Security and Safety With Facial Recognition Feature for Next Generation Automobiles

Nalini Nagendran, Ashwini Kolhe

Abstract: This is the era of automated cars or self-driving cars. All car vendors are trying to come up with different advancements in the cars (Like Automatic car parking, Automatic Lane changing, automatic braking systems, android auto, car connect, Vehicle to external environment technology etc). In the automation industry, TESLA, Google and Audi are the most competent leader among each other as well as for other automation business also. Modern vehicles are all equipped with different technologies like navigation system, driver assistant mode, weather mode, Bluetooth, and other safety features which brings broader impact to quality of human's life, environmental sustainability. This paper explains how the proposed feature, unlocks the semiautonomous cars or autonomous cars safely and provides the safety to the entry level cars. The acknowledged pictures are put away in the picture database amid confront acknowledgment by utilizing Support Vector Machine (SVM) classifier. Information from confront pictures through picture pressure utilizing the two-dimensional discrete cosine change transformation (2D-DCT). A self-arranging map (SOM) utilizing an unsupervised learning method is utilized to order DCT-based element vectors into gatherings to distinguish if the picture is "available" or "not available" in the picture database. The face is detected by the event that the framework perceives faces, only the authentic users are able to start the ignition of the car and untheorized users are not allow to start the ignition.

Keywords : Face detection, Controller, Autonomous vehicles, safety , new feature , driverless cars , SVM

I. INTRODUCTION

Vehicular automation involves the utilization of mechatronics, computer science, and multi-agent system to help a vehicle's operator. These concepts are terribly tough to implement in vehicles may be that's why it is named as the smart vehicles. The semi-autonomous car uses navigation by the automation and remaining tasks are handled under driver's control. And most advance part of this semi-autonomous are the Full Autonomous cars or robotic cars.

The task in such are handle by car itself. Al decision are taken by itself on the basis of initial input given bye the user like the destination address, pickup address etc.

This types of cars has automatic breaking control, weather forecasting for the climate mode activation, speed control Adaptive headlamps, Advanced Automatic Collision Notification, such as OnStar Intelligent Parking Assist System, Automatic Parking, Automotive night vision with pedestrian detection Blind spot monitoring Driver Monitoring System etc. These all features are leading world to self-automated cars and machines.

Many automotive companies Like AUDI, Volvo, GM,FORD,BMW, VW are prototyping the driver less cars and trying to implement more intelligent driverless car. There are many disagreement recorded by the self-driving cars in last year. Google had launched self-driving car which drove 140,000 miles on the street of California. Without human intervention car drove successfully but in next lap while car came to automatic lane parking it could not take decision about the bus(speed of the bus was 15kmph and speed of Autonomous car was approximately 2Kmph) which was going to hit from back side to Google's car. This was the minor crash. Later on Many advance approaches are coming to make car more adjustable in public environment i.e. on the street. China is the fastest growing market in EV(electrical vehicles). Tesla Inc., VW, Toyota Motor Corp, investing more than $100 billion dollar in EV.

Face is the most difficult part as it is multidimensional. This system focuses on face recognition of the person sitting on driver's position and ignition of the car. It is mainly consist of face detection, face recognition engine ignition. Information from confront pictures through picture pressure utilizing the two-dimensional discrete cosine change transformation (2D-DCT). The face detected by using face uncovering techniques. Detecting the face is first step of the face recognition. It recognizes the facial parts of the image and later on this input image is given to SVM classifier.

A self-arranging map (SOM) utilizing an unsupervised learning method is utilized to order DCT-based element vectors into gatherings to distinguish if the subject in the info picture is "available" or "not available" in the picture database. If the face has found the match from stored authentic user picture database of the car then radio will come in ON state and then engine will get start up push through the controller command. Other startup operation of the car to get fully turn ON the head unit(HU) will be handled by the house keeping processor and application processor. This provides the security to the car and make one step ahead in LEVEL5 driving cars.

The Support vector machine (SVM) is designed to resolve the classical two class face recognition pattern. The previous SVM used to return the binary, class of object. We can broadly state that difference between same input image and the difference between different input images. This are the two input classes to the SVM. The deep learning algorithm can train autonomous to about its surrounding, what is happening in surrounding of the car, detecting size of objects, Imapct of the object, still object, moving object etc wuth the help of other technology like radar, V2X, vehicular Ad Hock network, sensors, IOT etc.

II. LITERATURE SURVEY

[1] Hteik Htar Lwin, Aung Soe Khaing, Hla Myo Tun "Automatic Door Access System Using Face Recognition", this paper explains that how autonomous car will behave while opening the doors with the help to face recognition . There are multiple ways to open doors with smartest way but facial recognition will be safest as two people can never have same faces. This sytem is using PCA(Principal Component Analysis) which used for facial recognition, to authentic the authorized person for the car.

[2] Zhaoxia Zhu , Fulong Chen "Fingerprint Recognition-Based Access Controlling System for Automobiles" this paper explains that biometric recognition system can overcome threats to the automobiles. It overcomes the traditional way of unlocking the car like with keys now a days key is not needed, smart phones are enough to do many smart jobs to automobile. This system uses the fingerprint encryption technique. It has some advantages like smartness in autonomous cars, security, low power consumption and cost efficient.

[3] Yongmin Li; Shaogang Gong; H. Liddell "Support vector machine based multi-view face detection and recognition" this paper explains that the Detecting faces across multiple views is more challenging than in a fixed view, e.g. frontal view, owing to the significant non-linear variation caused by rotation in depth, self-occlusion and self-shadowing. To address this problem, a novel approach is presented in this paper. In the form of the tiny segments, the view sphere is mounted. Every segment has its own face detector. Here the pose of the image has taken under consideration weather it is face or not. A pose estimator is constructed using Support Vector Regression. The pose information is used to choose the appropriate face detector to determine if it is a face.

[4] "Development of a Student position Management System Using RFID and Face Recognition" it explains, Whole world and administrators of Educational institutions' in our country are concerned about regularity of student position. Student's overall academic performance is affected by the student's present in his institute. Mainly there are two conventional methods for position taking and they are by calling student names or by taking student sign on paper. They both were more time consuming and inefficient. Hence, there is a requirement of computer-based student position management system which will assist the faculty for maintaining position of presence. In this paper basic problem of student position management is defined which is traditionally taken manually by faculty. One alternative to make student position system automatic is provided by Computer Vision. In this paper we review the various computerized system which is being developed by using different techniques. Based on this review a new approach for student position recording and management is proposed to be used for various colleges or academic institutes.

[5] Yeka Joseph Abueh and Hong Liu "Message Authentication in Driverless Cars" , this paper explains how the data is getting exchanged between various modules of the car. The VANET is allowing the cars to communicate with each other. This system blocks many unwanted messages And denial-of-service attack.

[6] Keshav Bimbraw "Autonomous Cars: Past, Present and Future", The field of autonomous automation is of interest to scientists, and much has been skilled in this area, of which this paper presents a detailed chronology. This paut the new trends in automobile . also it explains the future and past about the autonomous vehicles. Various semi-autonomous features introduced in modern cars such as lane keeping, automatic braking and adaptive cruise control are based on such systems. It is predicted that most companies will launch fully autonomous vehicles by the advent of next decade. The future of autonomous vehicles is an ambitious era of safe and comfortable transportation

[7] Brian Markwalter "The Path to Driverless Cars The Path to Driverless Cars" this system this note gives the over view related to driverless car. CTA is eager to see self-driving vehicles come to fruition because of their potential for preventing the vast majority of high way deaths and injuries and for making drives more pleasant.

[8] William B. Rouse "The Systems, Man, and Cybernetics of Driverless Cars" This explains about the System, man and cybernetics. There are many signals in vehicles controller and processors. Numerous pathways are working for different signals. How the driverless cars will affect the human kind is explained.

III. ARCHITECTURE & IMPLEMENTATION

This system uses the efficient algorithm for the face recognition. Here, there are three main things, face detection, face recognition and then starting ignition of the engine. Implementation wise it consists of image processing and then processor and controller part.

Fig 3(a) represents the complete flow of the proposed system. In which the picture of authentic person is taken and stored in picture DB, the features from the input images are extracted by the extraction method and match with the authentic user of the car. The autonomous vehicles in coming are going to be very smart as smart phones we are using now in 2018. The traditional use of cell phone was to just voice communication. But now along with that feature many advancement has done. Over the period of time, Like that only the cars are getting more advanced. The technology is progressing, we also have to take care of the security of the car. The hacking of car, as it is autonomous car, so it is more prone for cyber-attacks, some local threats etc. By the proposed system local threats can be reduced along with giving the new latest feature to the car. The proposed system save Level 4 cars from getting stolen and for Level 5 with more advancement with this system, we will able to recognize the passengers in to full to automatic taxis, like uber taxis working in Arizona.
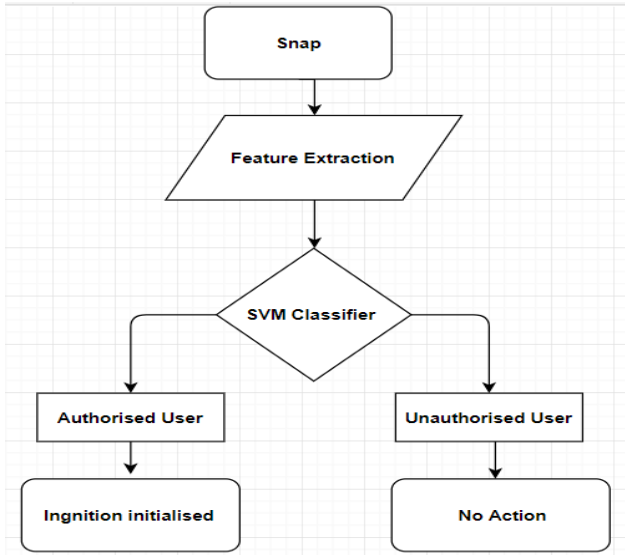
Fig.3.(a): The functional flowchart of the prosed system

A. Face Detection Method

The existing face recognition technique for identification of human general expression in DCT co-efficient technology. which is not that much flexible, Only predicting the facial movement and emotions and No security. The proposed system is using the image processing technique using the MATLAB programming in DCT-2D manner. Through after the image processing we are operating the Motor to show the ignition of the car. The flow of proposed system is explain as follows. Basically it is the combination of two domain MATLAB and Embedded. The image processing part is done in this section.
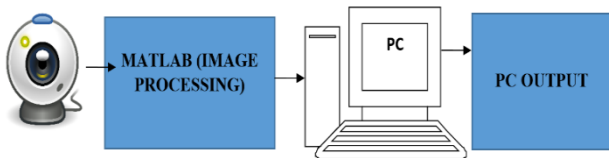

Fig 3(b) : Flowchart of MATLAB section

Integral picture at area x , y contains the whole of the pixels above and to one side of x , y, comprehensive:

$$ii(x,y) = \sum_{x'<=x,y'<=y} i(x',y')$$

Using following pair of the recurrences

$$s(x,y) = s(x,y-1) + i(x,y)$$
$$s(x,y) = s(x,y-1) + i(x,y)$$

Where the s(x,y) is the aggregate row sum, the essential picture can be figured in one disregard the first picture.

The total of the pixels inside rectangle D can be figured with four cluster references: The estimation of the vital picture at area 1 is the entirety of the pixels in rectangle A. The incentive at area 2 is A + B, at area 3 is A + C, and at area 4 is A + B + C + D. The total inside D can be figured as $4 + 1 - (2 + 3)$
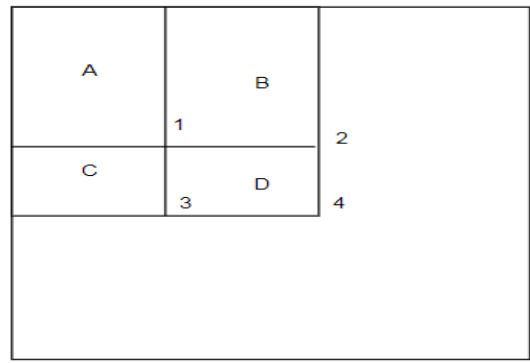

Fig.3.(c): Area captured by the integral image

Few these highlights can be joined to shape a powerful classifier. The fundamental test is to discover these highlights.

The present situation we are utilizing face acknowledgment framework in the different verification and security framework. Programmed acknowledgment of individuals is a testing issue which has gotten much consideration amid late years because of its numerous applications in various fields. Face acknowledgment is one of those testing issues and exceptional, there is no procedure that gives a powerful answer for all circumstances. It is the system for human face acknowledgment. This method utilizes a picture based approach towards manmade brainpower by expelling excess information from confront pictures through picture pressure utilizing the two-dimensional discrete cosine change transformation (2D-DCT). The DCT removes highlights from confront pictures in light of skin shading. Feature vectors are built by processing DCT coefficients. A self-arranging map (SOM) utilizing an unsupervised learning method is utilized to order DCT-based element vectors into gatherings to distinguish if the subject in the info picture is "available" or "not present" in the picture database. Face acknowledgment with SOM is completed by arranging power estimations of grayscale pixels into various gatherings. The viola jones algorithm uses 3D frames , here we are using the 2D matrix. The image processing deals with the changes in images, converting one type of image into another by using functions.

B. Classification

Assessment was performed in MATLAB utilizing a picture database of for eg. 25 confront pictures, here it performing 2 main things 1) training 2) testing part in training process it initialized the input images once and stored the feature of each and every person or object in 2D manner. Then it going to synchronize the input images by testing process by fetching the input images. Containing five subjects and each subject having 5 pictures with various outward appearances. In the wake of preparing for around 850 ages the framework accomplished an acknowledgment rate of 81.36% for 10 continuous trials. The primary favorable position of this system is its rapid handling capacity and low computational prerequisites, as far as both speed and memory usage.

The SVM classifier used for classification of the images. It decides whether the particular image is belongs to particular group or not. For example. In the this system, SVM decide whether the picture stored into the picture database is matching with the input images or not. If it matches then it will 1 and if it does not match then it will be 0. The input image before facing the SVM , might have gone through the several processing filter to extract the features.
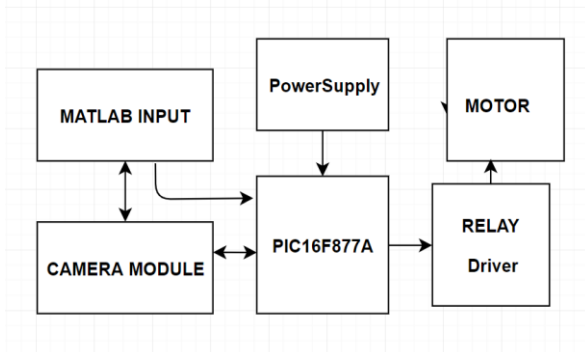

Fig 3.(d) : The block diagram of proposed system

The image undergoes from three interpolation. The Bi-linear , Cubic and the Nearest neighborhood interpolation. If some picture cuts from corner still we can pad some zeros at the starting and ending of the frame. This continuous discrete values added to increase the chances of getting sharp images. The nearest neighborhood interpolation algorithm used to increase the size of the image if it is smaller. It adds more pixels with the same color along with it preserves the original picture's properties.
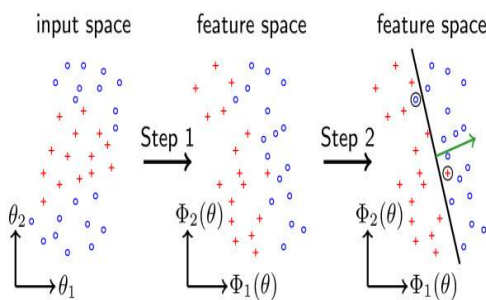

Fig 3.(e) : SVM for subgrouping the images

SVM for subgroup characterization. Perception of the SV machine approach for isolating cells with $\delta(i) = +1$ (+) and $\delta(i) = -1$ (∘). Left: conveyed information from set. Center: example changed in the component space which takes into account better partition. Right: partition come about for isolating hyperplane with ordinary vector w (→). As a flawless partition is as a rule unrealistic, misclassifications (○) exist.

Let the (xi,yi) be the set of points to get trained, the goal is to calculate the hyperplane.[16]

$$f(x) = sgn \sum_{i=1 to N} \alpha_i x_i y_i * x + b$$

x_i belongs to Rn , y_i belongs to {1,0}, by this equation the hyperplane is able to distinguish among the set of the input images. Above equation represent the optimal separating plane.

As we discuss the feature extraction, mapping those feature with authentic users picture and then giving push up command to the processor for ignition start, the security aspect we have to be more careful with this mapping state. After MATLAB's function SVM classifier will comes under account which will train the images and help to maximize the chances of getting correct output. The left eye , right eye, nose , mouth and face these 5 bbox will get created and along with it RGB, gray scaling , contrast will accompany. The face which comes in front of the camera will get mapped with stored picture so that it may allow you to start the engine.
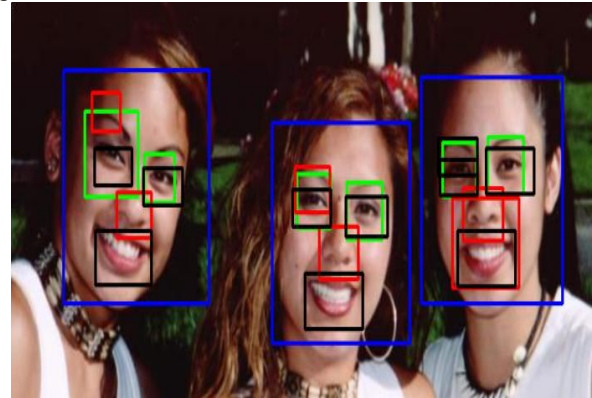

Fig 3(f) : Extraction of features(Left eye, right eye, nose, mouth and face)

C. Hardware Implementation

This system has used PIC 16F887 microcontroller because of its good features and integrated peripherals. The microcontroller is used to receive the signal sent from PC and to send a command back either to the engine circuit. Figure 3.(e) shows the overall implementation and fig 3 (f) shows the PIC 16F887 microcontroller pins assign.

The required hardware is pic16f877a micro controller, relay with driver circuit, motor , power supply, are connected as shown in the figure. A Relay driver IC is an electro-magnetic switch that will be used whenever we want to use a low voltage circuit. The required current to run the modules is different for each according to its requirement therefore the relay driver circuit is needed.
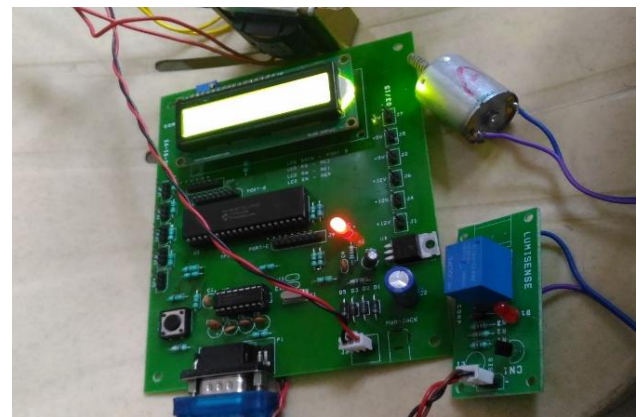

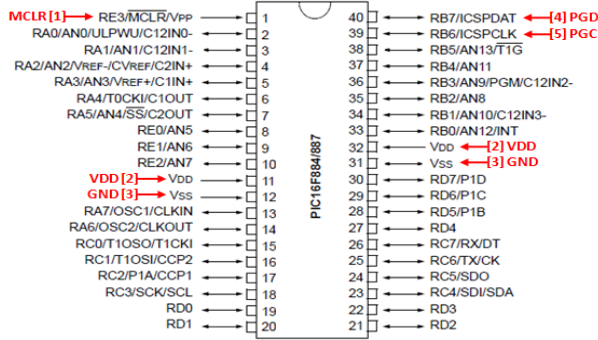**Fig 3.(i) : The hardware setup of the system**

Fig 3.(j): PIC16F887a microcontroller pins assign.

Pin 32,31 are dedicated for power and ground. Pin 25 is to take input from PC, Pin 19,20 is for motor. The camera module will interact with both the part i.e. MATLAB part as well as the hardware part. MATLAB tool's output is given to the controller and on the basis of the recognition engine should get start up. If the person's face is recognized and matches with the picture database then controller will send the signals to the engine for initial ignition.

IV. DISCUSSIONS AND CONCLUSIONS

industry. People like the their cars doing more than what it actually doing now. So all the automobile vendors are trying hard to make fully automatic self-driving cars for public with more safety and would not be hazardous to the mankind, because at the end the self-driving cars are nothing but the robots, which takes it own decision while being part of the public environment .Cameras, GPS, radars, sensors these all collects surrounding information of the car.

Roads will be more safer and accident ration due to drivers drowsiness will reduce. Many Road accident will get reduce by implementing such technology. The proposed system saves car from getting stolen or it denies access to unauthorized users by this we can reduce many accidents and loss. The automobile industry will launched their more most advance cars in coming 2020. Most cars will get fully autonomous by 2035. Future scope for this system will be like face getting recognized and then on mobile phone you will get the message along the driver's photo and information related like time, speed of the vehicles etc.

V. RESULT AND ANALYSIS

The overall system is stimulated by the MATLAB and controller part. The face detection will detect the authorized person's face and starting the motor. Which will provide the security to the vehicle. The system has gone through the several experimental images. The picture database contains the two authentic user's picture with good lightning condition. With this we have trained the classifier to detect the authorized user from number of input images.

And if the system detects unauthorized user, the controller does not send any stat up to the motor. It will simply discard the entry of this unauthorized user. So if somebody having duplicate key or master key still will not able to steal the car. This system provides the security along with a great feature to the automobile.

The network of the vehicles in coming future will avoid many road accidents, jam, local threat etc.
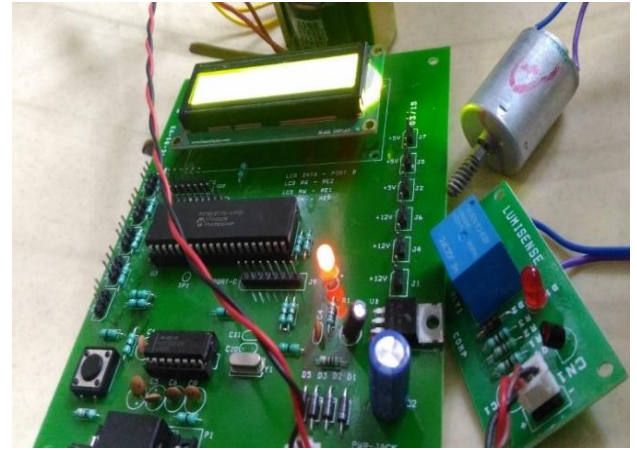

Fig 5(a): After the detecting the authorized user the motor starts rotating.

The Fig 5(a) shows the model representation of the proposed system. The controller is command to motor to get start after the input image has mapped with the authentic user of the car.

VI. FUTURE WORK

The future work for the proposed system is getting the message from the car itself with drivers photo, name, starting time of the journey, location of the car, finishing time of journey etc. and other details or the firm should receive the information about the number of passengers present in the fully autonomous taxis and their details etc.

REFERENCES

1. Hteik Htar Lwin, Aung Soe Khaing, Hla Myo Tun "Automatic Door Access System Using Face Recognition" INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH VOLUME 4, ISSUE 06, JUNE 2015 ISSN 2277-8616 294
2. Zhaoxia Zhu , Fulong Chen "Fingerprint Recognition-Based Access Controlling System for Automobiles" 2011 4th International Congress on Image and Signal Processing
3. Yongmin Lia,*, Shaogang Gongb , Jamie Sherrahc , Heather Liddellb "Support vector machine based multi-view face detection and recognition" Y. Li et al. / Image and Vision Computing 22 (2004) 413–427
4. Unnati A. Patel, Dr. Swaminarayan Priya R. « Development of Student Attendence Management System Using RFID and Face Recognition : A Review "International Journal of Advance Reasearch in Computer Science And Management Stsudies. Vol. 2, issue 8,August 2014
5. Yeka Joseph Abueh and Hong Liu "Message Authentication in Driverless Cars" 978-1-5090-0770-7/16/$31.00 ©2016 IEEE
6. Keshav Bimbraw "Autonomous Cars: Past, Present and Future"IEEE
7. Brian Markwalter "The Path to Driverless Cars The Path to Driverless Cars" Digital Object Identifier 10.1109/MCE.2016.2640625 APRIL 2017 ^ IEEE Consumer Electronics Magazine
8. William B. Rouse "The Systems, Man, and Cybernetics of Driverless Cars"
9. Paul Viola, Michael J. Jones, Robust Real-Time Face Detection, International Journal of Cumputer Vision 57(2), 2004.
10. Ayushi Gupta, Ekta Sharma, NehaSachan and Neha Tiwari. Door Lock System through Face Recognition Using MATLAB. International Journal of Scientific Research in Computer Science and Engineering, Vol-1, Issue-3, 30 June 2013.
11. I.Yugashini, S. Vidhyasri, K.Gayathri Devi, Design And Implementation Of Automated Door Accsessing System With Face Recognition, International Journal of Science and Modern Engineering(IJISME), Volume-1, Issue-12, November 2013.

12. Liton Chandra Paul, Abdulla Al Sumam. Face Recognition Using Principal Component Analysis Method. International Journal of Advanced Research in Computer Engineering & Technology (IJARCET),Volume 1, Issue 9, November 2012
13. Liam Ellis1, Nicolas Pugeault2, Kristoffer O¨ fja¨ll1, Johan Hedborg1, Richard Bowden2, Michael Felsberg1 " Autonomous Navigation and Sign Detector Learning " 978-1-4673-56478-03/123/$31.00 ©20123 IEEE
14. Young-Hwan Lee, Toun gseop Kim, Heung-jun Kim , In Kyoung Shin,Hyochang Ahn,YuKyong Lee " Mdofied Active Shape Model for Realtime Facial Feature Tracking on iPhone " 2016 10th International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing
15. Shaif Choudhury, Soummyo Priyo Chattopadhyay, Tapan Kumar Hazra "Vehicle Detection and Counting using Haar Feature-Based Classifier" 978-1-5386-2215-5/17/$31.00 ©2017 IEEE
16. Chapelle, O. (1998). Support Vector Machines et Classification d'Images.