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RESEARCH ARTICLE

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NOVEL SURVEILLANCE TO DETECT ABNORMAL ACTIVITIES IN ATM CENTERS

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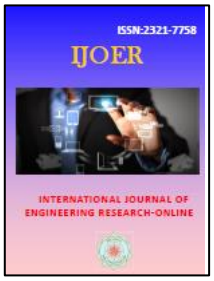

ABSTRACT
In recent days, there is an increased threat encountered by customers and ATM machines and hence the security systems are not up to the level. Many people may get involve in malpractices in different ways; likewise people try to impersonate themselves and access ATM machines. A secure technology is to be deployed to avoid such kind of misbehaviors. Initially, it is necessary to identify and make facial recognition. Here PCA algorithm is proposed for facial recognition. If any person has harm on his face, it's also considered as he's with a mask. Hence in such cases Biometric identification is use. At last the abnormal activities in ATM transaction are to be detected by using swarm theory; Histograms of Oriented swarms (HOS). And that information is to be delivered to the respective authorized person via SMS using GSM. ADABOOST algorithm is used for the abnormal activity detection. PIC microcontroller is used to control the GSM process.

Keywords—Facial Recognition, Biometric Identification, Abnormal Activity Detection

I. Introduction

ATM is one such machine which makes money transactions easy for customers to bank. The other side of this improvement is the enhancement of the culprit's probability to get his "unauthentic" share. Traditionally, security is handled by requiring the combination of a physical access card and a PIN or other password in order to access a customer's account. This model invites fraudulent attempts through stolen cards, badly-chosen or automatically assigned PINs, cards with little or no encryption schemes, employees with access to non-encrypted customer account information and other points of failure. This is high-time for banking sector and government to join hands to weed out this crisis in security system. So it becomes indispensable to strictly monitor the do's and don'ts inside the ATM centers, very specifically the facial recognition is considered to authenticate the entry of any individual inside the ATM center, it is achieved by employing classifier technique. As an additional feature, a combinational biometry system is used to access the ATM machine. The entire security module is incorporated with an easy access panic button and a sound sensor-cum-alarm, which alerts the cops as well as the bank's security wing, ensuring immediate rescue to the victims including physically challenged people. This overall system proves to be an autonomous, continuous and secured surveillance system. We propose an automatic teller machine security model that first recognize the face and give access to further process. If the user wear helmet or close their face by using mask, then our system will give the alarm

sound that someone is trying to enter the ATM with helmet or mask by using PCA algorithm. After face detection is successful the person can access the ATM. A person with an injured face when trying to get into the ATM, then it's hard to recognize. Since it considers that injury as a mask it doesn't allow. At that time Biometric identification (thumb impression) is used to identify the authorized person. Inside ATM, if the person makes abnormal activities such as raising hands, touch anything apart from ATM machine working area, walking inside the room our system will identify this activity by using, A newly introduced concept based on swarm theory, Histograms of Oriented Swarms (HOS), is applied to capture the dynamics of a person in the ATM, and sends the abnormal activity information to the respective authorized person. If this technology becomes widely used, ATM would be protected. However, it obvious that man's biometric features cannot be replicated, this proposal goes on a long way to solve the problem of Account safety making it possible for the actual account owner alone have access to his accounts. The combined biometric features approach is to serve the purpose both the identification and authentication will secure the cash from unauthorized person. Recognition System (FRS) can be subdivided into two main parts.

The first part is image processing and the second part is recognition techniques. The image processing part consists of Face image acquisition through scanning, Image enhancement, Image clipping, Filtering, Edge detection and feature extraction. The process would effectively become an exercise in pattern matching, which would not require a great deal of time. Secondly, the task of automatically detecting frames with abnormal activities or anomalous events from long duration video sequences as concerned. Thus, this work introduce an innovative deployment of swarm intelligence , which, together with the Histograms of Oriented Gradient(HOG) descriptor forms a new feature capable of successfully determining a regions "normality" in an SVM framework.

This research is intended to reduce the crimes by implementing simpler yet secure method of accessing ATMs.

The prime responsibility is to ensure a secured ATM service by providing enhanced security system in center. In this technically advanced world automation is grabbing attention in every field. So the ATM center can be made fully automated without manual mode of monitoring and intimation as a solution to the troubles faced.

II. Related Works

Bruce Poon [1] proposed methods on PCA based human face recognition for distorted image. Renliang Weng [2] Robust point set matching for partial face recognition by detect key points and extract their local textural features (RPSM). Zongwei Zhou [3] two- dimension principal component analysis- based motion detection framework with subspace update of background. Avenirk Troitsky[4] two-level multiple face detection algorithm based on local feature search and structure recognition methods. S. Thakur, J.K. Sing [5] face recognition using PCA (principal component analysis) and RBF neural networks. Zahid Mahmood and Tauseef Ali [6], Effects of pose and image resolution on automatic face recognition algorithm includes (a) the adaptive boosting (Ada Boost) with linear discriminant analysis as weak learner, (b) the principal component analysis (PCA)- based approach and (c) the local binary pattern (LSB)- based approach. Yogameena Balasubramanian [7] forensic video solution using facial feature- based synoptic video footage record, the algorithm includes Viola-Jones face detection, deformable part based models are used to detect the face attributes subsequently, Histogram Of Oriented Gradients and oriented center symmetric local binary pattern features are extracted. Xihao Zhang and Lin Zhou[8] A novel efficient method for abnormal face detection in ATM. With an empirical rule-based face localization is utilized to locate the face roughly, and then adaptive ellipse fitting helps accurately locate the face and ADABOOST to combine a skin color detection and face templates matching. Vagia Kaltsa and Alexia Briassouli [9] Swarm intelligence for detecting interesting events in crowed environments, here detecting the abnormal patterns in videos. Sudden changes in velocity, like an abrupt increase of its magnitude and the dispersion of individuals in the crowed are detected by Histograms of Oriented Gradients (HOG)

III. CONVENTIONAL METHOD

At present situation there are different kinds of security in different ATMs. The two kinds of securities are

1. Identify the Helmet/ Mask users in ATM center, by using "Haar Classifiers" algorithm.
2. Detect any other abnormal activities inside the ATM transaction by using Ellipse Fitting and Modified ADABOOST.

A. HELMET/ MASK IDENTIFICATION

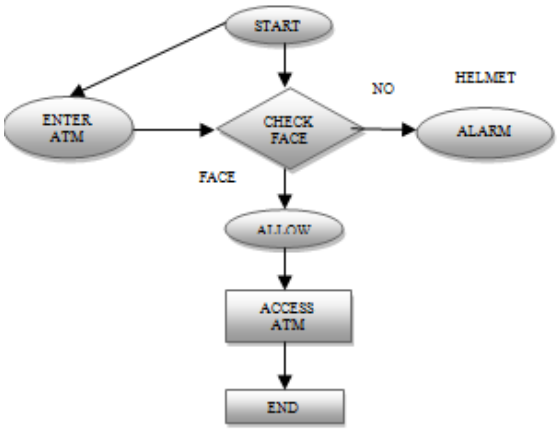

FIG.1 : ALGORITHM- HAAR CLASIFIERS

B. ABNORMAL ACTIVITY DETECTION

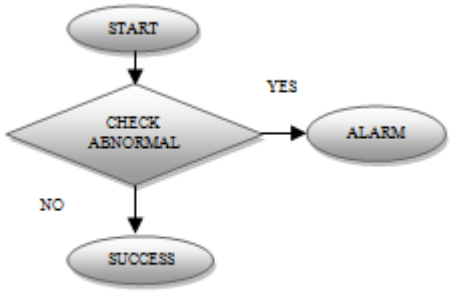

FIG.2: ELLIPSE FITTING & ADABOOST

IV. Proposed Application

1. PCA algorithm is used for recognition the face, to identify Helmet/ Mask users in ATM center.
2. Biometric Identification is sensed by "Thumb Impression" (Adhar ID verification).
3. Swarm Intelligence (HOS) is used to capture farms of images for every second to detect the abnormal activities inside the ATM.
4. GSM is used to send the information to the authorized person.

The conventional security system, which is very much concern over electronic transaction and not concentrating on ATM centers safety which in turn triggered the ATM center to host many fraudulent activities. This system shortens the problems faced in the conventional security system as it emphasize the need of strictly enforcing the dos and don'ts of ATM centers and it priorities physical safety of the costumer and ATM machine, by providing 24*7 surveillance and immediate rescue alter. As it is very particular about facial identification to authenticate the entry it provide sufficient data in the event of any discrepancies there by illegal activities can be avoided inside the ATM. It ensures more authenticated usage of an account as per the RBI rules. The mind set of people to do mischievous activities inside the ATM center is flatten. This system provides complete information regarding an unethical event and helps to track the intruder. This also provides necessary evidence for the legal prosecution.

A. PCA FOR FACE RECOGNITION

In this research we have reviewed a face recognition method based on feature extraction. By using extensive geometry, it is possible to find the contours of the eye, eyebrow, nose, mouth, and even the face itself. Principal component analysis for face recognition is based on the information theory approach. Here, the relevant information in a face image extracted and encoded as efficiently as possible. In mathematical terms, the principal components of the distribution of faces or the eigenvectors of the covariance matrix of the set of face images, treating an image as a point (vector) in a very high dimensional face space is sought. Here principal component analysis method will be presented in more detail.

The proposed research is based on an information theory approach that decomposes face images into a small set of characteristic feature images called "Eigen faces", which are actually the principal components of the initial training set of face images. Recognition is performed by projecting a new image into the subspace spanned by the Eigen faces ("face space") and then classifying the face by comparing its position in the face space with the positions of the known individuals.

The Eigen face approach gives us efficient way to find this lower dimensional space. Eigen faces are the Eigenvectors which are representative of each of

the dimensions of this face space and they can be considered as various face features. Any face can be expressed as linear combinations of the singular vectors of the set of faces, and these singular vectors are eigenvectors of the covariance matrices.

a) *Algorithm for PCA*

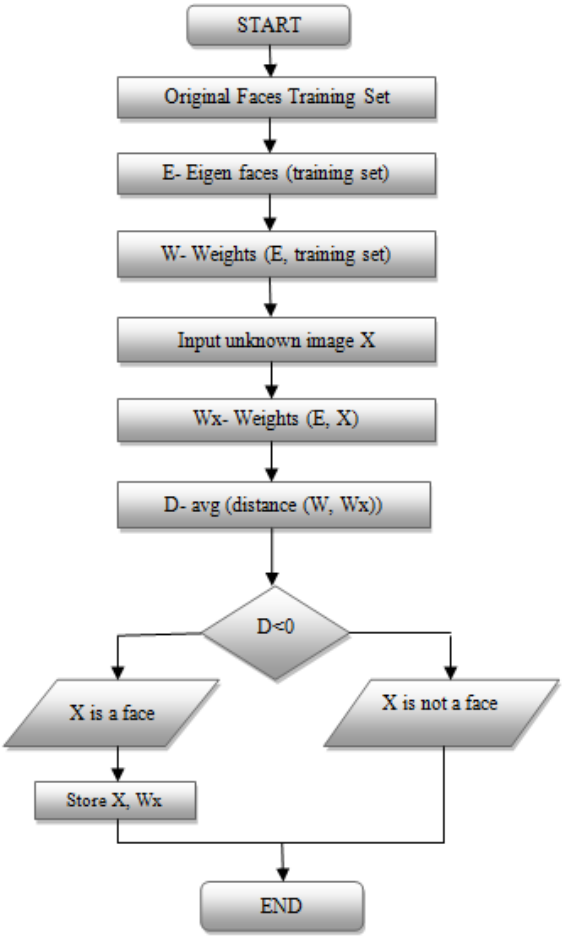

Fig.3: Program Algorithm

b. Calculation of Eigen faces and weights

Let a face image I(X, Y) be a two-dimensional N x N array of 8-bit intensity values. An image may also be considered as a vector of dimension N2 , so that a typical image of size 256 x 256 become as a vector of dimension 65,536, or equivalently a point in 65,536-dimensional space. An ensemble of images, then, maps to a collection of points in this huge space. Images of faces, being similar in overall configuration, will not be randomly distributed in this huge image space and thus can be described by a relatively low dimensional subspace. The main idea of the principal component analysis (or Karhunen- Loeve expansion) is to find the vectors that best account for the distribution of face images within the entire image space. These vectors define the subspace of face images, which we call "face space". Each vector is of length N2, describes an N x N image, and is a linear combination of the original face images. Because these vectors are the eigenvectors of the covariance matrix corresponding to the original face images, and because they are face-like in appearance, we refer to them as "Eigen faces". An N x N matrix A is said to have an eigenvector X, in linear algebra, the eigenvectors of a linear operator are non-zero vectors which, when operated on by the operator, result in a scalar multiple of them. The scalar is then called the eigenvalue An N x N matrix A is said to have an eigenvector X, In linear algebra, the eigenvectors of a linear operator are non-zero vectors which, when operated on by the operator, result in a scalar multiple of them.

B. BIOMETRIC IDENTIFICATION

I. RFID Reader

II. Thumb Impression Using Finger Print Identification

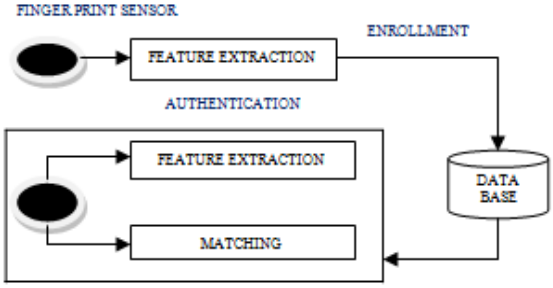

Fig.4: Block Diagram – Biometric Identification

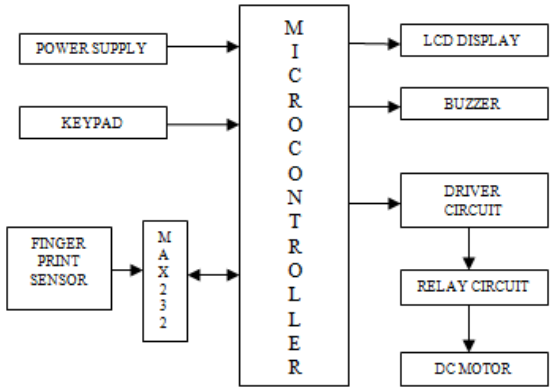

Fig.5: Block diagram for Biometric Identification

Person with an injury on his face when trying to get into the ATM, then it's hard to recognize since Biometric Identification is used.

I. RFID, read the ADHAR card unique number.
II. Thumb impression is used to identify authorized user.
III. The authorized person is correctly identified and thus the door will open automatically to that person

Facial recognition by using PCA and Biometric identification are takes place outside of the ATM door.

c. ABNORMAL ACTIVITY DETECTION

Abnormal activities inside the ATM transaction are to be detected by using Histograms of Oriented Swarms (HOS), is applied to capture the dynamics of the person/ crowded environment.

These appearance and motion feature are only extracted within spatiotemporal volumes of moving pixels to ensure robustness to local noise, increase accuracy in the detection of local nondomiant anomalies, and achieve a lower computational cost. It detect sudden changes in velocity, like abrupt increase of its magnitude and dispersion of individuals. HOS, to capture 30 frame dynamics per second. SVM frame work is used to capture "anomalies" appearing in a small part of the fram, this algorithm is applied only on regions of interest, and temporal information is incorporated to improve accuracy.

1. HEAD LOCATION: Head location consist of three cascade parts
   i. Fore ground Extraction
   ii. Initial location
   iii. Ellipse fitting
2. ABNORMAL DETECTION: To determine whether the human face is occluded or not
   i. Skin Colour Detection
   ii. Face Template
   iii. ADABOOST

This project offers high level of security in the ATM transaction by implementing mask detection in camera .The classifier technique is utilized for the purpose of face detection, this is done using MATLAB software tool. The client/server model is used for facilitating online monitoring for better security features.

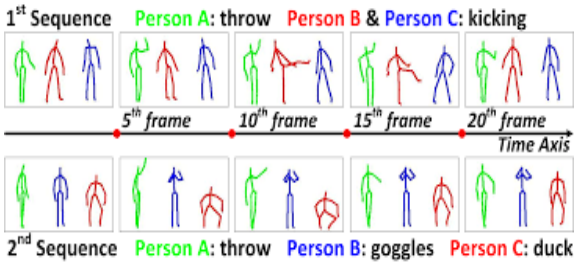

Fig.6: abnormal activities

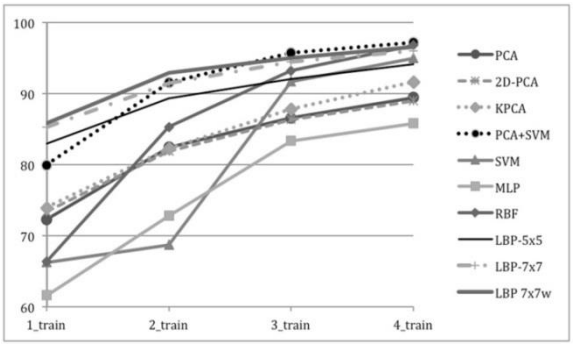

Fig.7: PCA efficiency rate for facial recognition

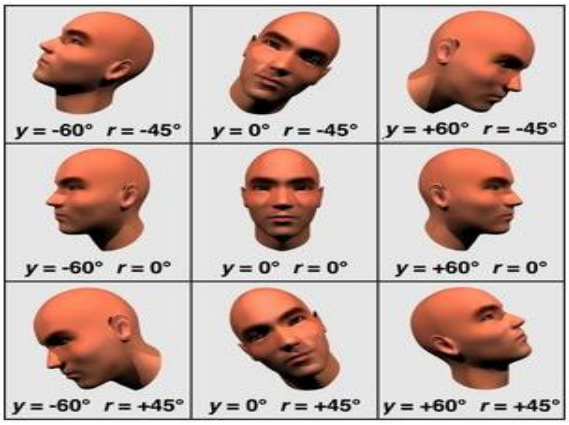

Figure One resized low-resolution face image (left) and one reconstructed high-resolution face image (right).

V. WORKING FUNCTIONALITY

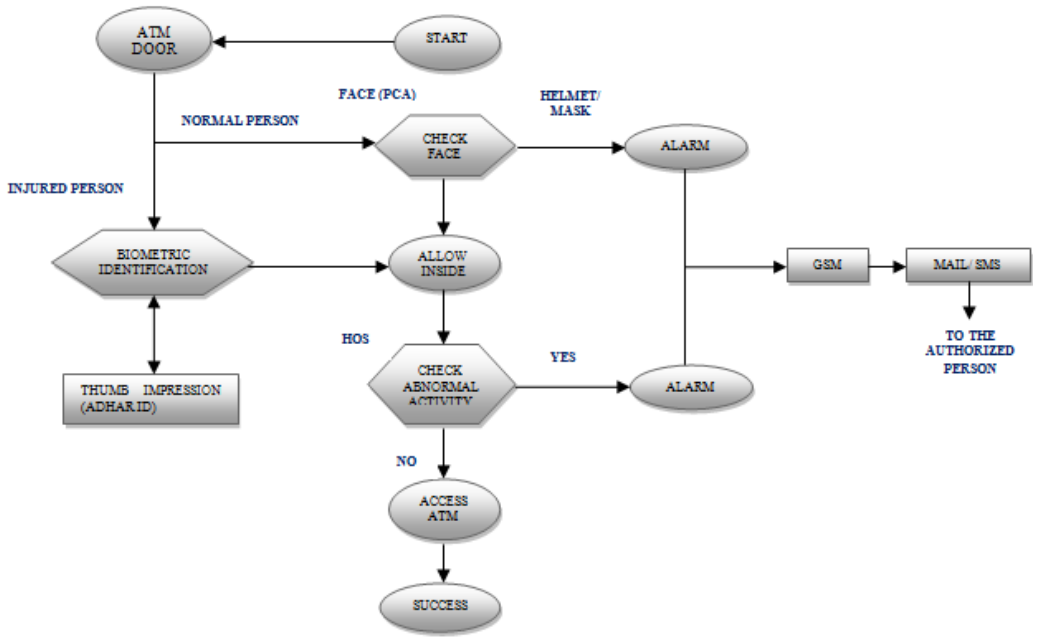

Fig.8: Working Functionality

VI. IMPLEMENTATION

A. HARDWARE BLOCK DIAGRAM

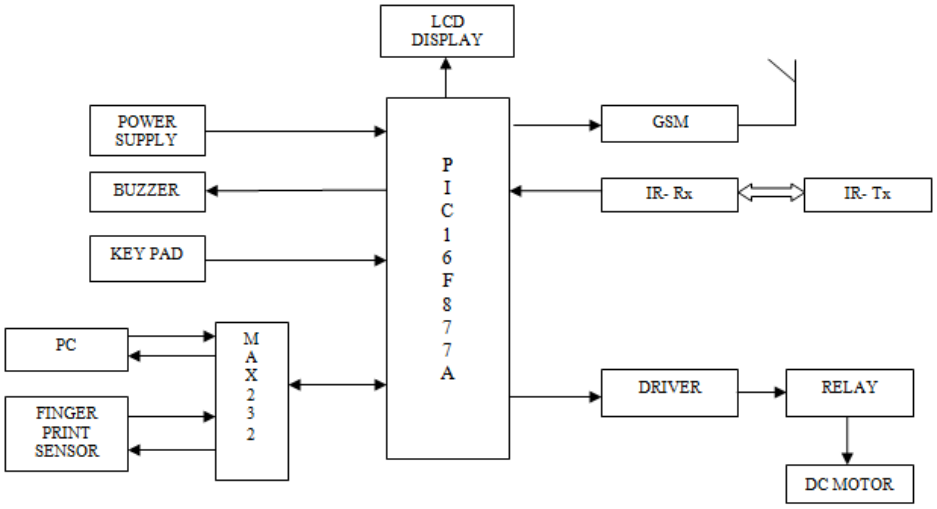

Fig.9 : Hardware Block Diagram

B. WORKING

The process starts right from capturing the images of the person standing near the entry of the door by using IR sensor. The camera module gets the clear picture of the user. The captured image is then analysed with the help of PCA algorithm which run in MATLAP with image processing. The face detection algorithm detects the images and compares it with the trained data set. If the features are matched then a signal is send to the PIC microcontroller. If the input from the camera (MATLAB tool) is TRUE then the Door is locked (Person wearing the HELMET/ MASK). If not means the PIC microcontroller drives the DC motor to open the DOOR. A person with an injury on his face when trying to get into the ATM, then automatically RFID reader get enable and read the RFID code of the persons ADTHAR card. Then the module ask thumb impression of the user, if the thumb impression and RFID code get matched means the TRUE signal send to PIC microcontroller and controller drives DC motor to open the DOOR. Else it will close automatically. Inside the ATM if a person makes any abnormal activities means this module identify the activities by using HOS algorithm which is run in

MATLAB and the signal send to controller through MAX232 then door get automatic lock. All the misbehaviours' information happens inside and outside of the ATM send to the authorized person or nearby police station through the GSM module.

LCD display is used for intimate the instructions to the users, who mishandling the ATM centre. Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication.

PIC 16F877A is a 40 pin, 8bit microcontroller based on RISC architecture. Its operating frequency is 20MHz. it has 8Kb flash memory and EEPROM data memory of 256 bytes. Their instructions set Contains only 35 instructions and have both parallel and serial communications. Many pins have dual operations and it is easy to interface with external components.

C. TRAINING SET

For this research 500 positive and 1000 negative images were taken as sample datasets in-order to train the Face, Eye and Mouth classifiers

In this algorithm, first the image is acquired by the webcam for processing. Then the PCA- Viola Jones is used to search and detect the faces in each individual frame. If no face is detect another frame is acquired. If the face is detected then the region of interest is marked within the face. This region of interest contains the Eyes and Nose and Mouth. Defining the region of interest significantly reduces the computational requirements of the system.

To detect the abnormal activities need to know

- ✓ Face location
- ✓ Skin color – $R_{CORRECT,NORMAL} = 97.66\%$, $R_{CORRECT,ABNORMAL} = 95.45\%$ $R_{CORRECT} = 95.90\%$
- ✓ Face templates- 94.35%for normal faces

$T_{FRONT} = 0.63\%$, $T_{LEFT} = 0.55\%$
$T_{RIGHT} = 0.51\%$, $T_{DOWN} = 0.47\%$

- ✓ occlusion detection

Detection rate for faces increases to 98.65%

VII. EXPERIMENTAL RESULTS

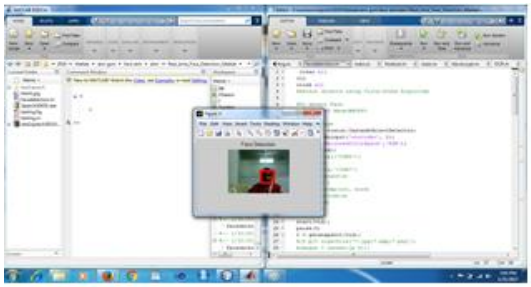

Fig.10- Face Recognition for Identifying Helmet/ Mask Users

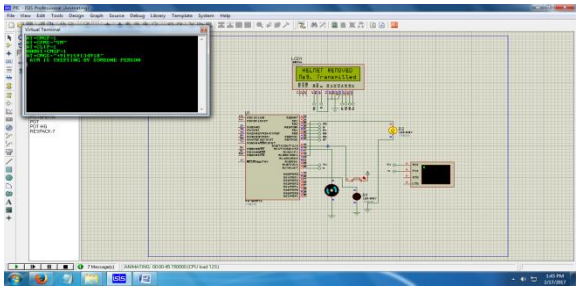

Fig. 11 Helmet Removed – Door Open

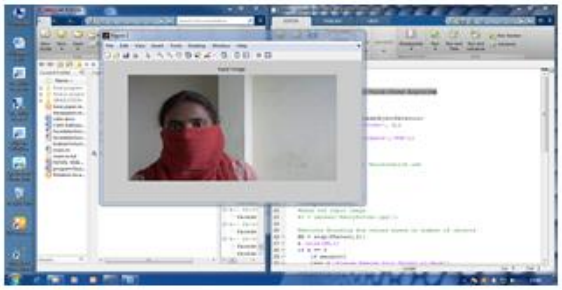

Fig.12- Helmet/ Mask Detection

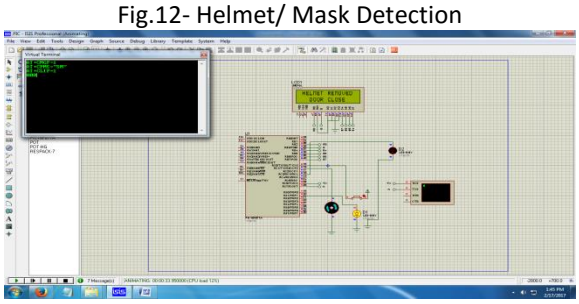

Fig.13- Helmet/Mask Detected Door Close

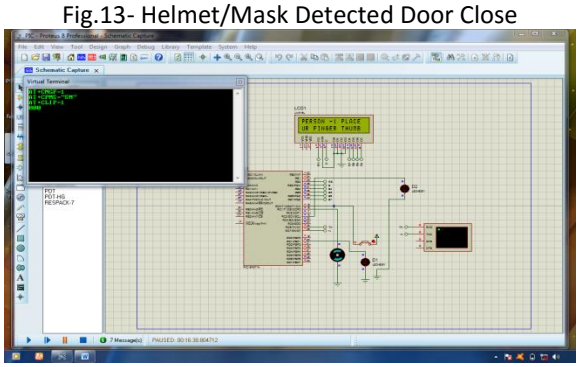

Fig.14- RFID Reader & Thumb Impression

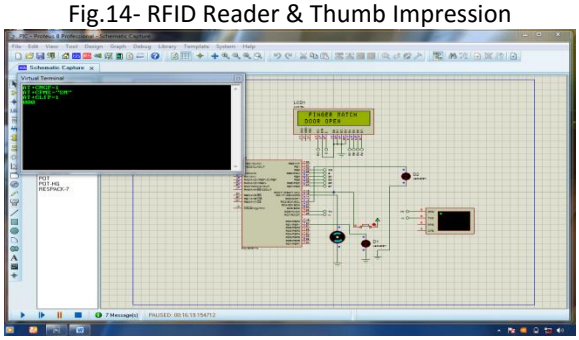

Fig.15- ADHAR code & Thumb Impression Matched Door Open

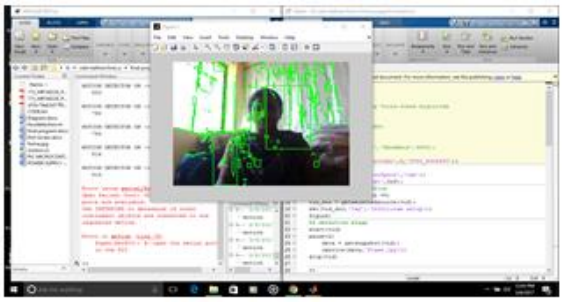

Fig.16- Abnormal Activity Detection

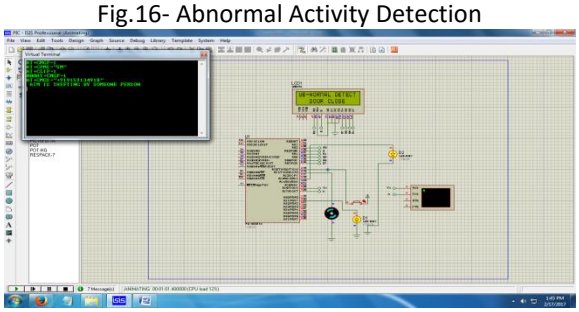

Fig.17- Abnormal Activity Detected Door Close

VIII. CONCLUSION

In this research, we implemented real time Human face detection by using PCA, Biometric identification using Thumb impression, as well as abnormal activity detection using HOS- ADABOOST, ELLIPSE FITTING algorithms. With the help of these three things we provide "integrated securities" for all ATMs. It provides an easy and efficient access for avoiding misbehaviors in ATM, and also it allows the authorized person to continuously monitor all the activities performed in the ATM system.

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