

Iot Based Biometric authentication using Raspberry Pi

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Abstract—Biometric authentication is one of the most prevalent technology which stands out amongst other authentication technologies because of its accuracy rate. It's an authentication process which majorly relies on the unique biological characteristics or traits of humans such as fingerprints, facial recognition etc. Biometric authentication has several applications like employee and student attendance management system, banks and ATMs etc. Biometric authentication replaces the traditional methods of authentication through external entities like ID cards, passwords, keys which can be easily lost or forgotten. This biometric authentication system is a low-cost system which is implemented using Raspberry Pi, a low-cost Linux based small sized mini-computer. Scanning of fingerprints, authentication and display of scanned fingerprints were coded using python and were entirely done on Raspberry Pi.

I. INTRODUCTION

Security has become one of the major concern nowadays. Out of all the authentication methods, biometric systems are more secured and accurate security systems. Biometric authentication is a secure way of authentication which is based on the human characteristics or traits such as fingerprints, iris and facial recognition etc., and the fact that every individual has unique traits or features makes the biometric system stand out amongst all the authentications methods as it is the most accurate system. Biometric authentication replaces the

traditional methods of authentication through external entities like ID cards, passwords, keys which can be easily lost or forgotten. Biometric authentication has several applications like employee and student attendance management system, banks and ATMs etc.

Biometric authentication system is gaining lot of popularity mainly because of two reasons: Reliability and Accuracy. Fingerprint based biometric authentication is one of most reliable and oldest biometric techniques and is most popularly used.

The biometric system proposed here is implemented using Raspberry Pi, a low-cost Linux based small sized mini-computer and a fingerprint scanner connected using a UART serial to USB connector. The fingerprint characteristic is captured using the fingerprint scanner and is passed to the Raspberry Pi for processing and authentication. Raspberry Pi can be used for enrollment, processing and authentication of the fingerprints scanned.



Fig1:Biometric Authentication using Raspberry Pi

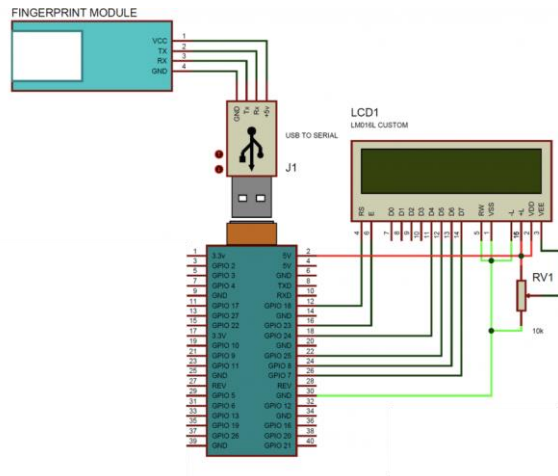


Fig 2: Circuit diagram of Biometric authentication

II. HARDWARE COMPONENTS

The following hardware components were majorly used for Biometric authentication:

1. Raspberry Pi 3 Model B

Raspberry Pi is a small sized minicomputer. It's a small PC which brings all the functionality that are delivered by a desktop PC. The Raspberry Pi has a 1.2 GHz Quad-core processor and a 1GB memory. It uses a 32 GB SD card for booting and data storage. The RPi has an Ethernet port for network connection, USB port for connecting exterior USB devices, 2.5A micro USB slot for power supply, HDMI port to connect to display and General Purpose Input Output (GPIO) pins to connect to other hardware devices.

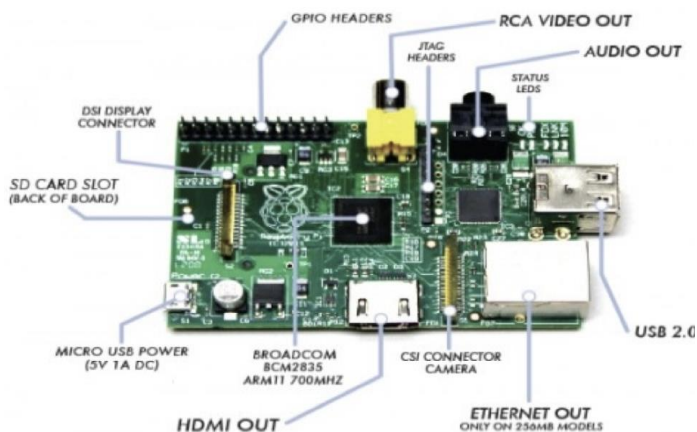


Fig 3: Raspberry Pi 3 Model B

2. Fingerprint Scanner

This is the optical fingerprint sensor used for capturing live fingerprint at the remote enrollment/authentication node running on RPi. A DSP chip is used for rendering of images, processing and searching of images. It comes with a flash memory which can store up to 162 fingerprints and an LED which lights up during enrollment.



Fig 4: Fingerprint Scanner

3. USB to Serial Converter

To connect Raspberry Pi to fingerprint module we need an USB to serial converter which also works on UART. The converter used here provides us with 6 pins out of which 4 pins were used such as GND, VCC, Rx and Tx. It also comes with an LED indicator for Rx/Tx communication.



Fig 5: USB to Serial Converter

III. ARCHITECTURE

Fingerprint scanner is connected to Raspberry Pi via an UART based USB to Serial converter. The fingerprints are scanned and sent to Raspberry Pi for processing, storing and retrieval. The process of fingerprint verification and authentication is carried out using python libraries. A 16x2 LCD display is used for the displaying of information related to enrollment, searching, position numbers etc. Once the whole processing is done, images are encrypted and sent to the Remote PC for storage via Internet.

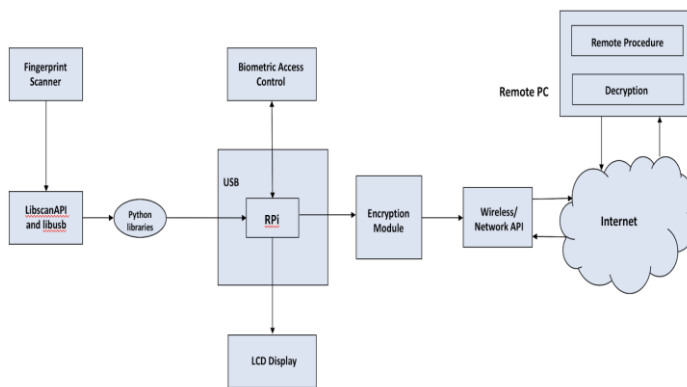


Fig 6: Workflow of Biometric authentication using Raspberry Pi

IV. APPLICATIONS

As explained earlier IoT based Fingerprint Sensor are responsible for enrolling fingerprints and store them safely and use them as reference to detect the person's authenticity. This fingerprint sensor at the beginning of installation should be placed in enrollment mode and should be enrolled with all the fingerprints. Then it can be placed in detection mode to verify across its own data. The fingerprints can be modified anytime i.e they can be deleted or re-captured. This form of fingerprint sensor may have wide range of applications:

1. Universities/Colleges:

It can be used in universities where the traditional way of swiping cards can be replaced by this automated device to verify student's identity.

2. WorkPlaces:

It can also be used at the entry points of various offices replacing the employee ID Cards. Their timesheets can be automatically validated with this device.

3. Border Control/Airports:

The manual checking made at airport may be incorrect sometimes due to manipulation, So accompanying this with a biometric security scanner like fingerprint it strengthens the security to a large extent.

4. Residential Areas:

To deal with the threat of intruders and prevent any unfortunate events in the residential areas using biometric devices is an excellent solution. This will help lower the rates of robbery and keep the residential area safe.

5. Financial Records Safety:

A person's identity can be best verified with this product. Maintaining security of one's financial records and protecting their identity is made easy with this IoT based fingerprint scanner.

V. SCENARIOS

Steps:

1. The FingerPrint Scanner is setup properly with proper power supply at the entrance of classroom in university.
2. The device is set to Enrollment mode to record the fingerprints.
3. All the students are required to enroll their finger placing it twice to ensure the capture of accurate image.
4. Once this process is complete, the administrator can verify the fingerprints across the data by displaying them.
5. He/She can delete any fingerprint at any point of time as per the convenience to limit the access accordingly.
6. After this setup this device can be mounted and is ready to use.

7. Before entering the classroom the student must place his finger to get access and record his entry.
8. The fingerprint is verified across the pre stored data and it searches for a match.
9. If a match is found the student's identity is verified and the position number of template where his fingerprint is stored is displayed with a success message saying **"MATCH FOUND"**.
10. If the fingerprint is not matched with any image stored in data, the person is not authenticated to enter the room and an error message saying **"NO MATCH FOUND"** is displayed.
11. Thus, this simple low-cost IoT based Biometric Fingerprint scanner can potentially replace the ID Cards and can be very useful to serve as Biometric Attendance.

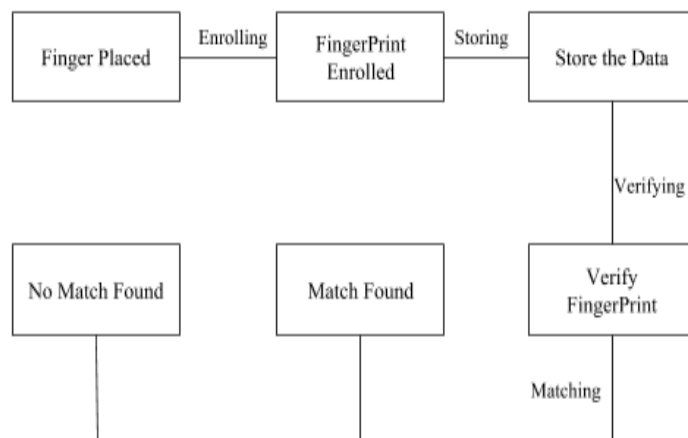


Fig7: Scenario for working of Fingerprint Scanner

VI. USE CASE DIAGRAMS

1. Biometric Attendance System:

Participation by biometric scanner dependably gives you exact information record. With the assistance of biometric participation framework, it turns out to be anything but difficult to look at in and time of your workers. Participation framework can deal with various worker participation information productively.

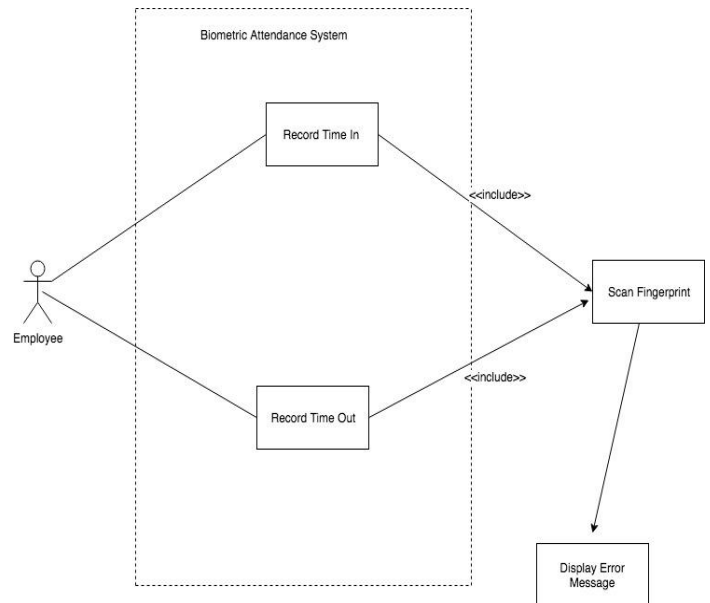


Fig 8: Use Case Diagram for Biometric Attendance System

2. Embedded Security Door System:

Unique mark sensor made a protected access for an entryway which approve the visitor fingerprint to open the door. Guest output's his fingerprint if it is entered accurately entryway is open by engine which is utilized to pivot the handle of the entryway bolt. If not then, it enrolled the finger, empowered the alert and send the picture of individual through camera to house proprietor. House proprietor stop the caution if the individual is known.

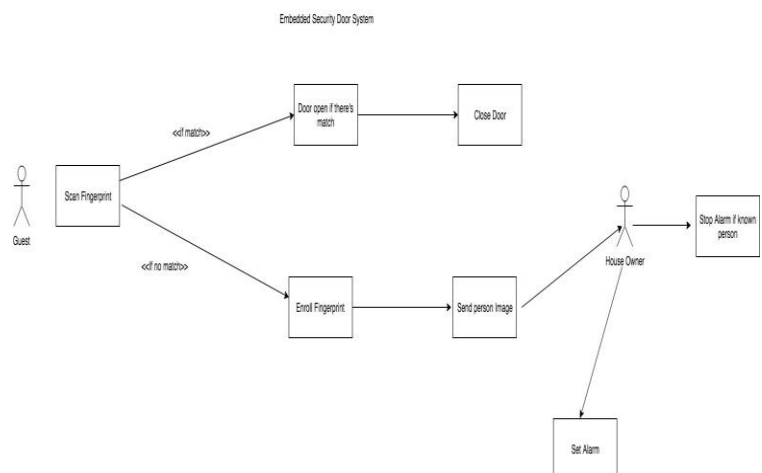


Fig 8: Use Case Diagram for Embedded Security Door System

VII. REFERENCES

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