International Journal of Interdisciplinary Innovative Research &Development (IJIIRD)
ISSN: 2456-236X
Vol. **05** Special Issue **01** | **2020**

Advanced Turnstile Entrance Access Gate

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ABSTRACT

Biometric security systems are gaining tremendous demand and popularity these days. It plays a vital role in an electronic entrance. However, some biometric systems are not reliable while some are easy to hack and expensive. This paper suggests a low cost multimodal biometric-based electronic entrance access gate which uses face recognition and fingerprint detection to identify the correct person and allows entry to the authorized person only. It provides two-step authentication i.e. identification and authentication to offer better security.

Keywords—smart entrance access; face recognition; fingerprint detection; Raspberry Pi 3

1. INTRODUCTION

Government offices, corporate offices, data centers, banks have their confidential and sensitive data or valuables which should be accessible by an authorized person only. Data is an important asset corporate that needs to be safeguarded. Misuse or loss of information can cause direct financial losses, lost sales, fines, or monetary judgments.

It is most important to restrict the access to the data and valuables to the specific person only. In areas like server rooms, bank locker, or any other place where only authorized person should enter to access such things, a mechanism is to be implemented which will restrict the entry of an unauthorized person in thatpremises.

Electronic entrance access gates are used to prevent the unauthorized entry but the most important drawback of these systems is, it uses single step authentication i.e. it relies on password, pattern or biometrics such as fingerprint due to that they are vulnerable to hack. Also, existing available systems in the market areexpensive.

This paper suggests an approach to eliminate the drawbacks of the existing system. The system is having two-step authentication for better security and provides a cost-effective solution for electronic entrance access. The proposed system is developed on Raspberry Pi 3 B+ which has Broadcom BCM2837B0 1.4GHz Cortex-A53 64-bit SoC providing sufficient computing power for face recognition. The system is also equipped with a 5MP HD camera,fingerprintmoduleandLCDdisplay.Thecameracaptures high-quality images which is useful for the better result. We have used the haar cascade algorithm for the face detection and LBPH [1] (Local Binary Patterns Histograms) algorithm for face recognition [2]. Fingerprint module [3] used for the authentication purpose whether the detected person is authorized or not. If the person is authorized it triggers the solenoid lock and unlocks the barrier gate. The LCD display shows various information related to the operation to the user.

2. METHODOLOGY

2.1 Overview of Face Detection using HarrCascade

Fig. 1 shows the flowchart of the face detection module. The face detection is developed based on the template matching algorithm. These templates include edge features, line features and four rectangle features which are found in harr cascade classifier. Each image will be compared to the template. If the matching score is greater than the minimum score, then the face is detected. The face will be stored in the database with the person's name using the feature extraction method. This database is useful for the process of face recognition.

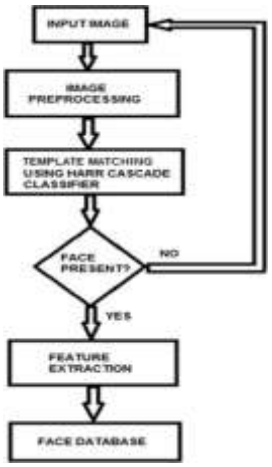

Fig 1. Flow Chart of Face Detection

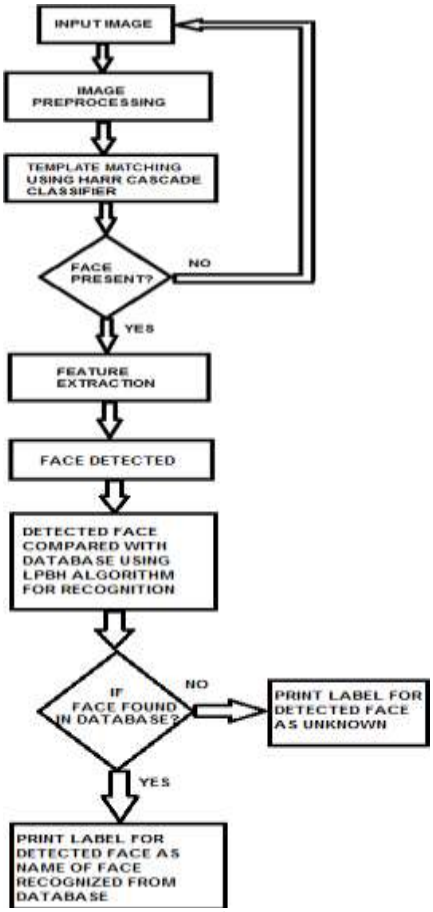

Fig 2. Flow Chart of Face Recognition

2.2 Overview of Face Recognition usingLBPH

Fig 2 shows the flowchart of the face recognition module. The image acquired from the webcam (real time) is processed first by the face detection module. After that, the face detected from the webcam is compared with the database created in the face detection process. Face comparing also called as recognition is done with the help of LBPH algorithm. The Local Binary Pattern Histogram (LBPH) algorithm uses the histogram of LBP characteristic spectrum as the feature vector for classification. It divides a picture into several subregions, then extracts LBP feature from each pixel of the subregion, establishing a statistical histogram of LBP characteristic spectrum in each subregion, so that each subregion can use a statistical histogram to describe the whole picture by a number of statistical histogram components. If the face is recognized [5] as a person in the database using the LBPH algorithm this means that he is an authorized person. Otherwise, the face is not recognized and hence the person is not an authorized one.

3. SYSTEM IMPLEMENTATION

3.1 Basic Configuration

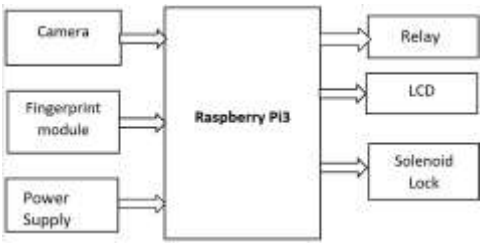

Fig 3. System Block Diagram

The basic system implementation diagram is given in the above figure. The interfacing diagram for system designing is in given fig no 3. The face detection and recognition part is done with the help of camera and raspberry pi 3. Camera takes the picture of person and sends it to the raspberry pi, raspberry pi extracts the features of that face and compares it with available database, if match found it will return Face-Id and procced to next stage for fingerprint authentication. In next step Person needs to put the fingerprint on the module if match found of fingerprint it will return a Finger-ID. When both the Finger-ID [4] & Face-ID matches it will unlock the lock and person can enter into that restricted area/premises.

3.2 Components

Raspberry pi: For detection & recognition we have used Raspberry Pi 3 B+. It is a single board computer with Bluetooth and WIFI connectivity having clock speed of 1.4Ghz. With very high processing power it is dedicated hardware for image processing. It operates on Broadcom BCM2835 SoC (System on Chip).

FingerprintModule: For providing addition security we have used optical R305 fingerprint module. It can store up to 255 fingerprints. It operates on 3.6-6V with current ranging from 100mA-150mA. R305 uses UART with baud rate of 9600 for communication with otherdevices.

Solenoid Lock: It is an electromechanical lock which operates on 12V dc supply. Solenoid is electric coil which energizes whenever supply is applied to the coil and it locks the system.

LCD: A 16x2 LCD is used here for showing the system instructions for human. It uses 4bit data bus to carry the data from system to LCD display. It operates on 3.3V-12V.

4. FUTURE SCOPE

Face recognition technique provides excellent accuracy when it is integrated with machine learning and deep learning. In future face recognition using deep learning can be implemented which gives great results, also iris detection can be added to achieve the highest security level enhancing the system reliability.

5. CONCLUSION

The proposed system provides a cost-effective solution with two-step authentication security. This will help small organizations to implement electronic entrances access to provide better security to their valuables and data at low cost with highersecurity.

6. REFERENCE

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