 mM AgNP and 10 mM H2O2. For the combination treatment, 0.5 mL of AgNP and 0.5 mL of bacterial inoculum were added to 3.5 mL PBS in a sterile glass vial. After a quarter-hour, 0.5 mL H2O2 was added to the previous mixture. Similar procedure was followed when testing the activity of every agent alone (i.e., AgNP alone and H2O2 alone) but with replacing the other agent (H2O2 and AgNP, respectively) with PBS. Furthermore, the intrinsic antibacterial activity of each capping agent (PVA or PAH) was evaluated by a procedure similar to that used for AgNP alone but with replacing the AgNP dispersion with a similar volume of the free capping agent solution. At different time points (15, 30, 45 and 60 minutes starting from the addition of H2O2), 20 μL samples were taken and immediately added to 180 μL PBS containing 0.5% w/v cysteine (L-cysteine, Sigma Aldrich, UK) as a neutralizer on which viable count was performed by the colony count method. Samples taken from a mixture of 0.5 mL bacterial inoculum and 4.5 mL PBS were used as the untreated control (i.e., to represent the zero-time point). Bacterial survival at each time point was calculated as a fraction by dividing the number of surviving cells at that point by the number of surviving cells in the corresponding control.

Final Outcome:

In this study, two types of silver nanoparticles were synthesized and characterized: non-ionic PVA-capped AgNP and cationic PAH-capped AgNP. Although PVA-AgNP showed only bacteriostatic activity, their use in combination with hydrogen peroxide resulted in complete killing of both Escherichia coli and Staphylococcus aureus in 45 and 60 minutes, respectively. Treatment with PAH-AgNP alone resulted in bacteriostatic to slightly bactericidal effect but its combination with peroxide resulted in complete killing of both Escherichia coli and Staphylococcus aureus in even shorter treatment times (15 and 45 minutes, respectively). This significantly enhanced activity of silver nanoparticles when utilized in combination with peroxide clearly indicates a synergistic effect between these two agents which may be attributed to a Fenton-like reaction generating the highly bactericidal hydroxyl radicals. The high bactericidal activity of this technique, its residual activity (provided by the released silver ions) and therefore the incontrovertible fact that silver nanoparticles are often surface modified to permit selective targeting of bacterial cells make it possible to use this system in a much wider range of antibacterial applications compared to the traditional Fenton reaction.

In paper [20] Using a final hydrogen peroxide concentration of 6%, 8% and 10% prepared by diluting the original stock solution/reagent with distilled water. The three concentrations of H2O2 tested worked with the following observations: A 6% Hydrogen peroxide is the lower threshold that will produce desirable disinfection. However, any mishandling, leak or degradation of peroxide solution due to poor storage has the potential to compromise the effective dosage and hence the process. At 10% hydrogen peroxide, we observed that the machine requires extensive cleaning after every cycle, often not feasible in the operational settings; or else the vaporization nozzle of the machine may get fully or partially clogged yielding unsatisfactory results. In our experience, 8% hydrogen peroxide solution provides the perfect balance in consistently ensuring complete disinfection without significantly increasing the cost.

Final Outcome:

Any intended method developed to enable a selective reuse of PPE should be able to meet a couple of broad requirements. Not only will it be able to disinfect the used PPE but also it should not negatively impact the integrity and functionality of treated PPE. In addition, the method should have the potential to be easily and economically scaled up. Our results show that the VHP-based disinfection method successfully fulfills these requirements and therefore is a suitable process to ensure a safe and effective reuse of PPEs. Considering the compatibility of VHP-based disinfection method to a broad range of PPE make and kinds (Masks, coveralls, face-shields), we believe that VHP-based decontamination protocol will have a universal applicability and utility in mitigating the shortages of PPE in situations like that of COVID-19.

III. CONCLUSION

This review paper can be used to compare the results of each paper in the literature survey and draw conclusions based on the methods used in the surveyed papers and their final outcomes. It also gives us an overview of the bigger picture which includes the present applications of technology and how the advancements of different methodologies can be revolutionary in the agricultural field.

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Steganography Technique to Secure Patient Confidential Data Using ECG Signal

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***Abstract*—Communication of medical data to the patient is changing in the current scenario, people no longer visit the hospitals and collect their reports and medical documents. The doctors' offices send the patients report via email or through online portals. These options are efficient and easy, but they place the patient at a higher risk of medical data theft because information security of data transmitted over the internet is the biggest concern. Healthcare data breaches expose patient's sensitive information such as patients' medical history, medicare number, health insurance information. Hence, special care must be taken to transmit patient data. To overcome the challenges of security and privacy of sensitive data, an ECG-Image Steganography model is proposed. This model is a combination of steganography and cryptography. This hybrid model is a remarkable technique for information security.**

Keywords—cryptography,steganography,AES_256,LSB, IWT

I. Introduction

Whenever a patient's confidential information such as name, age, basic details such as treatment number,insurance details,existing bank accounts are transmitted over the internet network, there may be an opportunity for a hacker to attack the information,there is also a chance for hackers to access the existing accounts of patient and also create fraudulent accounts thereby stealing money along with the data.So, effective security for information protection is mandatory. The patient must control his/her confidential data, so that no third party can access confidential data. In order to prevent unauthorized access to the confidential data, this strategy can be implemented.

Lots of hiding techniques have been proposed and gained huge popularity.Steganography is the study of concealing information (message) inside the other host information (cover), here we have used ECG Image. This technique includes, concealing patient information inside the ECG signal picture of the patient.

In[1] we can see,based on the results, time taken for encryption and decryption in RSA is more compared to AES & DES. Even the observed results indicate that AES is much better than DES and RSA.In [2],authors conveyed about three tier security that any doctor can see the Stego ECG signal, but only authorized doctors can extract the secret information,then in [3],scientists told about adaptive data hiding method on ECG signals with the purpose of protecting the privacy of patients' information in remote health care systems using the LSB matching algorithm.Later in [4], Haar wavelet decomposition and RSA based encryption technique is introduced to encrypt ECG and text information. Singular Value Decomposition (SVD) and steganographic concepts are used to embed the data and send through transmission media in a highly secured way.[5] tells the ,IWT technique based on the LSB algorithm.The proposed algorithms extract the hidden data efficiently without using the original cover image. It can embed a larger secret text (up to 8 192 digits in the case of grayscale images and 24 576 digits in the case of color images) with better results of PSNR and NCC. Later in [6],scientists suggested a wavelet-based steganography for ECG signals to conceal patient data just as indicative data inside ECG signals with an encoding method to encrypt the patient's classified data. The difficult errand here was to hold innovation of ECG signal information to stay diagnosable in the wake of recovering patient restricted intel from ECG signal.

II. Proposed Work

The proposed strategy utilizes a model which includes encryption to permit removing the information which is covered up. At the medical clinic server, the ECG signal image and its secret data will be stored. Any authorized individual can see the ECG signal and the information which is embedded in it and just approved and certain managerial faculty can extricate the privileged data and can approach the secret patient data just as different readings put away in the patient's ECG signal picture.

The proposed system has Four Stages: 1) AES-256 Data Encryption 2) Data hiding in Image using Steganography 3) Data extracting from Image using Steganography. and 4)AES-256 Data Decryption

A. *Collecting ECG Signals*

The first step in the proposed work is to collect ECG Signals of different patient's from an online database.The ECG signals are obtained from PhysioNet service (http://www.physionet.org) from the MIT-BIH Arrhythmia database presented in a website called *Mendeley data* https://data.mendeley.com/datasets/7dybx7wyfn/3. All ECG signals were recorded at a sampling frequency of 360Hz and a gain of 200adu/mV. Data is in. mat format (MATLAB)

B. *Converting ECG Signals to images*

After collecting signals which are in .mat format, we need to convert those signals to images. As in our case we are using images instead of signals, the benefit is that we can use any other medical images also instead of ECG but as ECG is very common and is unique for every individual , we have preferred that. We converted signals to images with the help of small MATLAB code.
Figure 1 shows the image obtained from the signal.

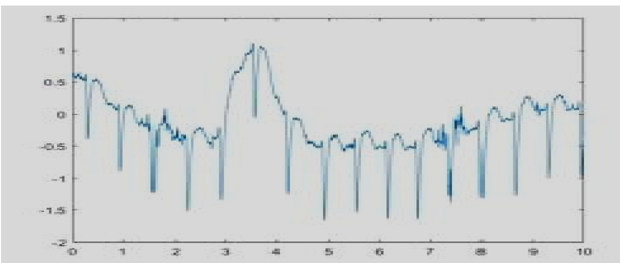
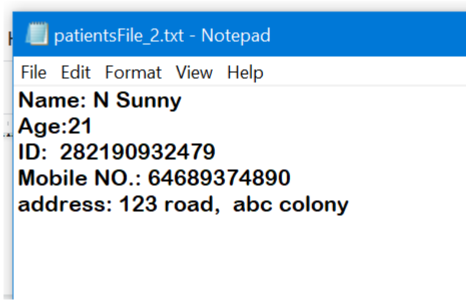


Figure:1. ECG Signal Image of Patient

C. *Encryption of patients' Confidential Information*

The aim of using AES_256 encryption algorithm is to prevent unauthorized persons from accessing patients' sensitive information. On the sender's side the patient's detail is encrypted using a 256 bit key and the same key is used for decryption at the receiver end because AES is a symmetric key encryption algorithm.Figure 2 shows a sample of the patient's confidential information.



patientsFile_2.txt - Notepad

File Edit Format View Help

Name: N Sunny
Age:21
ID: 282190932479
Mobile NO.: 64689374890
address: 123 road, abc colony

Figure 2.Patient information

INPUT: Patient's File
OUTPUT: Encrypted Patient's File
Step1: The cipher takes a plaintext (patient's data) block size of 128 bits, or 16 bytes.
Step2: A secret key of a 256-bit hexadecimal is entered. It is generated randomly.
Step3: 256-bit key is then expanded using Key Expansion Algorithm and made into 60 to 240 words/bytes.
Step4: AES_256 rounds are performed which depends on key size. The key is 256-bit so a total of 14 rounds are performed.
Step5: An initial single transformation (AddRoundKey) is performed before the first round, which can be considered as Round 0.

D. *IWT*

The IWT transform maps an integer data set into another integer data set.The LL sub-band in the case of IWT transform appears to be similar with a smaller scale of the original image.The lifting scheme is one of many techniques that can be used to perform the IWT transform.Due to its numerical advantages, IWT is able to transform integer wavelet coefficients from the pixel value and reconstruct the image from integer wavelet coefficients[7].

E. *LSB*

Least Significant Bit Steganography (LSB) is an embedding technique that involves overwriting the last bit with the arithmetic value. It is a spatial domain technique, in which the last bit is replaced by the encrypted data obtained from the AES_algortihm. The cover image and the stego image are similar to each other, however the flip side is that for each byte of encrypted text we require 8 bytes of image.Thus,embedding the sensitive information in done as shown in figure 3 and extraction of the sensitive information is done as shown in figure 4.

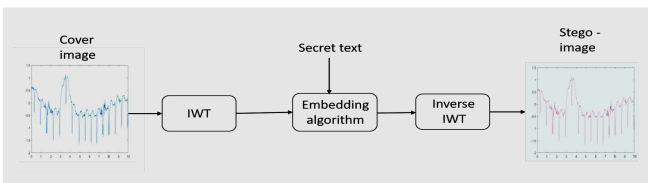


Figure:3. Embedding Confidential Data in ECG Signal using IWT-LSB Steganography Technique

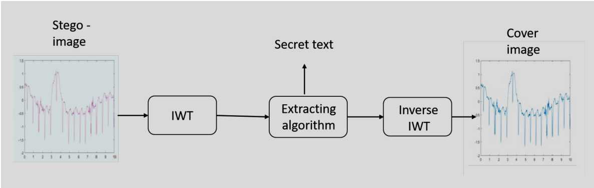
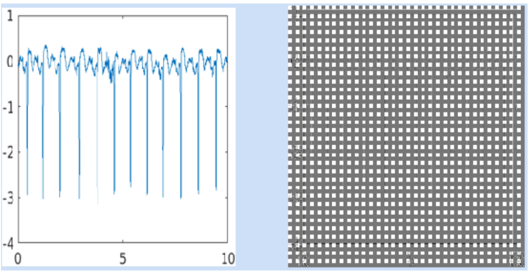


Figure:4. Extracting Confidential Data from ECG Signal using IWT-LSB Steganography Technique

(i) Steps of the proposed hybrid IWT-LSB embedding algorithm applied on grayscale images

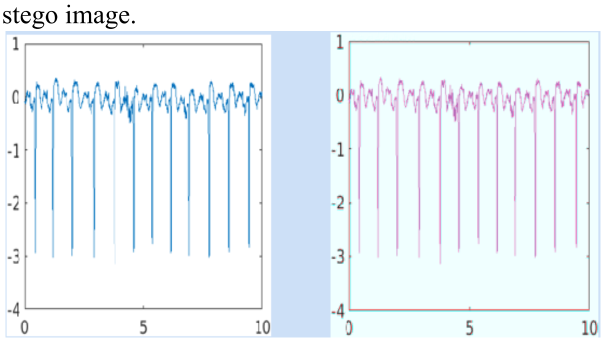
Inputs: ECG cover image and secret text.
Outputs: Stego image (image containing a hidden secret text).
Step 1: Read the ECG cover image.Figure 5 (a) shows the Input ECG image .
Step 2:Perform Histogram Equalization.
Step 3:Apply the IWT transform for the ECG cover image. Figure 5(b) shows the ECG image after integer transform.



(a) (b)

Figure 5: (a)Input ECG Image (b)Input ECG Image after IWT

Figure 6 (a) shows the input ECG image.
Step 4: Read the Confidential data in .txt format.
Step 5: Generate a secret key.
Step 6: Replace the LSBs of the approximation coefficient image by the secret text.
Step 7: Step 4 will continue until the secret text is completely hidden into the cover image.
Step 8: Apply the inverse IWT transform.
Step 9: Write the stego-image.Figure 6 (b) represents the stego image.



(a) (b)

Figure 6:Input ECG Image (b) Output ECG Image after inverse IWT

Step 10: Calculate the MSE and PSNR of the stego-images.

(ii) Steps of the proposed hybrid IWT-LSB extracting algorithm applied on ECG cover images

Inputs: Stego image
Outputs: Confidential data in .txt format
Step 1: Read the stego-image.
Step 2: Apply the IWT transform for the stego-image.
Step 3: Extract the confidential data from the approximation co efficient image of the stego-image.
Step 4: Step 3 will continue until the confidential data is completely extracted.
Step 5: Apply the inverse IWT transform.
Step 6: The extracted image is now formed.
Step 7: The confidential data is now extracted in .txt format.

F .Equations

MSE stands for Mean Square Error.

The equation to find out MSE value is

$$MSE = \frac{1}{mn}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}[I(i,j) - K(i,j)]^2 \quad (1)$$

PSNR stands for Peak Signal to Noise Ratio

The equation to find out PSNR value is

$$PSNR = 10.\log_{10}\left(\frac{MAX_I^2}{MSE}\right) \quad (2)$$

Table I shows the comparison of MSE and PSNR values of different ECG Signal samples by using the (1) and (2).

TABLE I. Comparing the MSE and PSNR values of different ECG Signal Samples

Sl.No	*Cover Image(Patient's ECG Signal Images)*	*MSE*	*PSNR*
1	ECG Signal Image_1	1.80	45.55
2	ECG Signal Image_2	1.13	47.59
3	ECG Signal Image_3	1.46	46.46
4	ECG Signal Image_4	1.59	46.10
5	ECG Signal Image_5	1.71	45.78
6	ECG Signal Image_6	1.46	46.47
7	ECG Signal Image_7	2.01	45.09
8	ECG Signal Image_8	2.00	45.10
9	ECG Signal Image_9	1.94	45.24
10	ECG Signal Image_10	1.77	45.63
11	ECG Signal Image_11	1.65	45.96
12	ECG Signal Image_12	1.81	45.54
13	ECG Signal Image_13	1.58	46.12
14	ECG Signal Image_14	1.58	44.11

15	ECG Signal Image_15	1.55	46.20

III. Experimental results

The results of the above is been shown or experimented with the help of MATLAB Gui and same is shown below:

1. Encoding: Patient's Details Encoded with AES_256.Encoding is shown in figure 7.

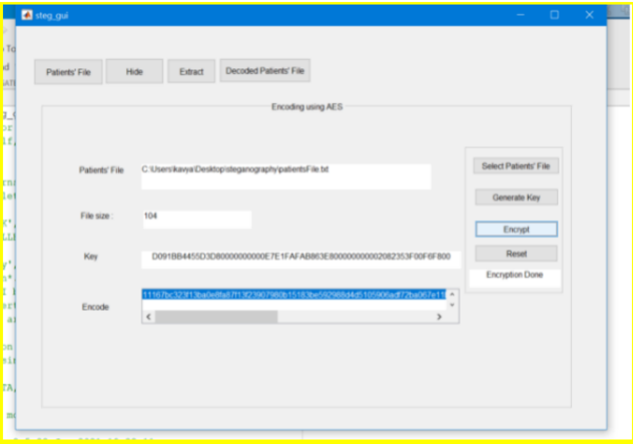


Figure:7. AES-256 Data Encryption

2.Steganography: Hiding encoded details from 1 in ECG cover image using hybrid LSB-IWT. Figure 8 shows the hiding of data and validation using MSE and PSNR.

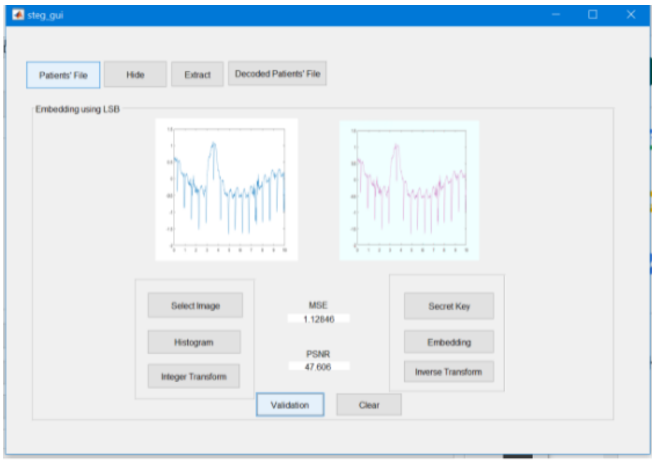


Figure:8.Encrypted Data hidden in Image using Steganography.

3.Extraction: The hidden details in ECG Cover are extracted in this step and obtained in the .txt file.The extraction of data is shown in figure 9.

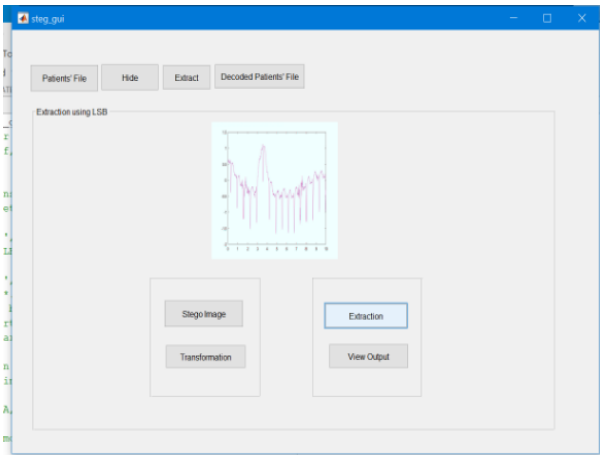


Figure:9. Extracted Data from Image using Steganography.

4.Decoding: The extracted data from step 3 is given as input and decoded using AES_256.Figure 10 shows the decryption of data .i.e getting back the original data.

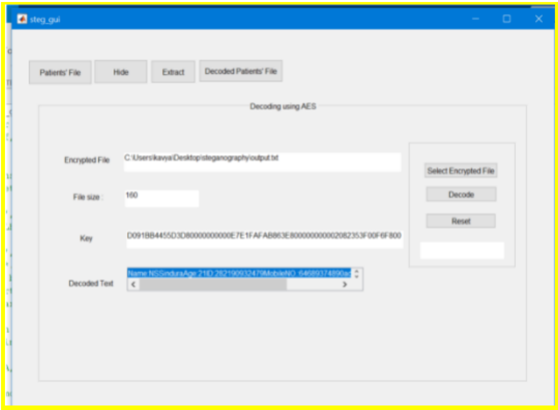


Figure:10.AES_256 Data Decryption

IV. Conclusion

We have presented a Cryptographic technique on the patient confidential information and then IWT-Steganographic technique on encrypted data and ECG signal image to secure patient's confidential data.The AES_256 algorithm was used to encrypt the data first and stored in .txt format which was later embedded in ECG signal image of the patient using LSB-IWT algorithm thereby having two-tier security as it uses both cryptography and steganography.The MSE and PSNR values are used to compare image compression quality .Similarly the opposite process is used in decryption.We also found that data can be hidden and extracted perfectly with high security.

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IMAGE RECTIFICATION USING RECURRENT CONVOLUTIONAL NEURAL NETWORKS

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ABSTRACT: Super-resolution encompasses a set of algorithms used to enhance and up-sample the resolution of images in order to increase the information density and the resultant sharpening of the output image. Conventional image rectification algorithms like nearest neighbor interpolation, linear interpolation, bicubic interpolation have been used to enhance images but are susceptible to the drawback of increased pixelation when the spatial dimensions are increased. In this paper we propose a novel algorithm that uses Recurrent Convolutional Neural Networks (AIRCNN) to achieve super resolution with improved PSNR and SSIM levels. Our results show an 11% improvement in both these values, when compared to traditional methods.

KEYWORDS: Super Resolution, Convolutional Neural Networks, Recurrent Networks, Deep Learning

I. Introduction

Convolutional neural networks are a class of neural networks that are used to detect and classify objects in an image by performing the convolution operation across the image pixels to obtain increasing complex patterns. These patterns can be utilized to classify the images and map them to some ground truth. One of the main advantages of these networks is the use of local spatial coherence that provides the same weights to some of the edges which minimize the global error.
The architecture of convolutional neural networks is the connectivity pattern present in the neurons of a brain where the network design between nodes looks like the association of the creature's visual cortex. Individual cortical neurons react to improvements just in a limited locale of the visual field known as the responsive field. The open fields of various neurons incompletely cover with the end goal that they cover the whole visual field. Similar to a human brain, the neurons are connected in particular configurations having shared weights which influence the activation of neighboring neurons.
The preprocessing required in Convolutional Neural Networks (CNN) is much lower in comparison to conventional classification algorithms. While in traditional methods like bicubic interpolation the filters are fixed, convolutional layers map input images to output images through a varying set of filters. In this paper, we attempt to achieve superresolution/image enhancement through the use of a recurrent convolutional neural network, which consists of skip connections and convolutional layers.

II. Related work

In [1] the authors generate realistic textures during single image super-resolution. To enhance the visual quality of the test images, they focused on network architecture, adversarial loss, and perceptual loss and improved on each one of them to derive an enhanced Generative Adversarial Nets (GAN). Their proposed network provides stronger supervision for brightness consistency and texture recovery. This paper provides a classic example of using generative networks instead of adaptive networks to get the required results. However, the adversarial nature of GANs makes them computationally expensive.
In [2] the authors exploit iterative up and down-sampling layers, providing an error feedback mechanism for projection errors at each stage. They constructed mutually connected up and down-sampling stages each of which represents different types of image degradation and high-resolution components.
This resulted in improved super-resolution, yielding superior results and in particular establishing a new state of the art results for large scaling factors. A feed-forward network is used to accumulate the auto-correction features for each of the upsampling stages to create a super resolution image.

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The most common techniques for obtaining higher resolutions involve using different Deep Learning architectures, ranging from the early CNN-based method, to recent promising SR approaches using GANs. Generalizing it, we can say the family of SR algorithms using deep learning algorithms has different features from each other in the mentioned major aspects:

- Types of network architectures as shown by [5], [6] and [7].
- Types of loss functions [8], [9], [10].
- Types of learning principles, and strategies [8], [11], [12].

In this survey, we have given a brief overview of recent advances in image super-resolution with deep learning. Although there are some existing SR surveys in literature, our work differs in that we are focused on combining Convolutional layers along with skip connections to achieve SR, while most of the earlier works aim at surveying traditional SR algorithms. On the other hand, some studies mainly concentrate on providing quantitative evaluations based on full-reference metrics or human visual perception.

III. METHODOLOGY

We began building our model from scratch. We began from just 1 CNN layer with limited dataset and afterwards changed the number of layers, filters and other parameters. At the point when it stopped increasing performance significantly, we attempted to change the model construction and attempted bunches of profound learning methods like mini batch, dropout, standardization, regularizations, analyzers and activators to become familiar with the implications of utilizing each design and methods. At last, we properly picked architecture and hyper boundaries which will best suit our SISR undertaking and assemble our last model.

A. Model Overview

Our model (AIRCNN) is a convolutional neural network combined with skip connections. As displayed in Figure 1, AIRCNN comprises a component extraction network and a recreation network. We combine groups of CNN weights, biases and non-linear layers to the input image. Then, at that point, to extricate both the local and the global features, all outputs of the hidden layers are associated with the reconstruction network as skip connections. At the other end of the skip connections, parallelized CNNs (Network in Network [2]) are utilized to reproduce the picture subtleties. The last CNN layer yields the output (or the channels of the square of scale factor) picture. Finally, the super resolute unique picture is assessed by adding these outputs to the up-sampled picture built by bicubic interpolation. Along these lines, the proposed CNN model focuses on learning the residuals between the bicubic interpolation of the low resolution (LR) picture and the High Resolution (HR) original picture.

In traditional SR techniques, up-sampled pictures were frequently utilized as the input for the DL-based models. In these models, the SISR organizations will be pixel-wise, leading to an increase in computational power. Moreover, only 20-30 CNN layers are essential for each up-sampled pixel and substantial calculation (up to 4x, 9x and 16x) is needed, as displayed in Figure 1. Also, we can easily understand that extracting features from original low-resolution images will be more helpful than artificially upsampled images.

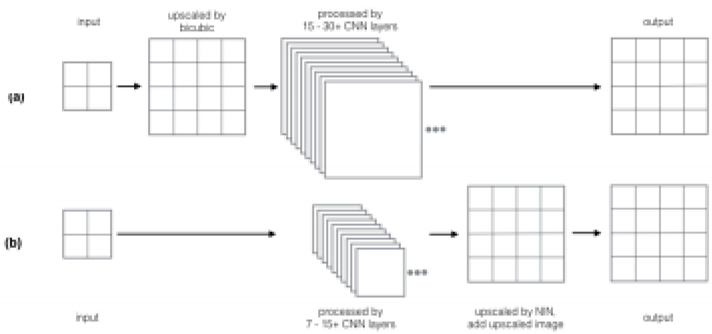

Fig 1. Simplified process structures of (a) other models and (b) our model (AIRCNN)

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B. Feature Extraction Network

In the primary feature extraction network, we cascade 7 arrangements of 3x3 CNN, bias and Parametric ReLU units. Each output of the units is passed to the following unit and all the while jumped to the reconstruction network. As opposed to other significant deep learning-based super-resolution models, the quantity of units of CNN layers is reduced from 96 to 32, as displayed in Table 1. As talked about in Yang et al. [10], for model pruning, utilize a proper number of preparing boundaries to upgrade the network. Since the local features have a higher priority than the global component in SISR issues, we decrease the highlights by the accompanying layer and it results in better execution with quicker calculation. We additionally utilize the Parametric ReLU units as initiation units to deal with the "Dying ReLU" issue [11]. This keeps loads from learning a huge negative bias term and can prompt a marginally better execution.

C. Image Reconstruction Network

As expressed in the Model Overview, AIRCNN straightforwardly measures original pictures with the goal that it can extricate features proficiently. The last HR picture is remade in the last part of the model and the organization structure resembles the Network in Network [2]. Since we are concatenating all the input layer features to the reconstruction network, the dimensions of data is somewhat enormous. So we utilize 1x1 CNNs to decrease the input dimensions prior to producing the HR pixels.

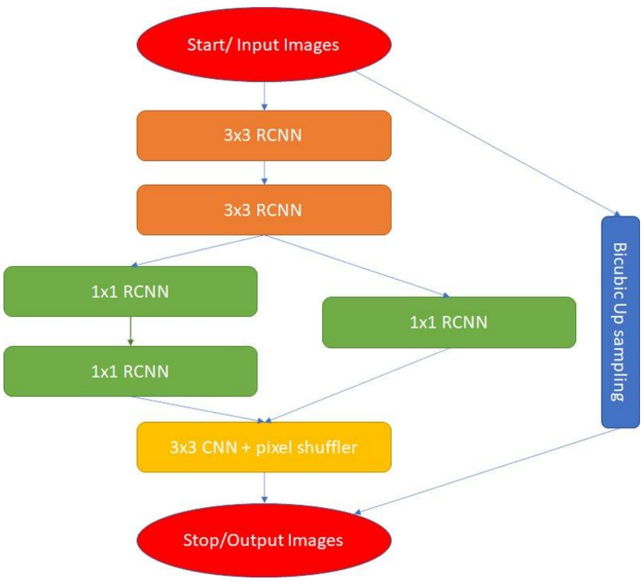

Fig 2.Architecture of AIRCNN

The last CNN, addressed by the yellow tone in Figure 2, yields 4 channels (when the scale factor is set to 2) and each channel addresses each corner-pixel of the up-tested pixel. AIRCNN reshapes the LR picture to a HR(4x) picture and afterward at last it is added to the bi-cubic upsampled original given picture. Typically with residual learning networks, the model is made to learn on residual output and this enormously helps learning rates, even in instances of shallow (under 7 layers) models.

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	Feature extraction network							Reconstruction network			
	1	2	3	4	5	6	7	A1	B1	B2	L
AIRCNN	96	76	65	55	47	39	32	65	32	32	4
c-AIRCNN	32	26	22	18	14	11	8	24	8	8	4

Table 1. The numbers of filters of each CNN layer of our proposed model

IV. Code snippet

The code snippet provided in this section demonstrates the core functioning of our Algorithm. It takes in an input image and performs the necessary transformations resulting in a higher resolution image.

```
def do(self, ip_im, bicubic_ip_im=None):
        ssval=self.scale
        h, w = ip_im.shape[:2]
        ch = ip_im.shape[2] if len(ip_im.shape) > 2 else 1

        if bicubic_ip_im is None:
        bicubic_ip_im = util.resize_image_by_pil(ip_im, ssval,resampling_method=self.resampling_method)
        if self.max_value != 255.0:
        ip_im = np.multiply(ip_im, self.max_value / 255.0)  # type: np.ndarray
        bicubic_ip_im = np.multiply(bicubic_ip_im, self.max_value / 255.0)  # type: np.ndarray

        if self.self_ensemble > 1:
        output = np.zeros([ssval * h, ssval * w, 1])

        for i in range(self.self_ensemble):
                image = util.flip(ip_im, i)
                bicubic_image = util.flip(bicubic_ip_im, i)
                y = self.sess.run(self.y_, feed_dict={self.x: image.reshape(1, image.shape[0], image.shape[1], ch),self.x2:
bicubic_image.reshape(1, ssval * image.shape[0],ssval * image.shape[1], ch), self.dropout: 1.0, self.is_training: 0})
                restored = util.flip(y[0], i, invert=True)
                output += restored

        output /= self.self_ensemble
        else:
        y = self.sess.run(self.y_, feed_dict={self.x: ip_im.reshape(1, h, w, ch),self.x2: bicubic_ip_im.reshape(1, ssval * h,
        ssval * w, ch),self.dropout: 1.0, self.is_training: 0})
        output = y[0]

        if self.max_value != 255.0:
        hr_image = np.multiply(output, 255.0 / self.max_value)
        else:
        hr_image = output

        return hr_image
```

V. Simulation Results

Since every execution happens under distinctive stages and libraries, it's unfair to look at these strategies by test execution time. Here we figure the calculation intricacy of every technique with all things considered. Since deep learning calculation is typically hard to parallelize, a calculation complexity of 1 pixel is utilized as a decent pointer of calculation speed. CNN layers are determined as size square times input channels times yield channels. Bias, ReLU, adding or duplicating layers are determined as the number of filters. When bicubic up-sampling is required, we compute it as 16 duplications and increments. In this manner, the surmised calculation intricacy for every technique is displayed in Table 3. The complexity determined may somewhat vary from genuine complexity. For instance, FSRCNN and RED contain translated CNN furthermore, it needs to be padded with 0 before handling. In any case, those distinctions are a lot more modest than CNN computations and hence can be approximated. We can see our AIRCNN has a cutting edge recreation execution.

As per the problem statement of our project we have successfully demonstrated the rectification of low quality images using a recurrent convolutional neural network. Through this model we have achieved an 11% increase in image quality and PSNR values as shown in Table 2

		PSNR		SSIM	
	Scale	Bicubic	AIRCNN	Bicubic	AIRCNN
set14	x2	30.228917	33.28912	0.86822	0.914005
	x3	28.325812	30.269423	0.853512	0.908652
	x4	25.623412	27.253961	0.823197	0.883519
set5	x2	33.654669	37.832237	0.92944	0.959015
	x3	30.825124	35.973251	0.91642	0.951189
	x4	29.864912	32.436129	0.90842	0.929845
bsd	x2	29.555535	32.036919	0.842629	0.897012
	x3	29.023412	30.32576	0.826849	0.873151
	x4	28.132456	29.963581	0.816812	0.865312

Table 1. PSNR and SSIM values

VI. Conclusion and Future Work

In this paper, we have presented a novel deep learning approach for single image super-resolution (SR). We utilize a combination of Convolutional layers along with Skip connections and Residual networks. In the feature extraction network of our method, the structure is optimized and both local and global features are sent to the reconstruction network by skip connection. In the reconstruction network, residual networks are used to obtain a better reconstruction performance with less computation. In addition, the model is designed to be capable of processing original size images. The proposed approach, AIRCNN, maps low and high resolution images, with minimalistic processing apart from the network architecture. With a lightweight structure, AIRCNN has performed equally if not better than state-of-the-art methods in terms of PSNR and SSIM values. Additional performance can be further gained by exploring diverse filters and applying multiple training strategies. Besides, the proposed structure, with its advantages of simplicity and robustness, could be applied to other low-level vision problems, such as image de-blurring or simultaneous SR+denoising. One could also investigate a network to cope with different upscaling factors.

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REAL TIME PARKING MONITORING AND AUTOMATIC BILLING

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Abstract:

With the proliferation of vehicles availability and usage nowadays, identifying a vacant space for parking is becoming more and more strenuous, causing a number of practical conflicts. This is about creating an expert system that takes over the task of identifying free slots in a parking area and reserve the slots for parking. This project reduces human effort at the parking area and makes the payment for the parking accurately when compared to payment by a security officer or any other person. The vehicle identification, free slot detection and payment calculation are the process executed in this system. Vehicle identification is done by using RFID, free slot detection is detected by IR sensor and the payment calculation is done on the basis of parking time.

I. INTRODUCTION

More than half of the world population lives in the urban areas; so the cities have reached its full occupancy. As a result, number of vehicles in the cities is also increased. Due to this, most of the people spend their valuable time on searching parking slots to park their vehicles. It is hectic job to find parking space to park their vehicles. We proposed an attempt to solve above mentioned problem. The system developed here is an integration of internet of things (IoT) user authentication for ADAS system. Internet of things is the inter-networking of physical device embedded with electronics that enables those physical devices to connect to internet. IoT was first introduced in 1999 at auto ID centre and first used by Kevin Aston.

Fig1. Congestion in parking

Fig2. Man power requirement

Congestion in parking is the problem which is a waste of time. So, users find the best spot available, saving time, resources and effort. The parking lot fills up efficiently and space can be utilized properly by commercial and corporate entities.

The other problem in parking slot is the number of man power used is more in number. This decreases the management. Thus, more automation and less manual activity save on labour cost and resource exhaustion. In this system IoT technology is used to connect parking slots in parking area to the internet. Here, cloud technology is related to creating, updating and deleting database which is maintained at central server and application provides user interface, allows user to get real time status of parking slots, to book parking slot and also displays parking charge which has to be paid. User authentication is accomplished by using unique ID number. The system not only provides ease to user for car parking but also reduces traffic which occurs due to dead locking of cars while parking and also saves fuel consumption of car by avoiding unnecessary traveling through filled parking lots which in turn reduces carbon dioxide emission in atmosphere.

II. REVIEW OF LITERATURE

In IoT based smart car parking system in paper [1], ultrasonic sensors are used for detecting the availability of parking slot. Each sensor is attached with a Wi-Fi chip. The gateway comprises raspberry pi board which updates the cloud using MQTT protocol. Mobile application is provided for user interface. Implementation cost of system is high as every sensing node has its own Wi-Fi chip. Parking availability prediction for sensor-enabled car parks in smart cities in paper [2], the waiting time is predicted based on the variable parameters such as time of the day, day of week, weather, temperature, humidity. The algorithm used for prediction is Regression tree, Support vector regression, and neural network. Parking is easier by using context information of a smart city in paper [3], the system defines four parking states which are: Available parking space, reserved parking space, in use parking space, load/unload parking space. The NFC technology is used here for wireless payment. Geomagnetic sensors are used for detecting presence of car. Major disadvantage of geomagnetic sensor based vehicle occupancy detection is: The sensor response is prone to magnetic interference .A cloud based intelligent car parking services for smart cities in paper [6] explains that the entire system developed with three layer’s sensor, communication, and application layer. The server finds the best available car parking lot for the user based on his preference and driving direction is returned to him. Intelligent parking lot application using wireless sensor networks in paper [7] proposed the use of a combination of magnetic and ultrasonic sensors for accurate and reliable detection of vehicles in a parking lot, also describing a modified version of the Min-max algorithm for detection of vehicles using magnetometers.

III. MATERIALS & METHODS

3.1.Requirements

Hardware requirements:

- ESP32
- IR sensor
- RFID
- Servo motor
- Power supply

Software requirements:

- C++
- Arduino IDE
- Blynk

3.2.Block diagram

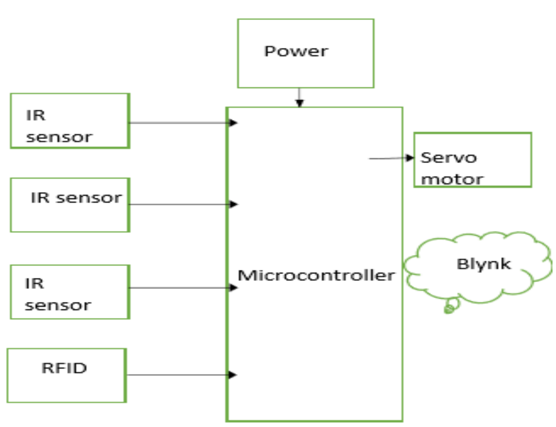

Fig3.METHODOLOGY

3.3.Methodology

Embedded controller: The input from parking lot sensor is given to embedded system. Upon any changes in input embedded system updates the information collected from sensor to database server. Microcontroller used as embedded system. Information regarding registered users, status of the parking slot, and time duration of parking is maintained in server and bill is generated according to the time slot. The information regarding availability of parking is shared among all users who use application. Database server is updated from two terminals. One is from sensors and embedded system and the other is from user application. It facilitates user to check availability status, to book parking lot and also integrated with unique authentication of user.

Sensing nodes: Information regarding status of parking lot is collected by using IR sensors attached to parking lot. Advantages considered while selection of IR sensor for vehicle occupancy detection are:

- Sensor response is not dependent upon color, transparency of object.
- IR sensors can work in critical conditions such as dirt and dust. The output is linear with the distance between sensor and target.
- Accurate detection even of small object.
- Adjustable detection ranges up-to 30cm.

IV. RESULT & DISCUSSION

4.1. Free Slot Detection

The free slot is detected using the Infra-Red (IR) Sensors. The IR sensors are fixed in the parking slots to detect the free slot. They detect the object in infra-red waves that is reflected and covers a short distance. A pulse of IR light is generated by the IR Sensor and emitted by the emitter. The information detected will be sent via WI-FI Module to transfer the data to the Arduino board and the results are displayed in the mobile app (Blynk) and in the LED Screen.

4.2. Vehicle Detection

It is assumed that each vehicle is built with the RFID tag and the vehicle is authenticated by RFID reader. The new user have to register to use these facilities and every user is provided with unique id which carries their information about the car and the tag holder. The authenticated vehicle will get the pass for the entry and the slot availability is displayed on their mobile.

4.3. Payment Calculation

The payment is calculated on the basis of vehicle parked time on the parking slot with arrival time and leaving time. The amount is generated and sent to the blynk app via WI-FI module. The payment is calculated by the Arduino board by the information gathered from the sensors. RFID Sensor reads the tag and process the payment for parking.

V. CONCLUSION

The problems of metro and cities, transportation mobility and environment sustainability is solved by the smart parking system. It also benefits in terms reduced cost and increases the revenues. Proposed system has developed from traditional system like toll-booth and parking attendants. It involves the use of IR sensor, ESP32 and server. The IOT is used to integrate the hardware and software to make network connectivity that enables the sensing of objects and remote accessing. Such integration allows users to check the available and unavailable parking slots that lead to improved efficiency, accuracy and economic benefit. By using this application people can find the parking space easily with accuracy and avoid traffic in cities which saves the energy fuels and people's time. However, installing RFID technology everywhere may be tedious and disadvantageous.

VI. FUTURE SCOPE

The above system can be upgraded to higher ranges using ultrasonic sensors and high range. RFID technology can be widely implemented in huge public gatherings with more vehicles. Furthermore,the wireless data transfer can be beneficial. Data transfer to remote locations also can be achieved by RFID and cloud IOT platform (blynk).

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Smart Agricultural Crop Prediction Using Machine Learning

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***Abstract*: Indian economy is mainly dependent on farmer's progress, making good profit in the agriculture field, technology plays an important role. Getting higher yields and improved quality of final product a system based on machine learning is proposed. In this system analyzing, quality of soil, rain pattern, weather and temperature, the farmers are suggested best crops and its required fertilizers as a solution by which farmers will get more profit on growing system suggested crop. This system is designed as a web application which uses big data analytics, prediction analysis and other techniques to predict the most suitable and profitable crop and its required fertilizers, predicts yield per hectare and value of crop based on current market price taking into consideration of current weather and soil conditions. Thus, farmers will benefit by using our system which will improve crop productivity and profit of farmers.**

***Keywords*: Big data analytics, crop yield, knn algorithm, Machine learning, profit, soil and weather conditions.**

1. Introduction

Agriculture is very important because it produces food and feed which is necessity to animals and human beings. It fulfill the basic need of billions of people. It is one of the major contributors to the country's GDP and economic growth. Hence, it is widely practiced in India. Agriculture sector requires more workforce than any other sectors, nowadays there is huge decrease in the agricultural work force. So, we need to fill that huge gap by making advances in agriculture with the help of technology. Thus, agricultural advancement results in gaining more profit by the farmers. Big data analytics techniques are used to analyze data sets of temperature, humidity, rainfall and soil which are collected from the meteorological department. This type of required analysis is performed by using specific software tools, many of them available as open source. By using this tools and techniques the system will have information, by this processed information the system will take better decisions. Thus, ensuring better results. Normally, farmers can guess the final yield by their experience of growing particular crop again and again. Farmers yield prediction accuracy is low and not cost effective. To meet the food requirements of the entire population of the country and for the export of some agricultural products to other countries, it is important to practice modern methods of farming by using technology instead of practicing traditional farming methods. Modern methods allow the farmers to cultivate the crops in small area with minimum amount of water, fertilizers and pesticides, which finally produces good yield and profit to the farmers. Application which is an interface between farmer and the system. By the provided data and analyzes the final values and predicts the best crop, list of fertilizers to be used, yield per hectare and total value of cultivated crop based on the current market price to the data.

2. Problem Identification

The cropping pattern which shows the proportion of the area under different crops at a definite point of time is an important indicator of development and diversification of the sector. Food crops and non-food or cash crops arc the two types of crops produced by the agricultural sector of the country. As the prices of the cash crops are becoming more and more attractive therefore, more and more land have been diverted from the production of food crops into cash or commercial crops. This has been creating the problem of food crisis in the country. Thus after 50 years planning the country has failed to evolve a balanced cropping pattern leading to faulty agricultural planning and its poor implementation. Achieving maximum yield rate of crop using limited land resource is a goal of agricultural planning in an agro-based country. Antecedent determination of problems associated with crop yield indicators can help to increase yield rate of crops. Crop selector could be applicable for minimize losses when unfavorable conditions may occur and this selector could be used to maximize crop yield rate when potential exists for favorable growing conditions. Maximizing production rate of crop is an interesting research field to agro-meteorologists which play a significant role in national economic. There are two types of factors which influence yield rate of crop: first is seeds quality which can be improved by genetic development using hybridization

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technology, and second is crop selection management based on favorable or unfavorable conditions.

3. Existing System Vs Proposed System

1) Existing system

The existing systems only predict yield based on input of total area of farm land in hectares but this systems doesn't predict best suitable and profitable crop, doesn't suggest fertilizers and doesn't calculate the total value of the crop. • And also the accuracy of the existing system is low compared to our system.

2) Proposed system

The solution proposed allows us to predict best suitable and profitable crop, its required fertilizers, estimates yield, and calculates the total value of the crop.

4. System Architecture

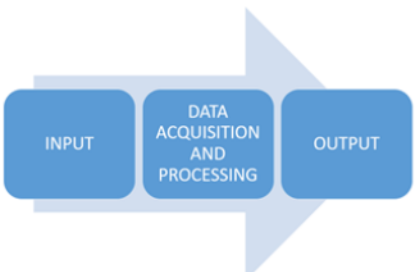

Fig. 1. Basic project flow

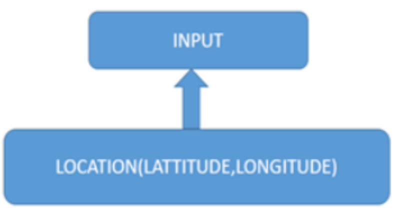

Fig. 2. Input Requirement

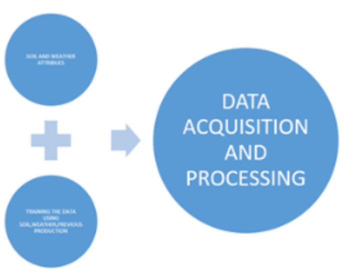

Fig. 3. Data Acquisition

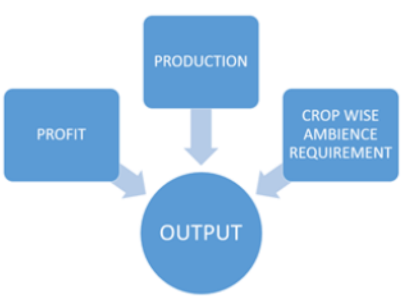

Fig. 4. Output (System Architecture)

1) Datasets

The data set is taken from UCI Machine Learning Repository for Smart Agricultural Crop Prediction Using Machine Learning It contains a number locations such as states,. Only physicochemical variables and the output variable districts and villages are available and contain more information about different types of crops, contains PH value of soil, weather conditions, longitude and latitude, selling prices etc. because of privacy and logistical problems.

2) Data processing

Data preprocessing is a method to explore data that involves raw data to be converted into accessible format. Data preprocessing is a established technique to overcome any data set issues. The preprocessing controls for missing values, normalizes the numerical data to minimize the number of variables, convert numerical data to categorical values where appropriate, etc. If all the attributes in the dataset are numerical, there is no need of any encoding. This work also check for the presence of duplicates on the dataset and take action accordingly.

The following are the specific steps in pre-processing data:

- *Cleaning of data:* data may have multiple sections that are insignificant and many missing. Data are cleaned to handle this portion. It requires the handling of missing data, noisy data, etc. Noisy data is not computer interpretable data. Due to errors in data collection, entry errors, etc.it can be created..
- *Data integration:* Data integration is a processing process which combines data from a variety of sources and allows the user to see the data uniformly.
- *Data transformation:* this is a step towards modifying data for mining in correct ways. It requires standardization, attributes selection, flexibility etc.
- *Data Reduction:* Data reduction is carried out to reduce the size of the data collection by taking only data features applicable to the mission into consideration. Data reduction technology aims to improve storage capacity, raising data storage and computational costs by operating with a vast volume of data and a wide variety of features. It comprises reductions in size, aggregation of the data cube, numbers, reduction, etc.].
- *Data Discretizing:* The division of values into bins, i.e. the decrease of the number of possible values, is the method of discretizing data. Data discretization the buckets are known to be organized and discrete values. Columns of numerical and strings can be debunked.

5. Machine Learning Algorithm

1) KNN algorithm

K-nearest neighbors (KNN) algorithm is a type of supervised ML algorithm which can be used for both classification as well as regression predictive problems. However, it is mainly used for classification predictive problems in industry. The following two properties would define KNN well –

- *Lazy learning algorithm* – KNN is a lazy learning algorithm because it does not have a specialized training phase and uses all the data for training while classification.

- *Non-parametric learning algorithm* − KNN is also a non-parametric learning algorithm because it doesn't assume anything about the underlying data.

K-nearest neighbors (KNN) algorithm uses 'feature similarity' to predict the values of new data points which further means that the new data point will be assigned a value based on how closely it matches the points in the training set. We can understand its working with the help of following steps −

- Step 1 − for implementing any algorithm, we need dataset. So during the first step of KNN, we must load the training as well as test data.
- Step 2 − Next, we need to choose the value of K i.e. the nearest data points. K can be any integer.
- Step 3 − For each point in the test data do the following
- 3.1 − Calculate the distance between test data and each row of training data with the help of any of the method namely: Euclidean, Manhattan or Hamming distance. The most commonly used method to calculate distance is Euclidean.
- 3.2 − Now, based on the distance value, sort them in ascending order.
- 3.3 − Next, it will choose the top K rows from the sorted array.
- 3.4 − Now, it will assign a class to the test point based on most frequent class of these rows.
- Step 4 − End

6. Implementation

- *Step 1:* Getting all the basic libraries that are useful for the project.
- *Step 2*: Searching and getting the data set from the online sites here data.gov.
- *Step 3*: Importing the data set to the project directory.
- *Step 4:* Purify the data
- *Step 5:* Splitting the data set and applying the machine learning.
- *Step 6:* Getting the result in the application created by using the python

Steps in Execution

- Import the libraries.
- Import the data set.
- Get the basic information about the data set.
- Get the correlation parameter for the variables,
- If required plot and analyses the parameters.
- And also need to purify the data set.
- Check for nulls in the data set.
- If any drop those rows.
- Check for any special characters in the columns.
- Just convert them in to nulls and drop those rows.
- New need to select the features for the project.
- Taking all the column as input and production as output.
- Now need to split the data set in to train and test data SET. 70 in to train data and 30 test data set.
- And train the machine using the KNN model.
- And finally using this trained model we can create an application to work.
- To take the inputs from the user and display the result

7. Result

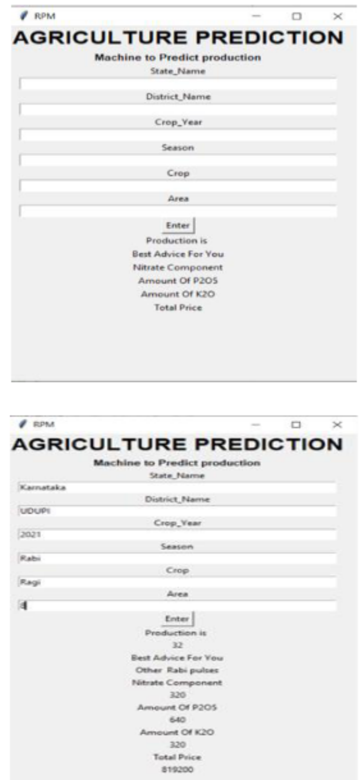

Fig. 2. Screen shots of input and output

The above result shows before and after the inputs given by the user. The first screenshot of the interface asks the user to give the details Such as state name, district name, crop year, season, the crop name and the area of the land. The second screenshot gives the results in accordance to the inputs given by the user, different results shown are: production in quintals best crop according to the conditions specified, the nitrate component, amount of phosphorous and potassium and the total price of production.

8. Conclusion

This paper presented an overview of Smart agricultural crop prediction using machine learning

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Auto Billing Shopping Cart Using Raspberry PI

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ABSTRACT

Shopping is simple but waiting on a bill counter after shopping is just too boring and tedious task. Huge amount of rush plus cashier preparing the bill with Barcode scanner is just too time consuming and leads to long ques. So here we've made an innovative project which can be placed within the shopping trolley itself. The system consists of a RFID reader which is controlled by Raspberry pi. So whenever the consumer puts any product in trolley it's been detected by the RFID module and it's displayed on LCD alongside the amount of the item. If the shopper adds more things it's detected by the module and therefore the price consistent with that increases. Just in case if customer changes his/her mind and doesn't want any product added within the trolley he can remove it and therefore the price added are going to be deducted automatically. After shopping, the consumer will press the button which when pressed adds all the items alongside their price and provides the entire bill to be paid. . At exit for verification the shopkeeper can verify the shopping with the assistance of master card. Hence this technique is suitable to be used in places like supermarkets, where it can help in reducing man power and in creating a far better shopping experience for its customers.

I. INTRODUCTION

Individuals have constantly created innovation to bolster their requirements as from the beginning of humankind. The basic reason for development in innovation is ought for more independency and this results in improving tasks and making regular one simpler and speedier. One of the task that individuals investmaximum measure of energy is in shopping. Shopping is a spot where individuals get their day to day necessities running from sustenance items, garments, electrical machines and so on. Number of the time clients haveissues with reference to the unspecific data about the item marked down and misuse of superfluous time at the counters. In this inventive world, each grocery and supermarkets utilize shopping trolleys with a selected end goal to assist clients to settle on and store the things which they expect to shop for. Customers commonlybuys the products required and place them in the carts and thereafter wait at the billing counters for payments of bills. The payment of bills at the counters is basically troublesome and time consuming process which thereby increasing crowd at the counters. Shopping in absentia is upheld from various perspectives including web shopping, online shopping, then forth which do not require the customer to be manually held at the Counters. Purchasing in-individual includes a private out in location of buying and selecting items in sight of various variables including need, comfort, brand, and so on. The proposed keen basket framework plans to assist shopping in-individual which will minimize the time spent in shopping. Persistent change is required within the customary time spent at the counters to reinforce the character of shopping background to the clients.

II. PROBLEM ANALYSIS

In realistic, markets are lately utilized by a substantial amount of people so as for securing most of things. Item procurement speaks to hit or miss procedure that involves time spent in passageways, item area and checkout lines. Consumers commonly encounter some problems and difficulty during purchasing. These problems comprise worrying about the cash which they need brought would be insufficient for all the things purchased and also dissipating tons of your time at the cashier. And also it's becoming an increasing problem for the merchants to form their shoppers consigned and to anticipate their demands due to the effect of contention and also due to lack of kit that isolate application designs.

At some instances clients have issues with reference to the inadequate data about the item of discounts and thereby misuse of superfluous time at the counters. We will end this issue by supplanting the omnipresent Universal Product Code (UPC) standardized identification by keen names referred to as frequency identification (RFID) tag. To beat the above problems, we implement the extensive notion of RFID based keen handcart within the field of retail stock.

Figure 1: Current Shopping Environment

III. MOTIVATION

The fundamental motivation behind this technique is to point out the proposition of a design and arrangement of an ingenious framework for obtaining of things in markets. This cart explores rising versatile innovations and programmed recognizable proof advancements, (for example, RFID) as an approach to reinforce the character of administrations given by retailers and to expand the customer esteem consequently permitting to save lots of time and cash. With this cart a superb opportunity are going to be developed which assists the purchasers by showing the catalog of products and their respective costs. This approach thereby helps the inventory management unit with an instinctive upgrade on each purchase of product. This smart cart has the potential to form shopping more relaxable, comfortable and systematic for the purchasers also as making easier for the shop management.

V. BLOCK DIAGRAM

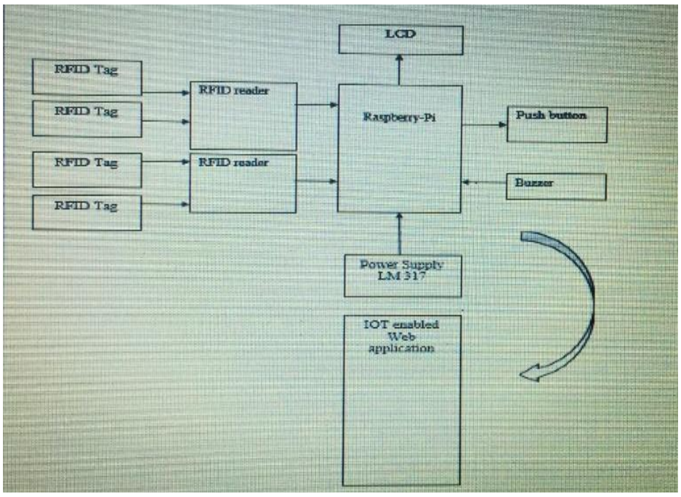
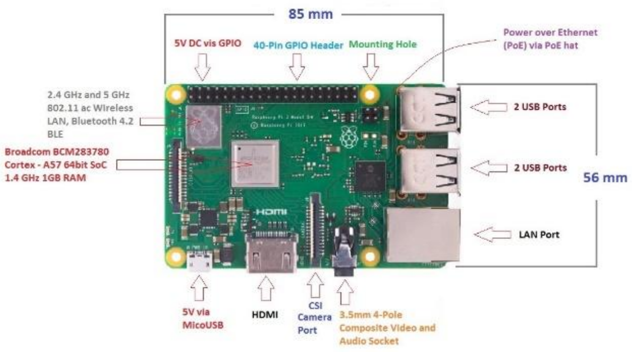


Figure 2: Block diagram

IV. HARDWARE SPECIFICATIONS:

Raspberry Pi

The Raspberry Pi is series master card sized single board computer that plugs into a computer monitor and television. Python may be a programing language which is employed to Interface raspberry pi.This possess the wireless LAN and Bluetooth Connectivity making it excellent solution for several connected designs. This is often operated with 5.1V micro USB supply. Generally it uses amidst 700-1000mA counting on what peripherals are connected. The utmost power Raspberry Pi can use is 2.5Amp.The power requirements of the Raspberry Pi increase counting on different interfaces attached thereto. The GPIO pins uses 16mA safely, The HDMI port uses 50mA, the camera module will use250mA, the keyboard and mice can take as small as 100mA or above 1000mA



Trolley Unit

In this unit the Raspberry-pi processor is attached to a RFID reader and barcode reader. Because the user puts the things within the trolley the reader on the trolley reads the tag and sends a sign to the Raspberry-pi processor. The Raspberry-pi processor then stores it within the memory and compares it with the lookup table. If it matches then it shows the name of item on LCD & also the entire amount of things purchased.

Billing Unit

As soon because the shopping is over the user comes near the billing section .The total bill will display on the billing computer.

Power Supply

In every project we'd like different voltages for various circuits. So we'd like to construct different power supply of various voltages employing different voltage transformers, rectifier circuits, filter circuits and regulator circuits.

LCD Display

Figure 4: LCD Display

LCD has the power to display numbers, characters &graphics. The display is interfaced to Input /Output port of microcontroller (P0.0-P0.7). The display is in multiplexed mode i.e. just one display remains on at a time. Within 1/10th of a second subsequent display switches on. During this way sequentially on and off display will end in continuous display of count thanks to persistence of Vision. A 16x2 LCD display is extremely basic module and is extremely commonly utilized in various devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. During this LCD each character is displayed in 5x7 pixel matrix.

RFID TAG

Figure 5: RFID tags

Tags are of two types: passive tags which haven't any battery life and active tags which have battery life. RFID tags released for automatically identifying an individual, a package or an items. These are transponders that transmit information. RFID tag contains two parts. One is microcircuit for modulating, storing and processing information and demodulating frequency (RF) signal. The second is an antenna for receiving and transmitting signal.

RFID READER

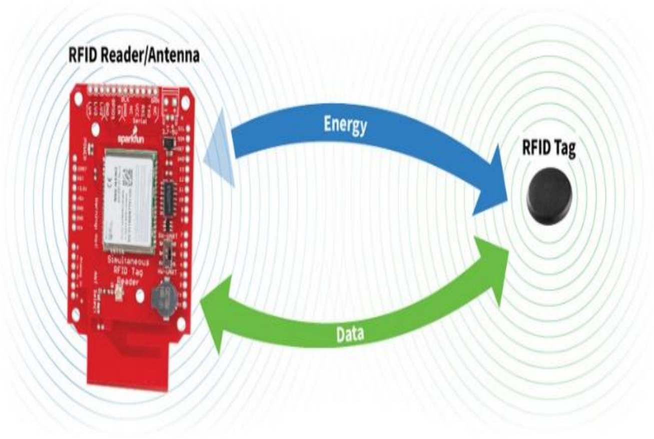


Figure6: RFID Reader

An RFID reader is that the brain of the RFID system and is important for any system to function. Readers, also called interrogators, are devices that transmit and receive radio waves so as to speak with RFID tags

V.RESULTS

The utility of trolley are going to be first of its kind for commercial use. Bill is uploading to web application with a message. Notification is shipped to web application. This device records the info of the various products with help of the acceptable sensors like RFID Tags. This recorded data helps the shop owner with detailed analysis of shopping by the customer & there preferences through the computer; printout of an equivalent are often obtained.

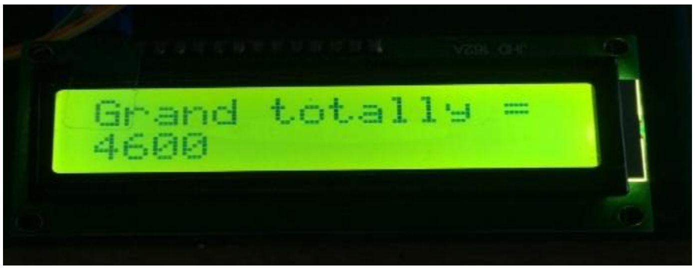


Figure 7: example of cart total result

VI. CONCLUSION

Each product within the shop or a mall will have an RFID tag attached to it. Each Cart will have an RFID reader and Trans receiver implemented thereon. There'll be online payment procedure for billing. If the merchandise is removed, it must get deleted from bill too. There must be an RFID reader at the entrance for anti-theft. Depending upon Customer Buying Habits Display Offers/Discount on screen. Display Product Info, Expiry Date, and Better Alternative. So by making use of this, the super market shopping system will become easier.

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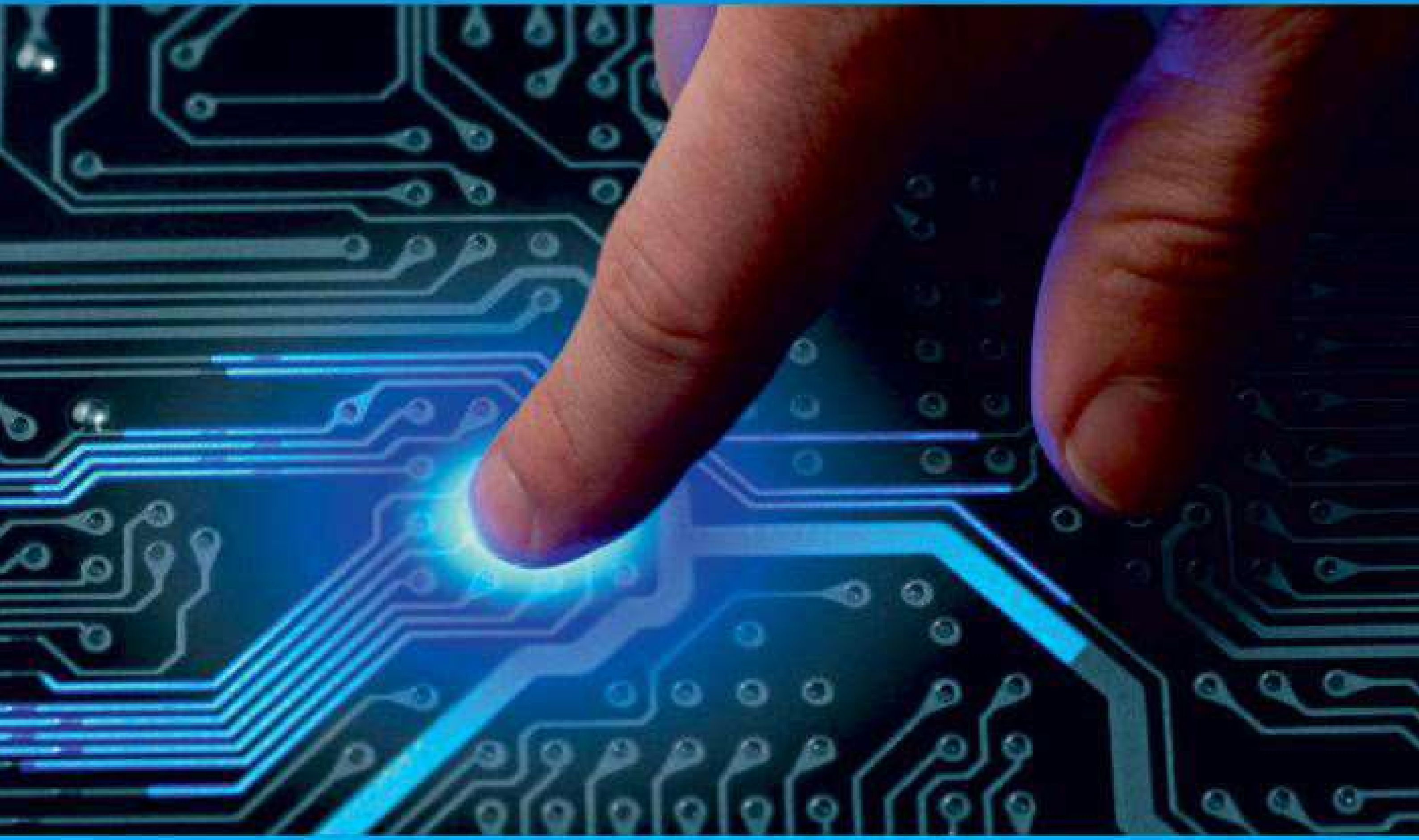

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Text Extraction and Translation from an Image

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ABSTRACT: Communication is an essential part of human beings, and in the world today there are almost thousands of languages being used for communication, a person knowing and learning all the languages is not possible. Hence this causes the problem of languages, acting as barrier for communication and leads to various other problems. So, translation is required to convert one language to other languages, so that people can easily communicate each other across the globe. In the proposed system the problem is overcome by using software tools that convert the required image or document to any desired languages. The proposed method is an assistive text reading that helps to read text present on the text labels, printed notes and products in their own respective languages. It combines the concept of Optical Character Recognition (OCR), Translator and Text to Speech synthesis.

KEYWORDS: Optical Character Recognition, Text to speech, Text Extraction, Image preprocessing,Translator.

I. INTRODUCTION

The only means by which human beings' abstract reality is through language. Language is an efficient and effective medium of communication which explicitly represents ideas and expressions of human mind. Over 5000 languages exist in the world today and this gives evidence of linguistic diversity. It is difficult for an individual to know and understand all the languages of the world. Hence methodology of translation has been adopted to communicate messages from one language to another. The translation software comes into picture for efficient translation of one language to other languages. The written documents such as signboards, or any other papers to be translated needs to be recognized beforehand, so that the methodology of translation can be applied and the language can be translated. Optical character recognition (OCR) is used for recognition of characters in the language. It is a process run by a software that attempts to read the characters into recognizable full text. It is a quick process that enables automated conversion of images into full text files that can then be searched by word or character. Hence combination of the OCR and translation software can be used to convert any document or image into desired languages. The language acts as barrier many times, as one person cannot learn all the languages in the world and cannot be confined to one place as well, hence translation of the other languages to the known languages are needed. The tourism industry has always need of the software which could help them in communication with the tourists who are from various parts of the world, who just knew their native languages. Every state or country have their own native languages, which are used by people living there. And majority of signboards, addresses or written documents may be in their respective languages and people, who doesn't know these languages face problems.In India there are several languages spoken in several parts of the state, and the person visiting these places faces problem in communication as these regions use their languages for signposts, hoarding's, addresses, etc., and state governments also function in their own languages, like in Karnataka, Kannada is used as medium in various official documents to convey the messages by the government. The proposed system motivates us to solve the problem of language by translating the written or printed documents in the required language. The proposed system can also boost tourism as many tourists face these problems every year, in locating locations, etc.

II. LITERATURE SURVEY

Literature Survey is an important phase in the system development life cycle as we collect and acquire the necessary information to handle or develop a project during this phase. A literature review is a description of the literature relevant to particular field or topic. It gives an overview of what has been said, who the key writers are, what are the prevailing theories and hypothesis and what methods and what methodologies are appropriate and useful. G. Vamvakas et al [3] proposed the large number of documents in today's world is being digitalized; this creates a need for accurate and fast processing system. Historical documents are of more importance as they reflect our cultural heritage. During the last decades a lot of research has been done in order to develop systems and software that can be used to preserve and digitalize documents. One such system for processing documents is the "Optical character recognition system" also

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known as OCR. Many commercial products have been designed that can convert digitized documents into word documents usually in ASCII format. These products can only read machine printed documents but when it comes to handwritten document's they are not able to produce satisfactory results. Till date recognition of historical, poor quality and handwritten documents is an evolving field in the study of OCR.Noman Islam et al [1] has found that character recognition is not a new problem but its roots can be traced back to systems before the inventions of computers. The earliest OCR systems were not computers but mechanical devices that were able to recognize characters, but very slow speed and low accuracy. In 1951, M. Sheppard invented a reading and robot GISMO that can be considered as the earliest work on modern OCR. GISMO was able to read and recognize musical characters and as well as words. But it was limited to only 23 characters. J. Rainbow, in 1954, devised a machine that can read uppercase typewritten English characters, one per minute. The early OCR systems were criticized for not being accurate and fast. Hence it has been an evolving field since the 1950's. Because of the complexities associated with recognition, it was felt that three should be standardized OCR fonts for easing the task of recognition for OCR. Hence, in 1970 OCRA and OCRB were developed by ANSI EMCA, that provided comparatively acceptablerecognition rates. Othman Saleh Mahdy et al [2] developed a system to process documents is Computer assisted translation also known as "CAT" or machine translation (MT). Translation plays a very important role for interaction between two different communities that speak and understand different languages. Computer-assisted translation (CAT) is the developments of computer technology that have created new opportunities for translators that cannot be found in traditional ways(Hutchins 1992) defines the term Machine Translation (MT) as the traditional and standard name for computerized systems responsible to produce translations from one language into another, with or without human assistance.Ankush Garg et al [4], Warren Weaver proposed using computers to solve the task of machine translation. Earlier research focused on rule-based systems, which gave way to example-based systems in the 1980s. Statistical machine translation gained prominence starting late 1980s, and different word-based and phrase-based techniques requiring little to no linguistic information were introduced. With the development in deep neural networks in 2012 application of these neural networks has become a major area of research. Various fields in the area of natural language processing (NLP) have been boosted by the rediscovery of neural networks. Early attempts used feed forward neural language models for the target language to re rank translation lattices. The first neural models which also took the source language into account extended this idea by using the same model with bilingual tuples instead of target language words, scoring phrase pairs directly with a feed forward network, or adding a source context window to the neural language model. The advent of Neural machine translation (NMT) certainly marks one of the major milestones in the history of MT, and has led to a radical and sudden departure of mainstream research from many previous research lines. NMT has already been widely adopted in the industry and is deployed in production systems by Google, Microsoft, Facebook, Amazon, SDL, Yandex, and many more.

III. PROPOSED METHODOLOGY

This project presents a prototype system for extraction of text present in the image and then translates it into desired language. As illustrated in the block diagram the system framework consists of three functional components: Optical Character Recognition (OCR), Translator and Text to speech conversion. In the first step the recognized text present in the image is extracted using OCR engines. In this project we use Tesseract OCR engine which helps to extract the recognized text. The aim of Optical Character Recognition (OCR) is to classify optical patterns (often contained in a digital image) corresponding to alphanumeric or other characters. The process of OCR involves several stepsincluding segmentation, feature extraction, and classification. In principle, any standard OCR software can now be used to recognize the text in the segmented frames. However, a hard look at the properties of the candidate character regions in the segmented frames or image reveals that most OCR software packages will have significant difficulty to recognize the text. Document images are different from natural images because they contain mainly text with a few graphics and images. Due to the very low-resolution of images of those captured using handheld devices, it is hard to extract the complete layout structure (logical or physical) of the documents and even worse to apply standard OCR systems. For this reason, a shallow representation of the low-resolution captured document images is proposed. In case of original electronic documents in the repository, the extraction of the same signature is straightforward; the PDF or PowerPoint form of the original electronic documents is converted into a relatively high-resolution image (TIFF, JPEG, etc.) on which the signature is compute. Finally, the captured document's signature is compared to with all the original electronic documents' signatures in order to find a match.

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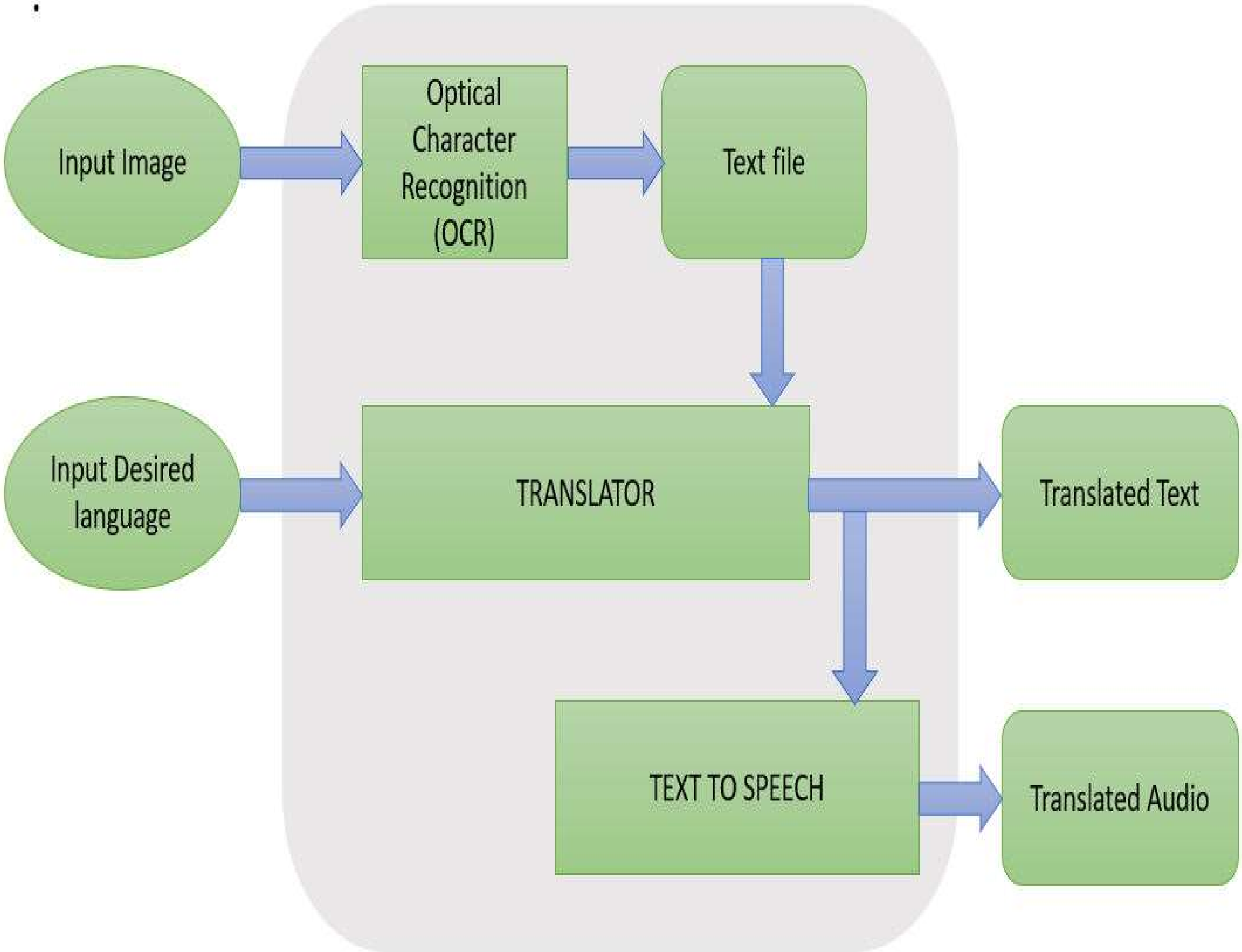

Fig : Block daigram of proposed model

In the proposed system we have used Tesseract OCR, it is a type of OCR engine with matrix matching. The selection of Tesseract engine is because of its flexibility and extensibility of machines and the fact that many communities are active researchers to develop this OCR engine and also because Tesseract OCR can support 149 languages. Before feeding the image to the OCR, it is converted to a binary image to increase the recognition accuracy. Image binary conversion is done by using Image magic software, which is another opensource tool for image manipulation. The output of OCR is the text, which is stored in a file (speech.txt). Machines still have defects such as distortion at the edges and dim light effect, so it is still difficult for most OCR engines to get high accuracy text. It needs some supporting and condition in order to get the minimal defect. Pre-processing is the first step in the processing of scanned image. The scanned image is checked for noise, skew, slant etc. There are possibilities of image getting skewed with either left or right orientation or with noise such as Gaussian. Here the image is first converted into grayscale and then into binary. After pre-processing, the noise free image is passed to the segmentation phase, where the image is decomposed into individual characters. The binarized image is checked for inter line spaces. If inter line spaces are detected then the image is segmented into sets of paragraphs across the interline gap. The lines in the paragraphs are scanned for horizontal space intersection with respect to the background. Histogram of the image is used to detect the width of the horizontal lines. Then the lines are scanned vertically for vertical space intersection. Here histograms are used to detect the width of the words. Then the words are decomposed into characters using character width computation. Feature extraction follows the segmentation phase of OCR where the individual image glyph is considered and extracted for features. First a character glyph is defined by the following attributes like height of the character, width of the character. Classification is done using the features extracted in the previous step, which corresponds to each character glyph. These features are analyzed using the set of rules and labeled as belonging to different classes. This classification is generalized such that it works for single font type. The height of the character and the width of the character, various distance metrics are chosen as the candidate for classification when conflict occurs. Similarly, the classification rules are written for other characters. This method is a

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genericonesinceitextractstheshapeofthecharactersandneednotbetrained.Whenanewglyph is given to this classifier block it extracts the features and compares the features as perthe rules andthen recognizes the character and labels it. Finally in the proposed system after applying the preprocessing to the images and extracting text we give the text to a translation and text to speech engines. Theses engines produce translated text and the text to speech engine reads the text aloud so that user can even listen and understand without the need to read the text.

IV. RESULTS

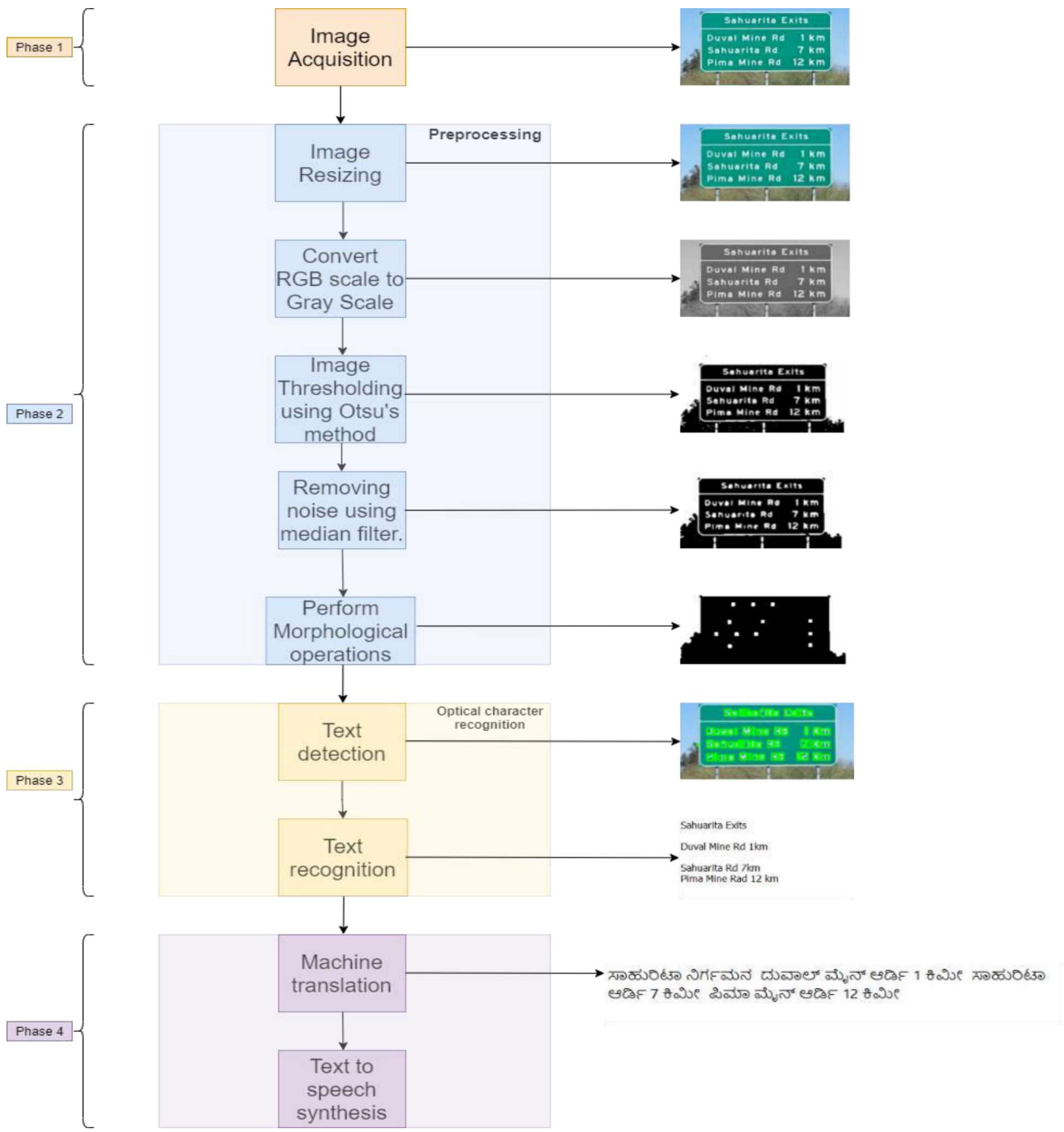

Fig:Flowchart of implementation

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The proposed project has been executed in 4 phases:
Phase 1: Image acquisition, Phase 2: Image pre-processing, Phase 3: Text detection and text extraction, Phase 4: Machine translation and text to speech analysis.
Phase 1: Image acquisition: Digital imaging or digital image acquisition is the creation of a representation of the visual characteristics of an object, such as a physical scene or the interior structure of an object. The term is often assumed toimply or include the processing, compression, storage, printing, and display of such images.
Phase 2: Image pre-processing: Image resizing: Image resizing is necessary when you need to increase or decrease the total number of pixels, whereas remapping can occur when you are correcting for lens distortion or rotating an image. Interpolation works by using known data to estimate values at unknown points. Image interpolation works in two directions, and tries to achieve a best approximation of a pixel's intensity based on the values at surrounding pixels. Common interpolation algorithms can be grouped into two categories: adaptive and non-adaptive. Adaptive methods change depending on what they are interpolating, whereas non-adaptive methods treat all pixels equally. Non-adaptive algorithms include: nearest neighbour, bilinear, bicubic, spline, sinc, lanczos and others. Adaptive algorithms include many proprietary algorithms in licensed software such as: Qimage, Photo Zoom Pro and Genuine Fractals**. RGB to Grayscale:** A pixel colour in an image is a combination of three colours Red, Green, and Blue (RGB). The RGB colour values are represented in three dimensions XYZ, illustrated by the attributes of lightness, Chroma, and hue. Quality of a colour image depends on the colour represented by the number of bits the digital device could support. The basic colour image represented by 8 bits, the high colour image represented using 16 bits, the true colour image represented by 24 bits, and the deep colour image is represented by 32 bit.**Image thresholding using Otsu's method:** Otsu's Thresholding concept: Automatic global thresholding algorithms usually have following steps: Process the input image,obtain image histogram (distribution of pixels), Compute the threshold value,replace image pixels into white in those regions, where saturation is greater than and into the black in the opposite cases. **Remove Noise by using median filter:** Median filter is one of the well-known order-statistic filters due to its good performance for some specific noise types such as "Gaussian," "random," and "salt and pepper" noises. The median filtering process is accomplished by sliding a window over the image. The filtered image is obtained by placing the median of the values in the input window, at the location of the centre of that window, at the output image. Medianfilters are useful in reducing random noise, especially when the noise amplitude probability density has large tails, and periodic patterns.
Phase 3: Text detection and text extraction; Boundingboxes: Bounding boxes are one of the most popular—and recognized tools when it comes to image processing for image and video annotation projects. A bounding box is an imaginary rectangle that serves as a point of reference for object detection and creates a collision box for that object. Data annotators draw these rectangles over images, outlining the object of interest within each image by defining its X and Y coordinates. This makes it easier for machine learning algorithms to find what they're looking for, determine collision paths, and conserves valuable computing resources. Bounding boxes are one of the most popular image annotation techniques in deep learning. Compared to other image processing methods, this method can increase annotation efficiency. **Text extraction:** In this phase of our tool, we use an OCR tool to extract the text from the pre-processed images and use it for further translation and for speech synthesis.
Phase 4: Machine translation and text to speech synthesis: Machine translation (MT) is the task to translate a text from a source language to its counterpart in a target language. The neural approach uses neural networks to achieve machine translation. Graphics processing unit (GPU) is used for a faster artificial neural network. It is used to implement the matrix multiplication of a neural network to enhance the time performance of a text detection system. In this phase we finally use the extracted text and give it to the translator API which converts the given text language to some other desired language. A Text-to-speech synthesizer is an application that converts text into spoken word, by analysing and processing the text using Natural Language Processing (NLP) and then using Digital Signal Processing (DSP) technology to convert this processed text into synthesized speech representation of the text. Here, we developed a useful text-to-speech synthesizer in the form of a simple application that converts inputted text into synthesized speech and reads out to the user which can then be saved as an mp3 file. The development of a text to speech synthesizer will be of great help to people with visual impairment and make making through large volume of text easier. The mp3 file gets stored in the project workspace and then it is finally played using the play sound library in python.The proposed system ensures the following:

1. It takes an image as input, pre-process it and extracts text from it.
2. The extracted text is translated to desired language.
3. The translated text is converted to audio and read aloud.

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A Graphical User Interface was built for a user to interact with the model.

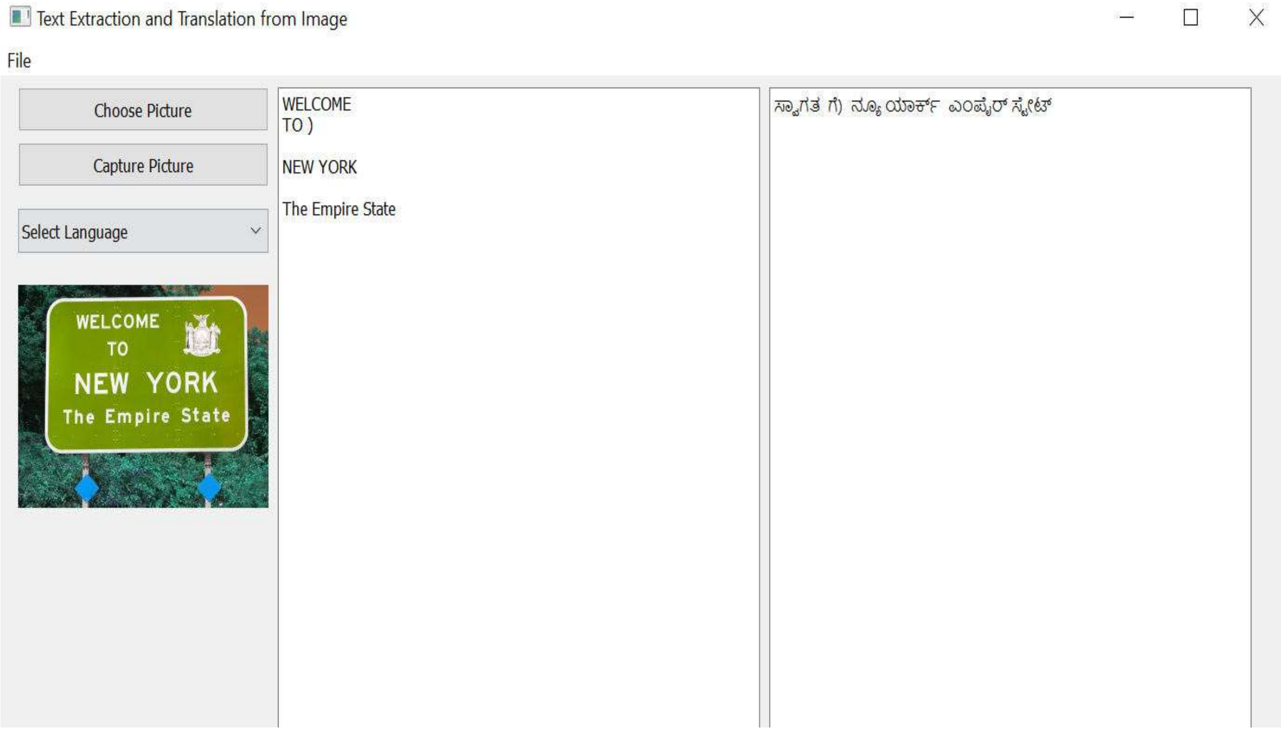

Fig: GUI with outputs

V. EVALUATION OF THE PROPOSED MODEL

To evaluate the application, 25 images from the database were selected and provided as input to the software. It has been ensured that the collected images fed to the software are unique. Best efforts have been made to ensure unbiased evaluation since this evaluation will prove to be an important feedback on the project.To evaluate the project, Accuracy is considered as the main parameter and is calculated in 2 stages. Calculating accuracy in 2 Stages is a good way to get detailed information of the evaluation.

In stage 1 the accuracy of the extracted text is calculated.

Formula used: $$Extraction\_Accuracy = \frac{number\ of\ words\ extracted\ correctly}{total\ number\ of\ words} * 100$$

In stage 2 the accuracy of the translated text is calculated.

Formula used: $$Translation\_Accuracy = \frac{number\ of\ words\ translated\ correctly}{total\ number\ of\ words} * 100$$

After evaluating the application using 25 images the average accuracy was found to be 90.1 % for stage 1 i.e., Extraction accuracy and the average accuracy for stage 2 was found to be 81.8 % i.e., Translation accuracy.

VI. CONCLUSION

Finally describing the conclusion of our project, it mainly intents to describe the approach of recognizing and extracting text in an image, then translating it to other language. The output of the project is presented by a Graphical User Interface (GUI) where the user can easily interact. The main aim of our project is to solve the problem of language and help the user to read the text in his known language, the User Interface also reads the translated text, hence even an uneducated/illiterate user can also know about the text in the image. Currently the proposed project is capable of translating text from English to Kannada, but for future enhancement of our project various other languages can be added, the user interface has an option of addition of languages in it. Further the project can be converted to mobile application or an App where it can be launched on app stores and can serve a broader range of users.

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> Paper Title: RFID based Attendance System.
>
> Author: Shashikala J, Srinivas C N, Parikshit Y P, Mohan Kumar R M, Naman G Shetty.
>
> Abstract: There has been a rising interest in a secure framework that must be solid and quick to react to enterprises and organizations. RFID (Radio Frequency Identification) is one of the solid and quick methods for recognizing any material article. Their huge favorable position is that they can read wirelessly, contain more data than standardized identification, and are progressively hearty in nature and in view of non-observable pathway innovation.

> In context to this, we bring you
> "RFID Based Attendance System."
> Regards
> Srinivas C N
> Please find attached the paper for the same.

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3 attachments

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Gesture Based Music Player Controlle

Sarhan ks 1BY16EC039
Shivakumar C A 1BY17EC413
Dr. Jayadeva G. S.
 # Professor in Electronics and communication department, BMSIT&M
***Students of VIII Semester Electronics Department, BMSIT&M**

ABSTRACT :

By keeping in mind the similarities of human hand shape with four fingers and one thumb, this paper aims to present a real time system for hand gesture recognition on the basis of detection of some meaningful shape based features like orientation, status of fingers, thumb in terms of raised or folded fingers of hand and their respective location in image. A primary goal of gesture recognition research is to create a system which can identify specific human gestures and use them to convey information or for device control. The proposed system mainly focuses on scenarios where we are multitasking that is working on many applications at a time or running various programs at a time on our desktop and along with that listening to music in background that is music being played in one of the windows. At such times if we wish to pause or switch a particular music track we have to make some movements like switching to the music window and doing the desired operation. This process is a bit long and time consuming as well. Suppose if you can do this operation without switching to the media player and by doing just one hand movement, it will save some time and also keep you linked with the work you are doing currently. With the help of Music Controller, one can simply wave or do a simple gesture of hand movement in front of the webcam which will in turn switch or pause the particular music track that was being played.

Keywords:Gesture sensor,Embedded arch,Hand gestures.

I. INTRODUCTION

Gesture recognition is a topic in computer science and language technology with the goal of interpreting human gestures via mathematical algorithms. Controlling a computer using hand gestures has long been the stuff of science fiction, the most memorable occasion being the movie Minority Report, where Chief John Anderton (played by Tom Cruise) controls a computer by deftly moving his hands around in a 3D space.It is now possible to control the music on your computer simply by making a few hand gestures. Through the use of
a few simple hand movements, you can play, pause, forward or replay your music. Gesture-based technology has been booming the past several years, especially with the creation of the Microsoft Kinect for PCs and the Xbox 360. Computer-integrated programs can be something for the future, especially because it simplifies tasks such as changing a song while you're reading something important
Controlling music playback (e.g. play, stop, pause, and next) is often used to demonstrate new interfaces and inter- action techniques. Using a set of function to control music playback has also been used to demonstrate and evaluate gesture recognition algorithms. In order to derive meaningful conclusions from an evaluation of a gesture recognition algorithm it is, however, helpful to use a gesture set which is not purely based on the designer's intuition, the algorithms capabilities, or chance. Most work in the area of gestural interaction focused on algorithms and robust recognition of gestures. How- ever, gestural interfaces must fulfils the same requirements as any other interaction technique. In particular, it is important to define usable gestures for the functionalities that the particular application offers. In order to deduce usable gestures a process that ensures valid results must be employed.

Methodology and Participants

The study was split into two halves. In the first half, we assessed people's music listening goals and needs in different situations through semi-structured interviews. In the second part, we presented them a simple prototype that recognises CDs using a webcam and plays the according music in order to get initial feedback about desired functionality and behaviour of the system. To not limiting the participants' creativity we did not reveal our intention to design a gestural interface to the participants.
First we asked about situations in which listening to mu- sic plays an important role for the interviewed person. For the rest of the interview, one of these situations was picked by the interviewer. Our aim here was to cover a wide range of different situations. In the following part of the interview, more in-depth questions about participant's goals during the respective situations and the role of the music were asked. Then, we investigated which steps the users usually perform while listening to music, what types of music players were used, and how satisfied the participants were with these solutions. Here we aimed at understanding, which functionality of music players would be most important in this situation.

Definition of gesture sets

The proposals for gestures must be formalised to define a consistent set of gestures. In contrast to Nielsen et al. we propose to derive multiple gesture sets. By not limiting the outcome to a single set of gestures the risk to reject promising candidates is reduced. Nonetheless, every gesture must be part of a consistent gesture set to ensure that a gesture can be combined with other gestures in a reasonable way. I.e. it must be avoided to define the same gesture or very similar gestures for different functions.

Music listening habits

Situations. We identified three kinds of situations were music was listened to that differ in the meaning of the music. We distinguished between situations were music is the key aspect, music play a major role, and music is secondary.
However, the borders between the three classes are blurred and the meaning of the music in each situation can vary constantly, depending on the current context.
Music was considered the key aspect when the participants reported to listen consciously to it while doing nothing else as a primary task. These situations typically occurred in the home or in the car when driving alone and usually about once a week and if the situation occurs it does not last very long. The second class of situations were those, were music was an integral part of the situation, such as at parties, at work, or in some cases while doing sports. These situations typically occur not daily but last for a longer time then the previous class of situations. The third class of situations were those, were music was listened by the way, while the participants were typically involved into other primary tasks. These comprised house work, surfing the internet, playing video games, and car driving. In general, this kind of situation occurs often and lasts long.

The role of music

The role of the music strongly de- pends on the respective situation. The participants' answers were mostly related to emotions. The most important effect of music was keeping, changing, or amplifying emotions. For example, in cases of parties, music played an important role in supporting good vibrations. When participants listen to music while relaxing, the music should calm them down. Another commonly named role was helping the participants in concentration while they were busy with another task, such as working or playing a video game
.

Music players

Participants reported the use of a wide range of music players that fell into the classes of computer media player, portable mp3-player, CD-players, and radio. The participants mostly use pre-installed or old versions of computer media players. The vantages named by the participants about the system they use typically were associated with convenience aspects, such as simple user interface, familiarity, or immediately available music.

DEFINITION OF GESTURE SETS

The third step of the process is to formalise the proposed gestures and to define consistent sets of gestures. We found manifold gestures in the user study. Based on these gestures we define two consistent sets of gestures. To define consistent sets the first set consists of dynamic gestures only and the second set consist of static gestures. Most gestures were taken from the gestures proposed by the participants in the previous user study. Since we aimed at defining consistent gestures sets some gestures were chosen because they fit consistently with the other ones although the exact gesture was not proposed. In the following both sets are described.

Set of static gestures
Static gestures were not used as often as dynamic gestures. To form a consistent set, most gestures are similar to the symbols for the corresponding functions found on a music player.

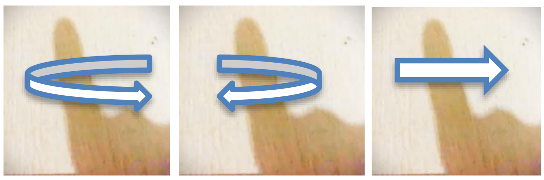

Fig.1

Fig.2

Play
This is the First operation performed in the gesture recognition to start this function two finger close to the sensor to play.

Pause
Similar to play function as the two fingers gets close to the centre to pass/stop the music

Volume up/Down
This a gesture to increase volume up and down of the music to function this operation moving one finger close to sensor and rotate clockwise/anti-clock wise to decrease and increase the volume.

Next and previous.
Again this is a gesture that is similar to the corresponding symbol on a music player. The one fingers showing in a right/left direction are representing the two arrows of the next or previous symbol on a music player. As a result this gesture should be easy to remember.

Block diagram:

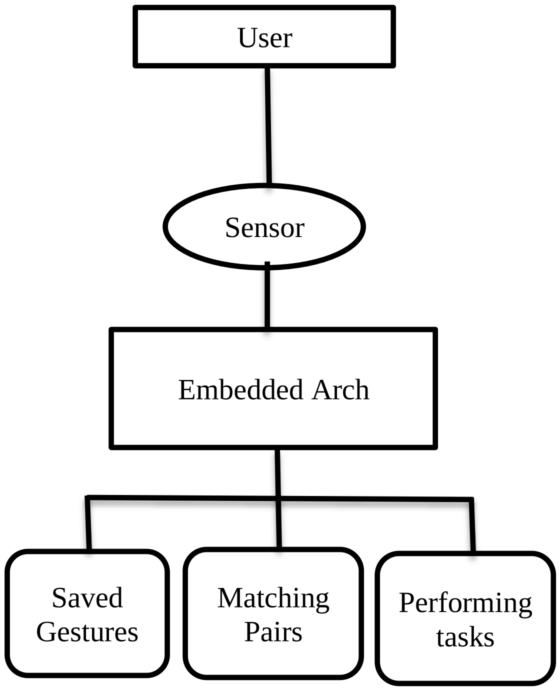

Fig.3

Implementation
The architecture of our system will be as shown in fig.3. Firstly the sensor will sence the input of the gesture by the user.This input will then go through various stages of background subtraction.Then the input will be sent to the database in which the predefined gestures are stored.In the database the picture recognition will play its part and one of function will be counted.Along with the counting of finger, mentation detection will take place and the actual gesture will be vent for matching.Once the gesture processed gesture is received, the pattern matching algorithm will carry out its function in find the matching by finding the pattern which is predefined in the database.When the match is found the report will be sent to the data which in turn will report to the system, The system will then carry out the task as specified in the database

for that particular gesture.Once the action in performed the task loop of the application is over and it is set to receive the next gesture and perform the last required by the server.

Conclusion:

We have thus implemented Gesture recognition using various algorithms and the best method/algorithm will be used in the further development of the project. The advantages of this approach include easy detection, simplicity and ease of understanding.

Since this method does not need to be trained, the time usage is reduced thus lowering the complexity of the program. It also eliminates the need for post processing as simple matching of gestures is carried out to find the suitable task and carry it out. Additionally these algorithms can detect the orientation of the gesture which can prove helpful as similar gestures can be carried out in various orientations to provide different tasks for every gesture.

The advantages of this algorithm thus result in a lower amount of computation time and hence improving the efficiency of the program and the project.

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Design of an Agricultural Land Maintenance Robot

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Abstract: In the process of crop production, there are several obstacles such as growth of weeds, lack of labour to prepare the land, and expensive equipment. We have developed a prototype of the robot that can be used for weeding, leveling and ploughing tasks. The project has been developed keeping the poor farmers in view. Hence an affordable system has been proposed. smaller, cheaper and efficient robot that can perform. The system also detects obstacles and avoids collision by taking a detour. An user-friendly webpage is developed to interact with the farmers. The webcam relays a live stream of the video onto the webpage for remote monitoring and also clicks snapshots which are processed inorder to identify the unwanted weeds and determine the percentage of weeds present in each snapshot.

Keywords: Agriculture Robot, Weed detection, Collision avoidance, Raspberry Pi

I. INTRODUCTION

In recent years, the agricultural industry has begun adapting numerous technologies that help in improving the quality of crops grown. Most of these new technologies aim at large scale farming in the order of thousands of hectares. The equipment that already exists is expensive, huge and not preferable for farmers having smaller lands that are of a few acres in size.

The research and development in the field of agriculture is ever growing with new technologies that aim at improving the efficiency of the robots and reducing the size. The concept of precision agriculture has inspired the new age farmers to make use of the available technology to maximize their yield.

The current approach towards crop production and other farming practices are strenuous, time consuming and requires labourers to manually perform each task, repetitively. A solution needs to be proposed keeping in mind the tools and mechanisation available in the present technological landscape.

This is achieved by a robot that can perform multiple tasks efficiently and provides a user friendly interface for the farmer. The robot will mainly perform maintenance and monitoring activities which will eliminate human effort and increase work efficiency. This will result in more productivity and higher overall output from the agricultural land and from each of the practices.

II. RELATED WORK

An extensive literature survey has been carried out to understand the prior art in the role of robots in Agriculture. The findings are recorded as indicated below.

Redmond, et. al [1] have listed the latest developments in agricultural robotics, specifically those that are used for autonomous weed control, field scouting, and harvesting. The author has focussed on digital farming using sensors, actuators and data analysis. The major challenges faced in digital farming were object identification, task planning algorithms, digitalization and optimization of sensors. The paper helped us to understand the challenges of automation and the drawbacks of the existing systems. We have understood the challenges and have made an attempt to automate the Agricultural system.

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An Agricultural robotic system which can be modelled using algorithms has been proposed by Nidhi, et. al [2]. Their model consists of Arduino boards and ultrasonic sensors. In their work the authors have employed a smart mechanization system using robots. The robot helps to disperse seeds, spray pesticides all over the field to kill the weeds. This is a random process wherein the pesticide is sprayed irrespective of the crop or weeds. They have used pesticides, which are harmful to health. But in our system, no chemicals or pesticides are used.

Amruta, et. al [3] have developed a prototype of a pesticide spraying robot that uses a wireless camera to determine the height of the target. This robot does not take into consideration the obstacles in the way. The robot will collide with any obstacle that is in front of it causing serious damage to the robot and the object it collides with. The robot developed by us has the ability to detect obstacles and take a detour around them.

The unmanned service units in agricultural environments are surveyed by Fernando, et. al [4]. A detailed analysis is presented and various algorithms and parameters that can be taken into account are mentioned. The collision avoidance techniques they have presented have been implemented in our model in a simpler manner.

The robot developed by Amrita, et. al [5] is capable of performing ploughing, seed dispensing, fruit picking and pesticide spraying using ultrasonic sensors for navigation. This helped us understand the mechanism behind automatic ploughing to implement the same in our project. Nonetheless, this robot does not take the growth of unwanted plants into consideration. Our model can differentiate weeds from crops and remove the same.

Usha, et. al [6] simulated the process of cultivating agricultural land without the use of manpower. The proposed model is a collision avoidance robot that has a seed dispenser and water sprinklers. But they did not take into account the growth of weeds. Whereas we have developed a working prototype of a robot along with the ability to identify weeds and remove them.

The use of microcontrollers and sensors for agriculture is emphasized by Abdullah, et. al [7]. They have simulated a model that can measure various parameters and display the result. This helped us understand the different sensors developed and used in farming practices. The implementation of this system in a greenhouse is also explained.

Nikesh, et. al [8] simulated and developed a system that aims at smart, automated agricultural activities such as weeding, spraying, moisture sensing and other monitoring activities. Pesticides which are sprayed irrespective of the presence of weeds can cause damage to the soil in the long run. The robot is not equipped with an obstacle avoidance system and hence it could collide with potential obstacles on the field.

The influence of shadows in recognition of weeds and insects is investigated by Zhao, et. al [9]. The model developed by them applies various transformations onto the image like erosion, gray transformation, threshold segmentation. A few of these transformations are applied in the weed detection process of the model we have developed.

Han, et. al [10] simulated an agricultural environment and applied the autonomous driving algorithm developed by them. They have also developed a model of the same which can control the movement and balance the robot. We have tried to achieve a similar result using a python program that determines the movement of the robot based on the output given by the sensor.

Fang, et. al [11] simulated a model that can enable agricultural robots to effectively operate on various farming practices on hilly areas and avoid obstacles in the process using 3D path planning. A partial implementation of the proposed functions has been done using the collision avoidance system itself.

A robot developed by David, et. al [12] consisting of an interlock drive system resulting in the robot to turn swiftly, follow straight rows and steer easily. They have used the number of rotations of the wheel to measure the distance moved by the robot from which we have derived a method to measure the distance moved by the robot in terms of the duration for which it was powered uniformly.

Yashaswini, et. al [13] propose a system to perform real time identifications of weeds in a farm using a deep learning method that works on real time farm crop images. The image captured by a webcam is processed by Raspberry Pi using OpenCV and deep learning techniques and eliminates the need to spray herbicides all over the field. This

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system only identifies the weeds but does not have the ability to perform the weeding activity. Our robot can remove the weeds in addition to identification of weeds.

The experiments conducted by Liu, et. at [14] on their robot for obstacle avoidance uses a Multi-sensor fusion algorithm. The robot can find the area around the obstacle with a fuzzy algorithm and remote monitoring is enabled through a camera which sends video over the internet. Our system implements a similar collision avoidance function along with various other functions.

Stephen, et. al [15] have developed a system to perform real time identifications of weeds in farm crops by using a deep learning method. It accelerates the operation by eliminating the need to spray herbicides all over the field. The developed robot is bulky and cannot detect obstacles. It can also perform only one specific task of weeding. Our model is compact and can perform multiple tasks.

III. METHODOLOGY

A powerful processor is used for carrying out the task. A sensor to determine the exact distance of the object, which poses as an obstacle to the forward movement of the robot is sensed. Once the obstacles in the path are sensed, the robot takes a detour around the obstacle and resumes its main path.

Weeding is the most arduous process in agriculture. A lot of money, time and effort is spent in this activity, which is an indispensable one in agriculture. An attempt has been made to identify the weeds and without harming the main crop, the weeding is carried out. First the video streaming of the crops is done. Then snapshots at a frequency of one second are captured by the program. This information is stored on the Raspberry Pi. then the snapshot is accessed for carrying out weed detection. Weed detection is done using image processing techniques. OpenCV is employed to distinguish weeds from the crop. A Weeder attached as an end effector to the robot takes out the weeds effectively.

An active user-friendly webpage is developed using HTML and CSS softwares. This enables the farmers to choose the task to be performed.

IV. BLOCK DIAGRAM AND WORKING

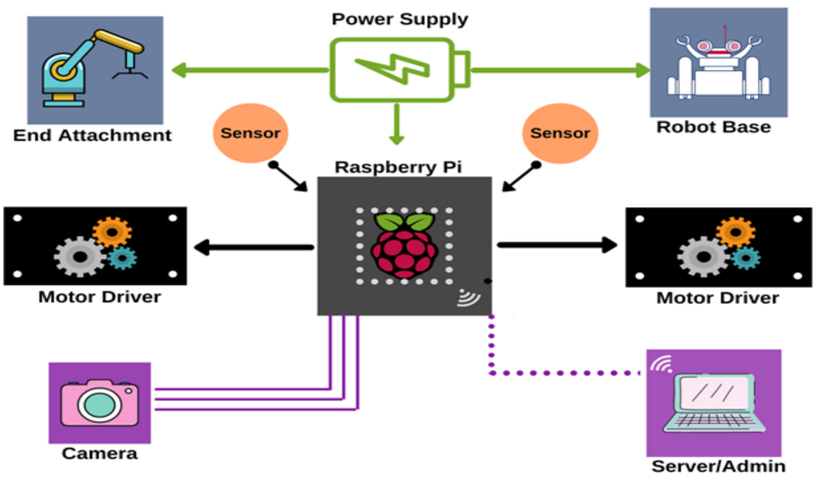

Figure 1. Block diagram of the proposed model

The system consists of a robot that is controlled by Raspberry Pi, a webcam, an L293D motor driver IC that controls two DC motors attached to the wheels, two servo motors that position the end attachments, an ultrasonic sensor that helps in obstacle detection and a robust software for collision avoidance.

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Raspberry Pi 3B is used in our project due to its low cost, compact design, in-built ports and easy programmability. An external webcam of 720p/30Fps, wide angle view is connected through one of the USB ports. The camera is enabled through the motion library of python and a live stream of the video is relayed on the website for remote monitoring by the farmer. Snapshots are captured from the live stream and processed by the python program. Ultrasonic sensor HC-SR 04 used is a low cost sensor with a range of 2cm to 400cm and a 30 degree cone. It is mounted at the front of the robot.

The L293D motor driver module is used to control the speed of the two DC motors connected to the front two wheels of the robot. For mechanical support, an acrylic chassis set is used with a holder for an ultrasonic sensor, DC motors, wheels. The end attachments to perform different activities like ploughing, levelling are moved up and down using servo motors. The complete system is powered using two 3.7V, 2500mAh 18650 Lithium Ion Batteries.

The various activities carried out by the robot are:

a. Weeding
b. Ploughing
c. Levelling

These activities are mentioned in the webpage as shown in Figure 5. The farmer chooses the activity that needs to be carried out by clicking on the web page developed for this purpose.The webpage has a livestream from the web camera on the robot for remote monitoring as presented in Figure 6.

On the click of the button on the web page, the control is transferred to the robot to carry out that particular activity. If the farmer clicks on the Weeding button, then the Camera will capture an image of the crops and store it on the Raspberry Pi. Image processing is performed on that image using OpenCV Python Library. This gives us the percentage of weeds present in the image. If the percentage of weeds is more than 70% then the weeder end effector is lowered and the weeding process is carried out. If the farmer clicks on Ploughing or Levelling, the robot lowers the respective end effector and the activity is carried out. With any of the above activities going on, the webpage keeps updating in real time and the farmer can view progress of the task on the web page as presented in Figure 6.

The movement of the robot and the process of collision avoidance is carried out using an ultrasonic sensor mounted at the front of the robot which is discussed in detail in the further sections.

The working of our prototype can be divided into three sections namely; Collision avoidance, Weed detection and User Interface.

Collision Avoidance

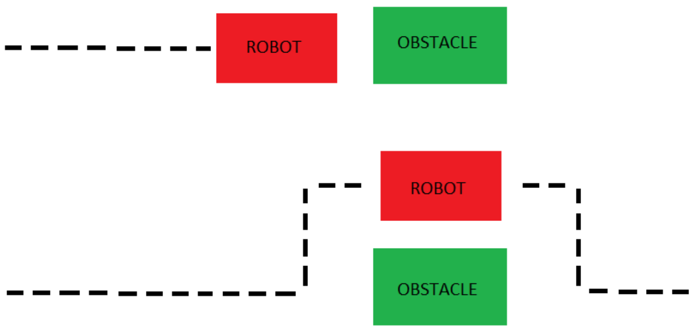

Figure 2: Collision Avoidance

An ultrasonic sensor is mounted on the robotic vehicle. The ultrasonic sensor measures the distance of an obstacle in front of the robot. The sensor can sense obstacles accurately within a range of 50 cms. Upto a distance of 15 cm to the obstacle the robot continues to move forward. If the distance is less than 15 cm then the robot stops, and moves backwards for 0.5 seconds (around 4cm) and turns to the left of the obstacle. If it still senses the obstacle then

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gets back to the previous position and then takes a turn towards the right of the vehicle and proceeds until it encounters no obstacle in its path.

To turn towards the left of the obstacle, the DC motor on the left wheel stops rotating and the right DC motor continues to rotate. Similarly to turn towards the right of the obstacle, the DC motor on the right wheel stops rotating and the left DC motor continues to rotate. In case there is an obstacle on both sides, then the robot moves backwards and covers a wider angle until no obstacle is detected.

Weed Detection

The Weed Detection process is carried out using OpenCV and image processing techniques. The camera captures the video stream of the plant along with the weeds. A snapshot is captured from the live stream and is stored on the Raspberry pi. The stored image undergoes a series of transformations such as RGB (Red, Green, Blue) to HSV (Hue, Saturation, Value) conversion, erosion and dilation. Parameters like colour and size are used to identify and differentiate the weed from the crop. The number of pixels occupied by the weeds was determined and the percentage of weed present was calculated.

User Interface

The farmer interacts with the robot via a web page developed using HTML5 and CSS. The web page has 4 main tabs as presented in Figure 4. It opens on the Home Tab, the Task Tab enables the user to select the task that has to be performed by the robot. This tab has three options: Weeding, Ploughing and Levelling. The live stream of the video from the web camera is received by the port number 80 of Raspberry Pi. This live stream is displayed on the progress tab of the webpage along with the Progress bar which shows the percentage completion of the task .

V. RESULTS

We developed a prototype of the robotic vehicle along with required mounting. It was field tested to verify the functionalities of the robot. The findings are presented in the following paragraphs.

Weeding Task

We selected the weeding task from the web page. The control was transferred to the weeding section. The web camera mounted on the robot shot the live stream of the plant along with the weeds in the field of interest. This live stream is continuously displayed and monitored on the webpage. The snapshots of the live stream were stored on the memory of the Raspberry Pi. A Python weed detection program was run on the snapshots of the livestream, and the image was divided into 3 vertical sections and the percentage of weeds detected in each part was calculated. The average and mid section percentage values for the density of the weeds were considered. In our case, we found that the mid section percentage was around 85. Hence the weeding for those sections were carried out. The end effector was lowered from the mounting onto the ground for weeding.

Levelling Task

The leveling task was selected from the web page for another trial. The control was transferred to the levelling section. The ground is levelled for other practices to be carried out. The leveler implement attached to the end effector was lowered. The implement levelled the ground as the robotic vehicle moved forward. In order to ensure the functioning of the vehicle in case of obstacles on its path, an obstacle was placed on its path. The vehicle detected the obstacle and took a detour around it from the left side. Then it resumed position after the obstacle and continued forward movement.

Ploughing Task

The ploughing task was selected from the webpage for the last trial. The control was transferred to the ploughing section. The plough was attached as the end effector, and it was lowered for ploughing. The ploughing task was also carried out like other tasks, taking measures to avoid collision.

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Figure 3: Weed detection

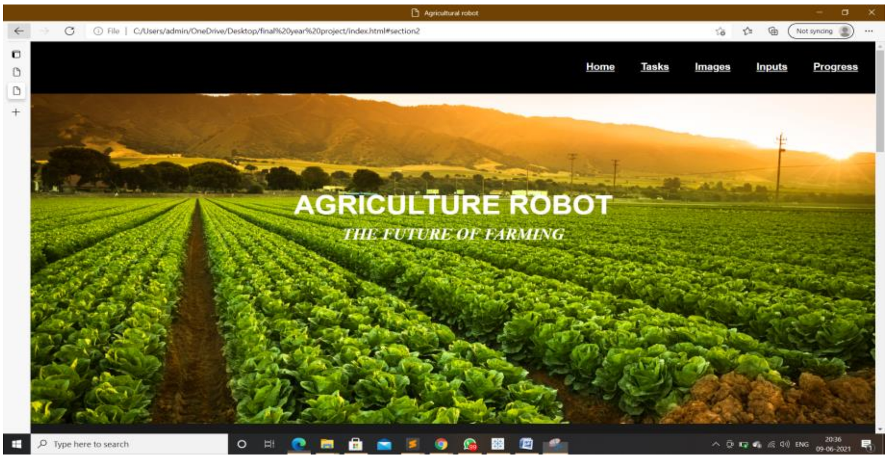

Figure 4: Agricultural Robot Webpage - Home

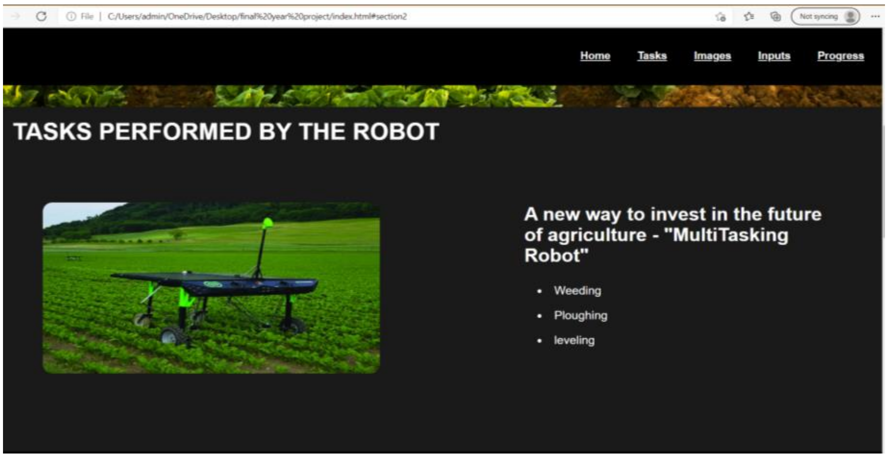

Figure 5: Agricultural Robot Webpage - Task Selection

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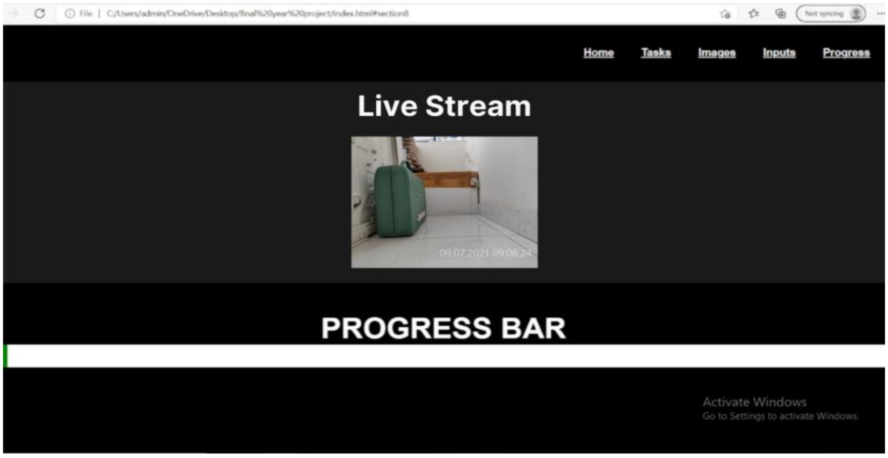

Figure 6: Agricultural Robot Webpage - Progress

VI. CONCLUSION

The Agricultural Land Maintenance Robot we have developed has the ability to perform routine maintenance tasks without much user intervention. This is a primary concern in the agricultural industry as the lack of labour causes loss of crops. This robot also helps to perform these tasks in a fraction of the time taken by humans. The comparative cost of the robot is significantly decreased by production using durable but inexpensive raw materials. The robot also avoids injury of labourers while working in the field.

Future Scope

This robot can further be modified to enhance its functionality by adding other end attachments, improving the user interface, adding more features to the webpage, increasing the accuracy of weed detection. GPS can be interfaced with Raspberry Pi inorder to track the exact location of the robot. Power is an important factor for the functioning of the robot. Solar Panels can be mounted on the robot vehicle in order to provide good battery backup as it moves through the field. Water sprinklers can be mounted to water the plants as the robot moves through the farmland. The movement of the robot in the field can be planned in advance using Novel Algorithms considering the dimensions of the agricultural land [16].

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Design of a Collision Warning System Using Image Processing and Development of an Android SOS Application

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***Abstract*- In order to avoid the growing number of accidents year after year, we have developed a system to reduce the occurrence of accidents. The system involves maintenance of safe distance from one vehicle to the other and thus avoiding collision. Image processing techniques have been employed to maintain safe distance, between vehicles. A display of distance along with caution notice to the driver of the vehicle is also developed. In case the accident occurs due to the negligence of the driver and also not paying heed to the caution alerts, then an SOS app has been developed to assist the driver both in sending information to the next of kin as well as to provide medical emergency services. Java software is used for the development of SOS app. Open CV is used for the processing of videos captured by web camera.**

***Key Words*- Object detection, SOS app, MS_COCO data set, Mobile net, Open CV**

I. *INTRODUCTION*

India tops the world in the number of road accident related deaths globally as per the records of the World Bank. Almost 11% of the total global deaths related to accidents are accounted by India. On an average, 17 people die in car accidents every hour. The Indian government has been actively trying to tackle this issue for several years.

Despite the fact that precautions such as seat belts, anti-lock brakes, and no drinking and driving have been severely enforced, the patterns show no significant statistical decline over time. Road accidents are multi-causal, resulting from several elements that can be broadly classified as human error, road condition and environment, weather and vehicle condition. Human errors caused by neglect and carelessness account for a large portion of these accidents. Drivers frequently lose sight of the road ahead and end up in a head-on collision.

To avoid such collisions, we devised a collision avoidance system that uses image processing algorithms to detect objects and send alerts when the vehicle comes too close to them. This allows drivers to take the appropriate actions quickly and avoid any fatal catastrophes.

We have also analysed the number of fatalities that occur as a result of a lack of a system that alerts the necessary medical aid team as soon as an accident occurs. The time for an ambulance to reach the destination might not find any significant changes in the future but the time required to inform the ambulance team can surely be reduced. Accidents are also not notified to the next of kin until it is far too late. Our system's SOS feature warns the next of kin and emergency service close to the site of the accident.

II. *RELATED WORK*

With the frequent loss of lives due to negligent driving, it is necessary to find a system which can be used to alert the drivers to avoid any possibility of an accident. In one of such techniques Roopa et al [1], has made use of background subtraction algorithm for vehicle detection and the vehicles are counted in a selected zone of the road but the algorithm accuracy is affected from poor lighting conditions. In [2], Usman et al proposed a system that uses ultrasonic sensors on the car to detect the collision and notify the current location using the GSM-GPS module but the sensors may lead to false alert due to external conditions(temperature, wind, etc). A variation of this prototype has been developed in [3], wherein they use a vibration sensor instead but has less accuracy when compared to the former. A dashboard video accident detection data set has been used in [4] which is used to detect the variation in visual information during an accident using Computer Vision techniques, however, the dataset used is limited.

Nazir et al [5] has proposed a system that makes use of MPU-6050 module which detects the accident and sends notification via the SIM808 module, but its usage is limited only to a mobile network. A 3-part prototype has been developed in [6], which consists of the prevention part, detection and rescue part and the black box part which makes use of various sensors along with Arduino which is coded using C++ software, but the range of the sensors used are limited. A vision-based technique is used in [7], wherein a Convolutional Neural Network is built using accident/non-accident images, however, it provided an accuracy of just around 85%. In [8], Naji et al makes use of an IR sensor along with RF transmitter and receiver modules to send SMS to the users upon the detection of the accident but the IR sensor results are affected by dust, haze or light. The YOLO V2 algorithm is used to detect the vehicles in [9] and estimates the distance using 2 ROS nodes for collision warning but accuracy decreases if object moves away. In [10], Andrew et al developed a warning system that uses YOLO algorithm for accident detection along with ultrasonic sensors for increasing the range of the detection at blind spots, nonetheless the sensors may not work under non-ideal conditions such as heavy winds. The system developed in [11] uses Bluetooth, WIFI and ultrasonic modules along with the processor for collision detection and an android application for distance reminder, alarm etc but the modules used have same communication band which may lead to interference between them. A machine-learning based approach including decision tree, neural net-based classification and support vector machine is implemented to give warning or no-warning signal to the driver in [12] but the processors used in this model makes it expensive. In [13] Abhir et al has chosen the approach which makes use of a LIDAR sensor for the obstacle detection and warns the driver based on the distance and angle of the obstacle, but the working of the sensor is affected during night/cloudy weather. Least Square – Support Vector Machine and Fuzzy logic algorithm is used in [14], which are used to predict danger from camera footage and estimates the appropriate speed respectively, however, it doesn't take other parameters into consideration beside speed of the vehicles. The response system of [15], makes use of MP6050, camera module and ultrasonic sensors for detection of accident and notifies the location fetched using GPS-GSM module via a mobile application but the sensors has limitations owing to it's proper functioning under ideal settings.

III. *METHODOLOGY*

Our work has three distinct modules. The first module caters to Collision Warning. The second module gives information about Collison Detection and Location Tracking. The third module is the development of app for SOS to contact emergency service and inform family.

A. Collision Warning System

Figure 1. Block diagram of Collision Warning System

The Collision Warning System developed by us comprises of a processor and a web camera. The object detection is carried out using Image Processing Techniques.

The camera captures the real time video of the road, where the vehicles are passing through. Then the labelling of the vehicles is carried out using Object Detection Model. The model then calculates the vehicle's approximate distance from each other. If the distance between the vehicles are greater than 10 feet, then no warning is given out. If the approximate distance is greater than 5 ft and less than 10 feet then, a warning sign in Green is displayed.

This mandates the drivers to slow down their vehicles. However, if the distance is less than 5 feet, a warning in RED is issued. This alerts the drivers to keep a safe distance between the vehicles.

B. Collision Detection

A robust Collision Detection has been developed using a microcontroller, accelerometer, GSM and GPS Modules. The Collision Detection Module is embedded in all vehicles. The accelerometer in the vehicles gives out signals to indicate that the vehicle has met with an accident. On collision with another vehicle or an object, the accelerometer senses the change in the acceleration and triggers the GSM and GPS Module. The GSM and GPS module, then broadcasts the vehicle's location to the emergency contact, indicating that the vehicle has met with an accident. This helps the family members and Hospital Emergency aid (such as ambulance) to track the user and reach out to him for help at the earliest.

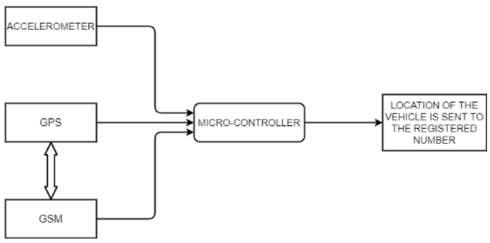

Figure 2. Block diagram of Collision Detection System

C. Development of Android Application for SOS

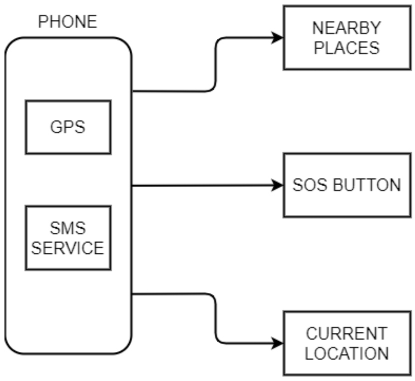

Figure 3. Development of Android Application for SOS

This module makes use of inbuilt Global Positioning System (GPS) and SMS (short message service) services of the phone.

More often than not, the information of any family member meeting with an accident reaches late, which may deprive the victim of good medical aid at the earliest. In order to facilitate a quick medical aid to the victims of accident, an application using android is developed. This android application is designed to facilitate the following:

1. Send an SOS message to the nearest emergency services. It also sends information to the driver's next of kin.
2. Current Location Aid to the driver if he is still alert.
3. Additional Navigational Features are provided to the driver. If he is alert, he can use these navigational features to drive to the nearest hospital. The app additionally gives location to gas stations, restaurants, medical centers, pharmacies, garages etc.

IV. *SOFTWARE DEVELOPMENT:*

PYTHON was used for developing the software required for image processing. The android application was developed using JAVA in Android Studio. The Microcontroller was programmed using embedded C. OpenCV was used to access the webcam as well as perform all the complex mathematical calculations. The MS COCO dataset is used to pre-train Single Shot Detection (SSD) Mobile net V1.

V. *WORKING*

An 8-bit microcontroller is used for controlling and processing the input data. The accelerometer is interfaced to the Microcontroller. If the vehicle collides with any object, the impact causes a sudden decrease in acceleration which activates the accelerometer which in-turn triggers the high signal to be input to the microcontroller. The microcontroller sends out appropriate signals to activate GPS and GSM, which are interfaced through digital IO pins.

The web camera captures the images of the vehicles. These images are processed using SSD mobile net V1. The model is trained using MS COCO data set. The Mobile net labels the data. There are approximately 90 labels in total. After the object has been spotted, the approximate distance is determined using a probabilistic value in the range of 0 to 1. Each reading indicates a different approximate distance between the driver and the object ahead. A green alert is issued if the value is 0.3. A red alert is displayed if the reading falls below 0.1. This warning informs the driver that he or she must come to a complete stop.

5.1 User Assistance SOS App:

When a user first opens the app, a home screen is presented, which is as shown in figure 4. The app is user friendly. The user can navigate to subsequent displays. The user will be able to view his current location, nearby emergency locations such as hospitals, fuel stations, garages, and an SOS emergency button.

5.1.1 SOS Emergency:

The functioning of the SOS Emergency button is as follows:

1. SOS Emergency button is provided to the user.
2. When the user clicks on the button, the stored emergency number is accessed. (The user is required to register the Emergency contacts on this app prior to its use.)
3. The stored number could be of family members/ Hospital
4. The app sends out the location of the user with SOS message.

Figure 4. Display of Home screen

5.1.2 Nearby Utilities:

When this button is clicked, a list of options is displayed for the user.

Figure 5. Display of nearby services

Some of them are Hospitals, Fuel stations, Pharmacies, Garages, Hotels, etc.
This is presented in figure 5.When the user clicks on, Hospitals, the app locates the coordinates and uses Google maps to access all the hospitals near the user's location. Likewise, for all other services the exact location is marked on the map.

5.1.3 Get Current Location

Get Current Location basically displays the user's location along with Longitude, Latitude, Locality, Postal code, and the complete address. This is an additional feature to help the user get his current location while traveling in an unknown city. The maps API provides more than 20 variables or attributes. The current location service screen is presented in figure 6.

Figure 4. Display of Current Location

VI. *RESULTS*

Our project has been tested in different scenarios. It was broadly classified into three cases based on the distance of the vehicles from each other. The test was carried out for Safe distance, Green Alert Distance and Red Alert Distance. The test outcomes are discussed in the subsequent paragraphs

6.1 Safe Distance:

Safe distance is a distance greater than 10 feet between vehicles. For this distance, the model is successfully recognising the vehicles and is also calculating the proximity. Based on this proximity number, the model will determine the closeness of the object to any vehicle.

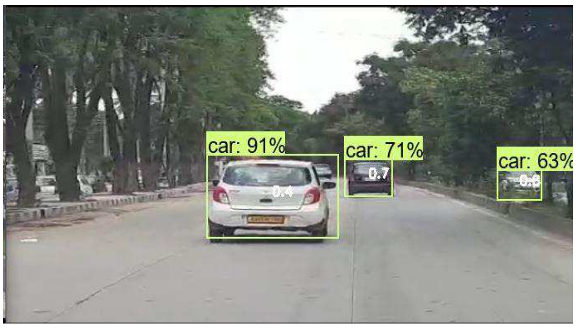

Figure 7. Safe Distance between Vehicles

6.2 GREEN ALERT DISTANCE:

Green Alert distance is a distance less than 10 feet and greater than 5 feet between vehicles. For this distance, the model is successfully recognising the vehicles and is also calculating the proximity. Based on this proximity number, the model will determine the closeness of the object to any vehicle. The model gives a warning in Green suggesting that the driver take heed and keep distance from the object ahead.

Figure 8. Green Distance between Vehicles

6.3 Red Alert Distance:

Red Alert distance is a distance less than 5 feet between vehicles. For this distance, the model is successfully recognising the vehicles and is also calculating the proximity. Based on this proximity number, the model will determine the closeness of the object to any vehicle. The model gives a warning in Red suggesting that the vehicle is too close to each other. And there is a probable chance of collision. The driver must immediately maintain the distance and take heed of the warning.

Figure 9. Red Alert Distance between Vehicles

6.4 Collision Detection

If a collision does occur, the accelerometer is triggered. This would cause the GSM and GPS modules to start working. A message would be sent immediately to the emergency contacts (Next of kin and medical assistance team) giving them the location of the accident.

SOS Message Display to the receiver: The SOS Message received by the next of kin or to Medical

Emergency Services looks as presented in the figure 9. The SOS message clearly indicates the location of accident and gives out the information required for one to reach the accident spot.

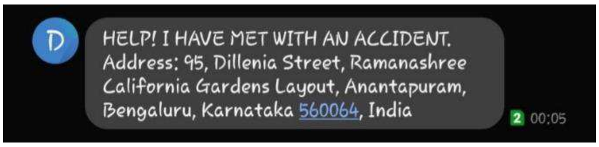

Figure 10. Message received by the user's next of kin and medical assistance team with the user's current location.

VII. *CONCLUSION:*

We have developed a collision warning System with a SOS user application.

The tests were carried out for different distance ranges. First the distance between the vehicles were maintained greater than 10 feet, which we have assumed as a safe distance. No message was displayed for this distance.

The vehicle was brought closer than 10 feet, approximately to a distance of 7 feet, and an alert was displayed to both the vehicle drivers, indicating that it is not a safe distance and a Green alert is displayed.

In the third case the vehicle distances were maintained less than 5 feet, resulting in the display of Red Alert caution to both the drivers.

The last case which is disastrous, when two vehicles collide, was only simulated. The functioning of the SOS application was tested. It sent the message presented in figure 10 to a friend's mobile. The driver was also able to send the medical emergency services message to another phone number. The driver was also able to locate his site of accident. He was also able to view the nearby utilities and services.

VIII. *FUTURE WORK:*

There is a vast scope for any project carried out for further enhancements.

With little modification the same unit can be used for Theft Detection, as the longitudes, latitudes and complete address of the car can be retrieved using the application.

The dataset can also be improved to recognize more vehicles as designs of vehicles are improving over time.

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