

Smart Door Unlock System For Home Security Using Facial Recognition

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Abstract— Nowadays security has become a serious issue. To resolve this problem an updated technology which provides accuracy and effectiveness is adopted. Here automatic door opening system based on face recognition is implemented. In this approach captured image through camera is compared with images stored in data base. If face with similarity is identified door is opened and unauthorized face detection results in alarm. For the facial recognition and detection Viola Jones method and principal component analysis (PCA) is used. Face is detected by Haar Cascade Classifier and Eigen classifier recognizes the detected face. The hardware implementation is done by Arduino.

Keywords: Principal component analysis, Haar classifier, Eigen classifier.

1 Introduction

As technology improves, security became an essential component in day to day life. Data security and violation of privacy etc. becomes crucial. In this paper automatic door access system is proposed where face is recognised by comparing it with faces in the databases. When a face of highest similarity is found out it is identified as a authorised user. The entire methodology will fall into two categories as face detection and face recognition. In the face detection classification between face versus non face region is performed. In order to perform face recognition features are extracted from the image obtained and is compared with the authenticated database to identify and verify the person. The face recognition ensures security by restricting unauthenticated entry.

2 Human Face Recognition Techniques

This section deals with the various human face recognition techniques available and their performance in case of various images. Out of many methods Karhunen Loeve transform, neural networks, temporal feature binding and dynamic link matching, Hidden Markov model (HMM) and geometrical feature matching are prominent. In Karhunen Loeve transform Eigen vectors and eigen values of covariance matrix are calculated. Eigen values corresponding to large eigen vectors are retained so that information content is more if variance is more. Once vectors are calculated, the weighted combination of vectors will allow to reconstruct the image back. This technique shows best result at over lighting, over

scale variations and over orientation variations also.

In face recognition method using eigen method the uniform pattern distributed in all images is observed and it is considered as object features. The distance between nose, eyes, mouth forms the characteristic feature and these are called eigen faces. These features are extracted by using principal component analysis method (PCA). PCA method allows the dimension reduction and to achieve a good representation of facial features. It is also possible to reconstruct the image back with combining all eigen features together. By checking the contribution of each eigen face a certain weight is assigned and the sum of all these weights enables to reconstruct the image.

3 Methodology

The basic input of this block diagram is from Webcam. Webcam captures all the real time images and the input image resolution depends on the system webcam dimensions. For example, the given input image is $m \times n$ then it normalizes the image into its standard resolution that is 300×300 . If the given input image is black and white then it is given as 2^8 that is nothing but 0 to 256 in binary. If the input image is colour image (RGB), then it is given as 2^{24} and the colour image intensity will be in 1000's of shades, the one more advantage of this image is, it can directly predict the image mathematically.

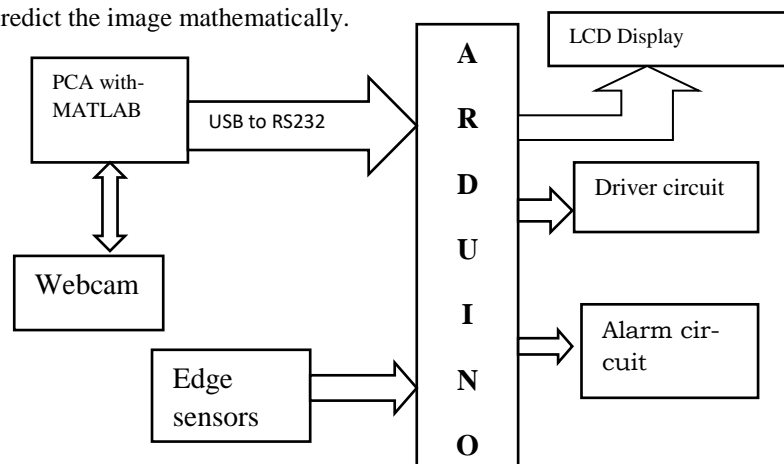


Fig.1. Block diagram of proposed method.

The PC converts the USB connection into a virtual communication port, which makes the USB connection looks like a serial port on the PC. Edge sensors are connected to the microcontroller 16F887 where these are used to switch off the motor if door reaches one of its two end positions.

The main function of this block diagram depends on the Microcontroller (16F887). PIC microcontrollers are very received due to their ease of programming, wide availability, easy to interfacing with other peripherals, low cost, large user base and serial programming capability (reprogramming with flash

memory), etc.

The microcontroller used to receive the signals sent from the PC and to send the common back signals to either door motor circuit or alarm circuit. The next component explains about L298 Driver IC. Here each pin of the microcontroller can supply maximum 25mA. It supplies more current compare to microcontroller. So, here L298driver IC is used to interface between the microcontroller and the DC motor. If the given input is authorised input then it is directly given to the microcontroller and from there it is given to the driver circuit and further to the door motor.

If it is identified as the original input image then the LCD displays the input as authorised person otherwise if it is unauthorised then the alarm circuit rings and LCD displays the input as unauthorised person. So here LCD is used to display the input and output of an image. The alarm circuit is majorly used for the security purpose because if any unknown person want to open the door then the webcam directly captures the real time images and it checks whether the given input image is stored in the database or not. If the given input image is not stored in the database then it identifies as unknown or unauthorised person and it directly displays as unauthorised person in the LCD and then the alarm rings

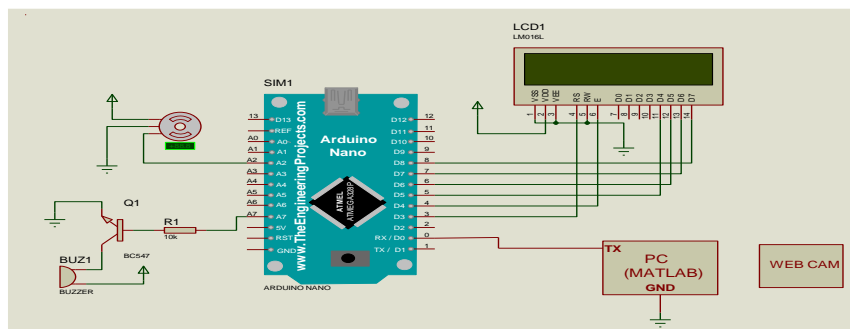


Fig. 2 .Schematic diagram

The Arduino Nano is a developed board, it has inbuilt pins within it. In the Arduino nano the data pins D3 to D8 are used and they were connected to the LCD Monitoring Data pins. In the LCD the Four Data pins one read/write pin and one Enable pin are used. The rest of the pins are used for ground supply and power supply. From the Arduino nano the receiver transmits the data to the PC(MATLAB).From the PC it is directly connected to the WEBCAM, where the WEBCAM captures the real time images given as input, and it normalizes the given input images into its original dimensions that is 300x300 resolution. The dc motor here used got a ground, power supply and analog pin.

In the schematic diagram the Buzzer is used as alarm circuit where it rings when the unauthorised person enters. The transistor BC547 is used where the emitter is given to the ground, the collector is given to the buzzer, and the base is connected

to the resistor of 10k where the resistor 10k is connected to the pin A7 of Arduino nano.

4 Results and Discussion



Fig. 3. Hardware setup

In the above figure it is clearly indicating the components which were connected to one another. The Arduino nano is placed on the PCB board where the pins of Arduino are connected to the LCD. The rest of the pins are short circuited on the PCB board. In the LCD it is clearly showing that automatic door access system using face recognition. From the Arduino nano the USBRS232 cable is connected to dump the code in to the Arduino. In the place of door here the CD DRIVER is used where it opens and closes the door with the help of dc motor. From the laptop the webcam captures the real time images and with the use of code we can directly identify the databases and the image is identified.

5 Conclusion

In this paper, by using face recognition and detection door is unlocked. Automatic face detection and recognition is done by Haar classifier and Eigen classifier. Arduino is used to control the door access system depending on the incoming data sent from the personal computer (PC). By the detection of authorized user door is opened and close after 2 seconds. For practical conditions these two seconds need to be increased. Viola-Jones face detection correctly detects the front view faces correctly. Principal Component Analysis method extracts the most relevant features of image. Since PCA method crops out the unwanted portion and only face is selected, so this system is a solution for security. This system improves or security for strangers without needing security guards and wasting too much time.

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