Automatic Locking Door Using Face Recognition

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ABSTRACT
Nowadays people use keys, security cards, password or pattern to open the door. The aim of this paper is to help people for improvement of the door security of sensitive locations by using face detection and recognition. Face is a complex multidimensional structure and needs enhanced computing techniques for detection and recognition. This paper comprises of three subsystems: namely face detection, face recognition and automatic door access control. Image acquisition is the process of capturing an image. The face is detected by using the Viola Jones method and face recognition is implemented by using the Principal Component Analysis (PCA). Face Recognition based on PCA is generally referred to as the use of Eigen faces. If a face is recognized, it is authenticated, vice-versa. The door will open automatically for the authenticated person due to the command of the microcontroller. Since PCA reduces the dimensions of face images without losing important features, facial images for many persons can be stored in the database. Although many training images are used, computational efficiency cannot be decreased significantly. Therefore, face recognition using PCA can be more useful for door security system than other face recognition schemes.
Keywords—Viola-Jones face detection method, PCA, Eigenvector, Covariance, Euclidean distance, Eigen face, microcontroller.

I.   INTRODUCTION

Face Detection and Face Recognition is the biometric on which lot of work has been performed over the years[1]. Over the time lot of algorithms are introduced for detection and recognition which are considered because it is an enhanced way for person identification and does not require human cooperation for identifying or verifying. Viola-Jones detection is a milestone for detection of facial parts[3]. It is an effective and fast way of detection than any present methods. Current paper presents a system development for the evaluation of the said method. The overview of the system is shown in figure1. The process depicts the method of face detection and recognition by using PCA algorithm for Eigenfaces made of images in the database and the one captured or one in the database[2]. Selection of face for displaying is dependent on the selection of the nearest value which is generated as a result of the algorithm performed. Figure 1 shows the processes involved on the face detection and recognition process. Face recognition is performed by 2 methods[4] -

        First method is extraction of some basic parts of a face such as eyes, nose, mouth, and chin, with the one stored in the database .This is done using Viola Jones algorithm[5]

        Second method is based on Principal Component Analysis method. In this method the information which defines more features of the face more is extracted. Face can be represented in terms of an Eigen value coordinate system.

II. IMAGE DETECTION

Face Detection is useful tool in biometrics, often as a part of a facial recognition system. Viola-Jones face detection technique is used for the purpose of detection of face in the image captured. Benefits of using this technique are: Firstly it is one of the fastest technique present for the detection of face process. Secondly a simple and efficient classifier built from computationally efficient features using AdaBoost for feature selection. In this step or process the location and size of the face in an input image is determined using boxes as shown in fig 2. Face detection can be regarded as specific case of object detection. Under face recognition it can be considered as a general case of face part extraction. In face extraction, the central task is to find the vital parts of the face and sizes of a well- known number of faces (usually one). Whereas in face under software section is completely based on MATLAB

Fig:1

III. IMAGE AQUISITION

Image Acquisition Toolbox enables user to capture images or video from camera and direct it to MATLAB. This tool can directly detect hardware automatically and configure its properties. This toolbox provides graphical tools and a programmable interface to work with image grabbing through hardware in MATLAB. This toolbox helps in converting the live feed to RGB or to gray scale as per requirements provides graphical tools and a programmatic interface to work with image capturing through hardware in MATLAB.

Fig: 2

IV. PRINCIPAL COMPONENT ANALYSIS

PCA is a useful statistical technique that has found application in fields such as face recognition and image compression, and is a common technique for finding patterns in data of high dimension. Mathematical concepts that will be used in PCA covers standard deviation, covariance, eigenvectors and eigenvalues. Feature extraction for face representation is one of the central issues to face recognition system. Among various solutions to the problem, the most successful seems to be those face recognition-based approaches, which generally operate directly on images or appearances of face objects and process the image as two-dimensional patterns. The purpose of PCA is to reduce the large dimensionality of the data space (observed variables) to the smaller intrinsic dimensionality of feature space (independent variables), which are needed to describe the data economically. The jobs which PCA can do are prediction, redundancy removal, feature extraction, data compression, etc. Because PCA is a classical technique which can do something in the linear domain, applications having linear models are suitable, such as signal processing, image processing, system and control theory, communications, etc
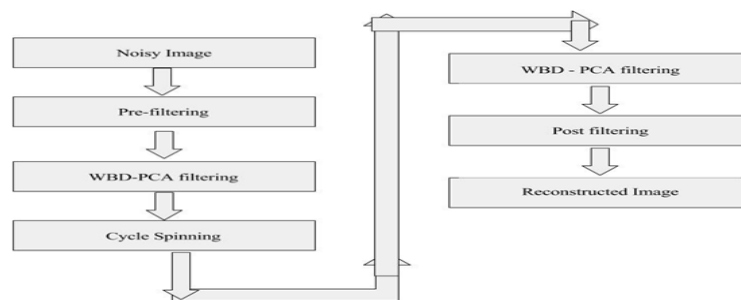

Fig 4: Flow Chart of Image Acquisition

V. IMAGE PROCESSING

In imaging science, image processing is processing of images using mathematical operations by using any form of signal processing for which the input is an image, a series of images, or a video, such as a photograph or video frame; the output of image processing may be either an image or a set of characteristics or parameters related to the image.[1] Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it. Images are also processed as three-dimensional signals with the third-dimension being time or the z-axis[2]

Image processing usually refers to digital image processing, but optical and analog image processing also are possible[3]. This article is about general techniques that apply to all of them. The acquisition of images (producing the input image in the first place) is referred to as imaging [4].

Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. [5]It is a type of signal dispensation in which input is image, like video frame or photograph and output may be image or characteristics associated with that image. Usually ImageProcessing system includes treating images as two dimensional signals while applying already set signal processing methods to them.
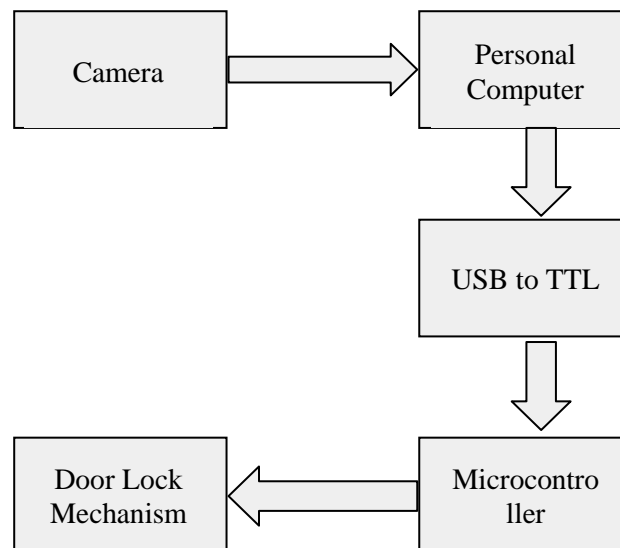
VI. HARDWARE IMPLEMENTATION

Fig 5: Flow Chart of Project

A.USB to RS232/TTL Converter:

This is used for serial communication between the PC and hardware (microcontroller, door lock) it consists of MAX 232 IC which is used for serial communication. It is basically single system on chip.

Fig 6: USB TO TTL Converter

B. 89C52 Microcontroller :

AT89C52 is an 8-bit microcontroller and belongs to Atmel's 8051family. AT89C52 has 8KB of Flash programmable and erasable read only memory (PEROM) and 256 bytes of RAM. AT89C52 has an endurance of 1000 Write/Erase cycles which means that it can be erased and programmed to a maximum of 1000 times.

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Though very slight difference between the features of AT89C51 and AT89C52, they are very similar in their pin configurations* and operations. The differences between AT89C51 and AT89C52 have been tabulated below.

	AT89C52	AT89C51
RAM	256 Bytes	128 Bytes
Flash	8 KB	4 KB
Number of Timers/Counters	3 (16-bit each)	2 (16-bit each)
Number of Interrupt Sources	8	6

C. DC Motor :
A motor which runs on dc supply is will be used as rotating device to open and close the door. It will be connected with driver IC 298 which will rotate the motor. A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor.

VII. PROS
1) No More Time Fraud–One of the big benefits of using facial biometric systems in your company is that you won't have to worry about time fraud. It will be impossible for buddy punching to occur, since everyone has to have go throughout face scanning biometrics devices to clock in.
2) Enhanced Security–You'll also enjoy enhanced security with a face biometrics system. Not only can you track employees thru biometrics time attendance tracking, but any visitors can be added to the system and tracked throughout the area too. Anyone that is not in the system will not be given access.

VIII. CONS
1) Image quality-Image quality affects how well facial-recognition algorithms work. The image quality of scanning video is quite low compared with that of a digital camera. Even high-definition.
2) Image Size: When a face-detection algorithm finds a face in an image or in a still from a video capture, the relative size of that face compared with the enrolled image size affects how well the face will be recognized.

IX. APPLICATIONS
1) Image and face recognition is bringing whole new dimension to gaming
2) It can also be used for price comparison by taking pictures of the items and comparing with the social sites.

X. RESULTS AND DISCUSSIONS
In PCA based face recognition, by increasing the number of images of faces in the database increases the recognition rate of system. But the recognition rate starts saturating after definite sum of increase in Eigen value. This is because increasing the images in the database increases the recognition rate but however this increase is compensated by noisy images which increases the efficiency
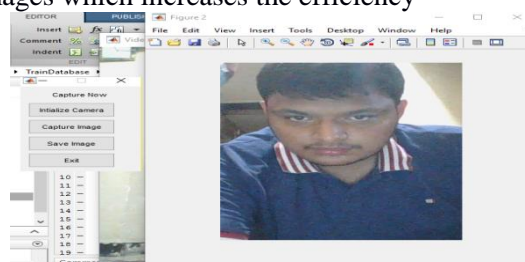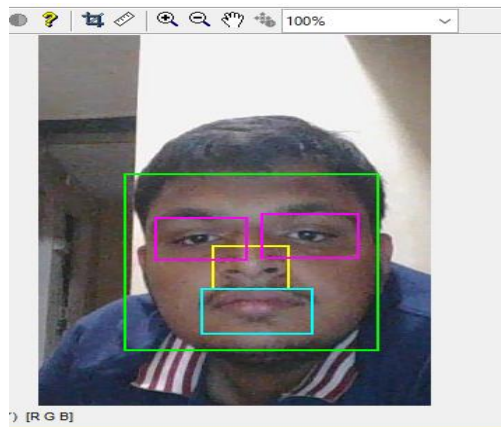

Fig 7: Acquisition of Image

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Fig 8: Detection of Face

As shown above, the image will be captured and matched with database after extraction of face region.

XI. CONCLUSION

In this work we performed we are able to develop a system to evaluate the face detection and face recognition. To speed up the process of face detection we used Viola-Jones detection algorithm. The database created is used as a source for the Eigen faces and the input image is matched over the mean Image in Eigen space. As in PCA based face recognition, increasing the number of faces increases the recognition rate but the recognition rate saturates after a definite sum of increase in Eigen value. Increasing the images in the database increases the recognition rate however noisy images decrease the recognition accuracy

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