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DOOR SECURITY SYSTEM USING FACE RECOGNITION

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Abstract : Face recognition, is one of the most successful applications of image analysis, has recently gained significant attention. It is due to availability of feasible technologies, including mobile solutions. Research in automatic face recognition has been conducted since 1960s, but the problem is still largely unsolved. Last decade has provided significant progress in the areas owing to advances in the face-modelling and analysis techniques. Although system have been developed for face detection and recognition researchers. There are several reasons for recent increased interest in face recognition, including rising public concern for security, the need for identity verification in the digital world, face analysis and modelling techniques in multimedia data management and computer entertainment.

IndexTerms - Face recognition, detection, PCA, MATLAB, Biometrics, GSM, GPS, Mobile Application.

I INTRODUCTION

Nowadays, biometrics data has become popular for automatic personal identification in access control instead of using cards, passwords or pattern. Most of the biometrics data must be collected by using special hardware such as fingerprint scanner, DNA analyzer, and palm print scanner. and, the target objects have to touch with the required hardware in the stage of data collection. The influence of this system is that face recognition does not require to be touched with any hard-ware. Face is detected significantly by using face detection technique and the entire face recognition is completed without touching with any hardware.

It is one of the few biometrics methods that acquires the qualities of both low intrusiveness and high accuracy. Face recognition technology has range of applications in law enforcement and inspections, access control, information security, smart cards, others. It has many potential applications such as surveillance, credit cards, password security, etc. So in this paper we proposed a system with two level security checks. This system uses password with face recognition technique for theft detection. First system acquires password from user. If that password matched with authorized password, then current captured image will get compared with authorized image stored along with that password. This two level security reduces the number of comparisons required to match the image with authorized person. If any unauthorized person tries to get access of area, then system raises alarm and sends message to registered mobile number using GSM (Global System for Mobile Communication) module. If any unauthorized person tries to harm the system, vibration sensor sends signal to microcontroller 89E51RD2 which in turns raises alarm.

This system helps users for improvement of the door security of sensitive locations by using face detection and recognition. This system uses sensor, namely passive infrared receiver (PIR) which detects presence of human in front of door, Vibration sensors for detecting vibrations at door or window area, Microcontroller 89E51RD2 for sending signals to computer, Camera for capturing images, GSM module for sending messages and a buzzer for alerting authorized persons. In the field of face recognition, the measurement of the facial images is very high and require considerable amount of computing time for classification. The classification and subsequent recognition time can be reduced by reducing dimension of the image data. Principal component analysis (PCA) is one of the famous methods used for feature extraction and data representation. It not only reduces the dimensionality of the image, but also retains some of the fluctuations in the image data and provides a compact representation of a face image. The key idea of the PCA method is to reconstruct the face images into a small set of attribute feature images, referred eigenfaces, which are the principal components of the initial training set of the face images. PCA yields projection directions that maximize the total scatter across all classes, i.e., across all face images.

II RELATED WORK

There are several methods available today to perform sentiment classification, and thus it is important to carefully select appropriate methodology. One of the earliest works on sentiment analysis was conducted by Mohammad Amanullah [1]. Digital door lock security system provides security and safety to house or office owners, belongings, assets from being damaged by external agent or undesired strangers. They have used a new technology, incoming number verification system which gives more protection for controlling & security system. As Conventional security system does not use any password, there is a chance to hack or break the system. In this regard they used a desire mobile number without verification which doesn't allow the door to be opened. That system is composed of the microcontroller based by using matrix keypad & GSM/CDMA network. The microcontroller based digital door lock security system is an access control system that allows only authorized persons to access restricted area.

Another sentiment analysis proposed by Kawser Wazed Nafi [2]. This paper presents work done on minutiae based palmtop recognition system for automatic door open and locking system. Here, the palmtop recognition system works by taking an image of the person, partitioning it, processing it and finally verifying the person. This system provides input for an electric circuit. The circuitry system consists of two unique states;

door open and door lock. The whole system basically uses extensive Image processing for minutiae based palmtop recognition. Thus reducing the probability of error in human recognition and solves maximum problems of fingerprint recognition.

Research on face detection done by W. Zhao, R. Chellappa [3]. Their aim was to perform face recognition and verification system that can run on mobile devices. The developed application was based on comparing the faces in two photographs. The user uploads two photos to the system, the system identifies the faces in that photos and performs authentication between the two faces. As a result, the system gives the output that the two faces in the photo belong to the same or different persons. So the system provides a security measure thanks to the face identification and verification feature included in that application.

M. Turk and A. Pentland [4] present their approach to the detection and identification of human faces near-real-time face recognition system which tracks subject to head and then recognizes the person by comparing characteristics of face to those of known individuals.

Pantic M. and Rothkrantz L.J.M [5] tweet that humans detect and interpret faces and facial expressions in a scene with little or no effort. Still, development of an automated system that accomplishes this task is rather difficult. There were several related problems: detection of an image segment as a face, extraction of the facial expression information, and classification of the expression (e.g., in emotion categories). A system that performs these operations accurately and in real time would form a big step in achieving a human-like interaction between man and machine. They overcome that problem. The capability of the human visual system with respect to these problems is discussed, too. It is meant to serve as an ultimate goal and a guide for determining recommendations for development of an automatic facial expression analyzer.

C. Bunney [6] proposed that his paper was a review of existing face detection and recognition which is conducted to investigate the result of different approaches in terms of recognition accuracy and some of them are discussed for minimizing processing time point of view. The goal of the paper was to present a critical survey of existing literature on human face recognition. Their paper had two level security which makes the security stronger and reliable. In turn, this gives the user more control. Due to the advancement in recent techniques, some door lock security systems are based on PROTEUS, GSM, GPS, many sensors, iris recognition, software like MATLAB, microcontroller, biometrics like face recognition, face detection, RFID and smart cards. His paper was basically comprised of three subsystems – Face detection, Face recognition and automatic door access control.

Hong Duan¹, Ruohe [7] infers that the technique has strength and reason for use. Along with data and information accumulating in abundance, there is a crucial need for high security. Biometrics had received more attention. Face biometrics, useful for a person's authentication is a simple and non-intrusive method that recognizes face in complex multidimensional visual model and develops a computational model for it. They present an overview of face recognition and discuss the methodology and its functioning. Thereafter they represent the most recent face recognition techniques listing their advantages and disadvantages. They specified some techniques to improve the efficiency of face recognition under various illumination and expression condition of face images.

A. S. Tolba [8] stated that face recognition research still faces challenge in some specific domains such as pose and illumination changes. Although numerous methods have been proposed to solve such problems and have demonstrated significant promise, the difficulties still remain. For these reasons, the matching performance in current automatic face recognition is relatively poor compared to that achieved in fingerprint and iris matching, yet it may be the only available measuring tool for an application. Error rates of 2-25% are typical. It is effective if combined with other biometric measurements.

Jyoti S. Bedre [9]. The authors reported 96 percent, 85 percent, and 64 percent correct classifications averaged over lighting, orientation, and size variations, respectively. Their database contained 2,500 images of 16 individuals. As the images include a large quantity of background area, the above results are influenced by background. The authors explained the robust performance of the system under different lighting conditions by significant correlation between images with changes in illumination. But she proposed a new method to compute the covariance matrix using three images each was taken in different lighting conditions to account for arbitrary illumination effects, if the object is Lambertian.

R. Bruneli and T. Poggi [10] said that person identification system based on acoustic and visual features. They use two different methods for the rejection of an unknown person to introduced. The performance of the integrated system was shown to be superior to that of the acoustic and visual subsystems. The resulting identification system can be used to log personal access and, with minor modifications, as an identity verification system.

In March 2001 Moon H. [11] published paper on principal component analysis (PCA) form the basis of numerous studies in the psychological and algorithmic face-recognition literature. He stated that PCA is a statistical technique and its incorporation into a face-recognition algorithm requires numerous design decisions. He explicitly state the design decisions by introducing a generic modular PCA-algorithm. This allows us to investigate these decisions, including those not documented in the literature. He experimented with different implementations of each module, and evaluated the different implementations using the September 1996 FERET evaluation protocol (the de facto standard for evaluating face-recognition algorithms). He experimented with (i) changing the illumination normalization procedure; (ii) studying effects on algorithm performance of compressing images with JPEG and wavelet compression algorithms; (iii) varying the number of eigenvectors in the representation; and (iv) changing the similarity measure in the classification process. He performed two experiments. In the first experiment, he obtained performance results on the standard September 1996 FERET large-gallery image sets. In the second experiment, he examined the variability in algorithm performance on different sets of facial images. The study was performed on 100 randomly generated image sets (galleries) of the same size. Their two most significant results are (i) changing the similarity measure produced the greatest change in performance, and (ii) that difference in performance of $\pm 10\%$ is needed to distinguish between algorithms.

With data and information accumulating in abundance, there is a crucial need for high security. Biometrics has now received more attention. Face biometrics, useful for a person's authentication is a simple and non-intrusive method that recognizes face in complex multidimensional visual model and develops a computational model for it proposed by Riddhi Patel [12]. She present an overview of face recognition and discuss the methodology and its functioning. Thereafter she represent the most recent face recognition techniques listing their advantages and disadvantages. Some techniques specified here also improve the efficiency of face recognition under various illumination and expression condition of face images.

III PROPOSED METHODOLOGY

1. Components:

In the present system we have been using the equipment's as follows:

Esp32 cam module
 Microcontroller
 Solenoid Lock
 Jumper wires
 Door
 Relay Module
 Programmer

2. Implementation:

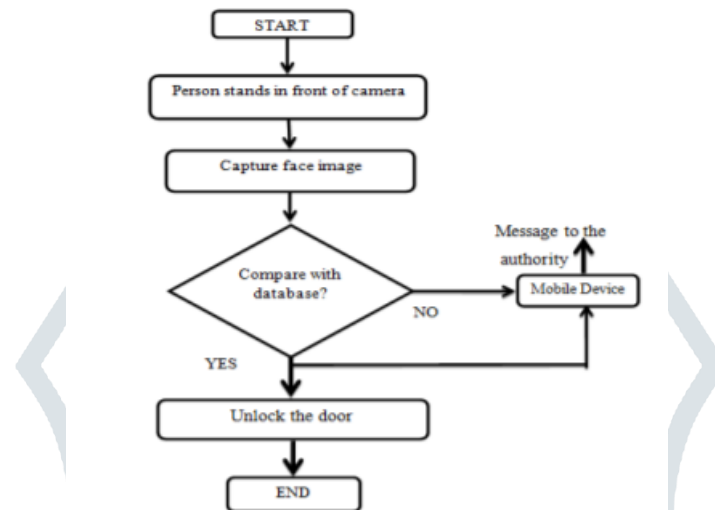


Fig. Flowchart of implementation

In this fig 2.3 shows that the flowchart of face captures and recognition process, at initial stage the authorized person comes in front of camera. The camera module will capture the face image with current poses. The captured face of current poses creates a data base of the authorized person and stores this. At the next time camera module will capture the current live face of the person. All this process is done in Esp32 cam module. When comparison done successfully the Relay switch is ON to unlock the door otherwise Esp32 cam module will capture an image once again through the camera and process is repeat Esp32 cam will send a command to the Mobile device send a message to the Authorized person is "FACE MATCHED" when comparison is done successfully otherwise send security alert "Unknown person will try to unlock the door".

IV CONCLUSION

In this system we have implemented the Smart Door Unlock System using Face Recognition. The system is able to accurately detect and recognize the face, and informing the owner/admin about the user name and taking access from the owner. The owner is able to remotely access the door from any other location. The owner is also able to blacklist the person and get alert if the blacklisted person comes in front of the door. The implemented system is moderate cost, so that it is affordable to the averaged salaried person.

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