



## Security Alert Using Face Recognition

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### ABSTRACT

Security is one of the important requirements of homes and businesses which requires biometric identification. This paper aims to identify a person through face recognition. Face recognition is very complex and multidimensional problem. Principal Component Analysis based on MATLAB is used for face matching decision. The system which converts facial images to feature characteristics of initial training database images is designed in MATLAB. Facial features are extracted from the face. Eigenvalues are calculated and represented as an Eigen vector. Using Euclidian distance method, an unknown face image and database image are compared. The recognized facial image has minimum Euclidian distance with the database images. When face is recognized by MATLAB Code it will send SMS to the authorized person using GSM module and an alarm will be running. Security system using MATLAB and Embedded system design is cost effective, reliable and highly accurate.

**Key words:** Face recognition, PCA algorithm, Facial features, Eigenvectors, Euclidian distance, GSM module, Alarm

### 1. INTRODUCTION

Security is one of the utmost requirements of homes and businesses. In today's high technology use of information, particularly personal data, the threats to information systems from criminals and terrorists are increasing rapidly. As part of their system of internal control, many organizations will identify information as an area of their operation that needs to be protected. This paper aims to identify a person through face recognition.

In order to extract some useful information from an enhanced image, image processing is a method to convert an image into digital form and perform some operations on it. It is a type of signal distribution in which input is image (video frame or photograph) and output may be image or characteristics associated with that image. While applying already set signal

processing methods to them, image processing system includes treating images as two dimensional signals. One of the purpose of image processing is face detection and recognition.

Face detection is widely used in interactive user interfaces, advertising industry, entertainment services, and video coding. It is also necessary first stage for all face recognition systems, etc. Face detection issue is about how to find, based on visual information, all the occurrences of faces regardless of who the person is.

A face recognition system is a computer application, which is capable of identifying or verifying a person from a digital image or a video frame, obtained from a video source. One of the ways to do this is by comparing selected facial features from the image and a face database.

Here security systems which consist of face recognition, alarm and SMS alert has been built. For detection we use viola-jones algorithm and a trained classification model. Face recognition is done by PCA algorithm. Comparison is done using Euclidean distance method and if we got a minimum value in this procedure, it means two images are different. That is access by unauthorized person is detected. This is informed to higher authorities through mail and SMS an also an alarm will be running to notify the securities spontaneously.

### 2. MODULES

The following figure represents the systems architecture diagram. It includes different modules.

- Detection Module uses Viola-Jones Object Detection. When a person enters into a restricted area, the camera captures the image and detects the face.
- Comparison Module is using PCA Algorithm. The detected face image will compare with the reference image stored in the database
- Alert Module uses GSM. If the detected image and reference image are not matched, an alarm will start immediately and also a SMS will sent to higher authority.

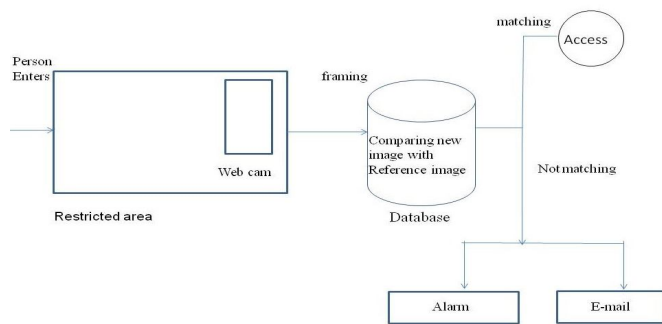


Figure 1 : Architectural diagram

## 2.1 Viola-Jones Object Detection

The Viola Jones face detection is a widely used method for real-time object detection. Although it can be trained to detect a variety of object classes, it was motivated primarily by the problem of face detection. The cascade object detection uses the Viola-Jones algorithm to detect human faces, nose, eyes, mouth, or upper body. The characteristics of Viola-Jones algorithm which make it a good detection algorithm are:

Robust – very high detection rate & very low false-positive rate always.  
 Real time – For practical applications minimum 2 frames per second must be processed.  
 Face detection only (not recognition) - Distinguish faces from non-faces (detection is the first step in the recognition process).

The algorithm has four stages:

- Haar Feature Selection
- Creating an Integral Image
- Adaboost Training
- Cascading Classifiers

## 2.2 PCA Algorithm

Principal Component Analysis (PCA) is a simple and useful linear transformation technique that is used in numerous applications. The PCA compare captured image with the authorized person's image. PCA Algorithm Standardize the data. Obtain the Eigenvectors and Eigen values from the covariance matrix or correlation matrix, or perform Singular Vector Decomposition

**Step 1:** Image of training set is converted into image vectors

- This training set consist of total M images

**Step 2:** Face vectors are normalized

- Average face vectors are calculated
- Subtraction of average face vector from each face vector

**Step 3:** Eigenvectors are calculated (It represent the variation in the faces)

**Step 4:** Calculation of Eigen vectors from reduced covariance matrix

**Step 5:** Selection of K best eigenfaces such that  $K \leq M$ . It can represent the whole training set

- Selected K eigenfaces MUST be in the ORIGINAL dimensionality of the face vector space

**Step 6:** Conversion of lower dimension k eigenvectors to original face dimensionality

**Step 7:** Representation of each face image a linear combination of all K eigenvectors

- Calculation of weight of each eigenface
- An unknown face is recognized

## 2.3 Alert Using GSM Module

GSM represents a mobile communication modem; it stands for global system for mobile communication. A GSM Module is a GSM Modem connected to a PCB with different types of output taken from the board – say TTL Output (for Arduino and other microcontrollers). The board will also have pins or provisions to attach mic and speaker, to take out +5V or other values of power and ground connections. These type of provisions vary with different modules.

## 3. LITERATURE SURVEY

Viola-Jones algorithm is the one which is used for detection in this paper[1]. Although there are various detection methods, this algorithm presented by Paul Viola and Michael Jones is more fast and robust. In [2], they used the concept of Haar feature. Haar feature based Adaboost algorithm is applying for detecting eye, nose and mouth regions. Here facial feature points are extracting using Haar feature method. Also, the image processing techniques such as template matching can be used for the same purpose.

This paper focus on face detection[3]. A portion of face is detected by extracting the features and circles it. Face pattern is important for face detection and thus a method of pattern reorganization is used. Face recognition can be done by computers easily as it can compute the logic corresponding to the facial structure.

Face detection is the primary stage in all face recognition systems[4]. Haar like feature stands in the first position for its speed of calculation over the other existing features in constant time. Learning the Haar features using the Adaboost algorithm is said to be a most successful approach.

A motion sensor, PIR sensor is used here and it is connected to a microcontroller for detection. In this surveillance system[5],the microcontroller used is Arduino Uno. For notifying via twitter, this is attached with a web browser.PIR is the most commonly used sensor due to its low cost and low power consumption. Infrared rays emitting from the human is catches and analyzed for further procedures.

Marking the attendance is a major task in most of the organizations. This can be done by recognizing the face of a person[6].In this paper, a database of all the students in a class is predefined. Each day the image of students is captured by the camera which is placed in the classroom. So this image is compare with the images in database of the student. Thus attendance marking is done and a message is send using GSM module.

In [7], moving object is detected by using the Eigen-object which is computed from the frames. Human body detection algorithm have the advantage of accuracy. Elimination of shadow of moving object is possible. Frame processing and pre-processing is used in this paper. Frame processing is to make video frames and pre-processing for improving the detection. There is a reference background image and moving regions are detected by pixel-by-pixel subtracting of the current image from reference background image.

The input image is processed by face detection[8]. Artificial Neural Network is used in this system. The system crops the image when face is detected. Accuracy rate and level of performance is noticeable as a feature. In [9] ,it describes a system which is helpful in traffic surveillance. This system is developed in the platform of MATLAB. Background subtraction method is a type of object detection method which is used here.

Techniques such as image scaling, parallel Processing are used in [10]. The architecture is implemented in Model sim and Verilog HDL is used for designing. This paper also used Adaboost algorithm. The system explained in this paper uses PCA algorithm for face recognition[11]. This paper focus on reducing the robbery rate. In highly secure areas, reducing the robbery rate by low power consumption is a highlighting factor.

The concept of RF transmitters and receivers are used here[12]. Transmitters transmit the signal and receivers for detecting the transmission. A signal is converted in to audio, video by demodulator which is used by the RF receivers. Here GSM has a role of fetching information from database and making this to a message. An arduino can be connected to the system by the RF modem.

Detection of fire is introduced in this paper[13]. In indoor scenarios surveillance camera is installed and the presence of fire is detected by recording the video. A

GPS/GSM technology for providing alert and to find the location is used. Also it is used for sending SMS.

This paper mainly focus on a home automation system which helps in different ways[14]. The system explained in this paper give alert for gas leakage, presence of thief and fire. Smoke and temperature detector and LPG leakage detector are used here. An alarm is set for emergency cases and SMS can be send using GSM module to the users.

The next paper is introduced a system for motion detection[15]. A set of values for each pixel is taken and the current pixel value is compared with the reference value. When an intruder enters in to a restricted area the change in foreground reaches a maximum threshold value. So the GSM connected to the system is used for sending the message to higher authority.

**4. PERFORMANCE ANALYSIS**

The different techniques are evaluated through performance analysis phase. The main aim was to determine accuracy of various techniques which used in various modules. We choose Viola-Jones Algorithm in detection module which is more accurate than any other techniques. While comparing with other techniques for face recognition and security alert, we adopted PCA Algorithm and GSM technique. In this paper, Viola-Jones algorithm is more used which gave high accuracy because this algorithm includes Haar Feature extraction and AdaBoost Algorithm.

The following table shows the percentage of accuracy of different techniques.

Table 1 : Performance Analysis

Sl.no	Techniques	Accuracy
1	Viola-Jones Algorithm	85%
2	PCA Algorithm	81%
3	GSM	76%

The below figure shows the chart of the accuracy of techniques

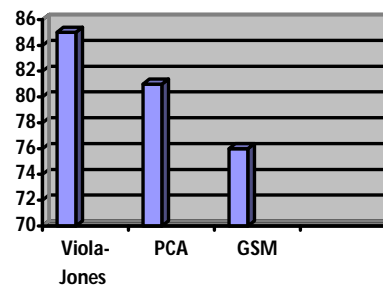


Figure 2 : Accuracy of Techniques

## 5. CONCLUSION

Here a security system which consist of face recognition, alarm and SMS alert has been built with three modules where first module consist of the face detection. Here the face of the person entering the area is detected. In the second module face is recognized using PCA algorithm. Third module comprises of the alerting techniques in which we have implemented alarming and sending message using GSM module. Our system has the following advantages

1. Using PIR sensor camera is turned on only when human presence is detected.
2. Memory can be managed efficiently because we are not surveillance and recording every time but only in the case of unauthorized access.

So our project is better and efficient than the other existing system.

## REFERENCES

- [1] B. K. P. Mehul K Dabhi, **Face detection system based on viola - jones algorithm**, International Journal of Science and Research (IJSR), Volume 5 Issue 4, April 2016.
- [2] L. D. Hoang Minh Phuong, **Extraction of human facial features based on haar feature with adaboost and image recognition techniques**, IEEE, 2012.
- [3] D. R. T. Alpika Gupta, **Face detection using modified viola jones algorithm**, International Journal of Recent Research in Mathematics Computer Science and Information Technology Vol. 1, Issue 2, 2014.
- [4] Z. C. Jie Zhu, Real time face detection system using adaboost and haar-like features, 2nd International Conference on Information Science and Control Engineering, 2015.
- [5] M. G. F. Husni Teja Sukmana, **Prototype utilization of pir motion sensor for real time surveillance system and web-enabled lamp automation**. IEEE Asia Pacific Conference on Wireless and Mobile, 2015.
- [6] P. S. S. Vadiraj. M, VinayRaghavendra. R, **Face recognition based attendance monitoring system**, IEEE Asia Pacific Conference on Wireless and Mobile, 2015.
- [7] K. S. B. Sapana K. Mishra, **Human motion detection and video surveillance using matlab**, International Journal of Emerging Research in Management and Technology, vol:5,issue:5, 2016.
- [8] K. J. E. Ma. Christina D. Fernandez, **“Simultaneous face detection and recognition using viola-jones algorithm and artificial neural networks for identity verification,”** IEEE, 2014.
- [9] Chin Hong Low, Ming Kiat Lee, **Frame based object detection - an application for traffic monitoring**, IEEE, 2010.
- [10] M.Gopi Krishna, A. Srinivasulu, **Face detection system on adaboost algorithm using haar classifiers**, International Journal of Modern Engineering Research (IJMER), Vol. 2, Issue. 5., 2012.
- [11] K. R. Kumar and V. Srimadhavan., **Security system with face recognition, sms alert and embedded network video monitoring terminal**, International Journal of Security, Privacy and Trust Management (IJSPTM) Vol 2, No 5, October, 2013.
- [12] S. K. G. Vijayendra R, **Identifying objects using rf transmitters and receivers, and retrieving data using gsm**, IEEE, 2010.
- [13] S. J. . D. A. Janeera., **Real-time fire detection, alerting and suppression system using live video surveillance**, Imperial Journal of Interdisciplinary Research (IJIR) Vol-2, Issue-7,2016.
- [14] A. P. M. M. S. Asst. Prof. S B Dhekale, **Smart home safety and security system automated with alerts through gsm mobile phone**, 3rd international conference on electrical, electronics engineering trends, communication, optimization and science, 2016.
- [15] B. K. H.Venkateswara Reddy, **Automated video surveillance system with sms alert**, International Journal Of Engineering And Computer Science ISSN:2319-7242 Volume1 Issue 3 Dec, 2012.