

A Biometric Solution for Door Accessing System on Real-time Embedded Systems using Raspberry pi

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Abstract

Now days, security plays key role at office, industry and home. In order to secure your data/things from unauthorized persons, we require security implementations. Previously security implementations are done by using passwords, unique identification cards and face recognition. These methods are not safest to our belongings. To overcome this, we developed a prototype for biometric based security implementation and this is cost effective.

In this system finger prints of the authorized persons are stored in database by using R305 sensor. Whenever a finger print detected, it'll check whether the person is authenticated or not. If the person is authenticated then door will open. If the person is unauthenticated then SMS alert will be sent and sound alert given such that intimation to the neighbors or security persons.

Keywords: Raspberry pi, R305, SIM 900A

1. INTRODUCTION

Normally, human finger tips contain valleys and ridges and they are mixing together from the different patterns. These patterns are called finger prints. From the research, it is told that no two persons have same finger prints. Therefore unique identification of a person using finger prints only. The revolution in electronics and information technology, all the data can be transformed into digital form and processed using technology, so that data (biometric) can be compared with database. Due to population, there was no other way. This biometric data is useful in all the sectors, not only in security issues. Users no need to remember passwords or personal identification numbers. By using finger print sensors, biometric data was converted into digital data and needed for the comparison with saved data. Different algorithms are developed and implemented to eliminate unwanted effects.

2. RELATED WORK

Modern security is a battle between high security and low friction. Developers want users to use unique, complicated passwords for their apps to increase security. Users, faced with the challenge of remembering a number of different passwords, want to use the simplest password or pass code possible [1]. This makes it easier to remember, and makes access to the app or site quicker, but is fatal for online security. Various attempts are made for providing security for all domiciles. Up to date, complete security is not discovered [2]. First step towards security was Lock and key system. Security protocol followed in this system was "Single key for a single lock" [3]. Initially, this system was considered to provide at most security. But this belief was soon proved wrong by the fact that multiple keys can be easily made for a single lock. Hence this system is an outdated system to provide security [4]-[5].

Next level of Security used password as an authenticating tool. This system stores password of authenticated users for the purpose of validation [6]. System using password authentication provides considerable security to the users as it acts as a secret of authorized users. This system also have a pitfall that password can be acquired by unauthorized user by continuously trying all the possible combinations. This is also one among the hundreds of attempt made for providing security.

Later technological development for providing security was authentication by RFID card. This system enriched the level of security [7]. Access is granted only for the user whose RFID code matches with the authorized code. This system also have disadvantage of duplication of RFID card and anyone who possess this card can unlock the door [8].

Fingerprints are unique (even among identical twins), impossible to guess, and difficult to fake without significant effort [9]. Modern fingerprint authentication uses the fingerprint to create an encrypted key, which is sent for server authentication. This finger prints sensors are also used in attendance monitoring system [10]-[11].

3.SYSTEM ARCHITECTURE

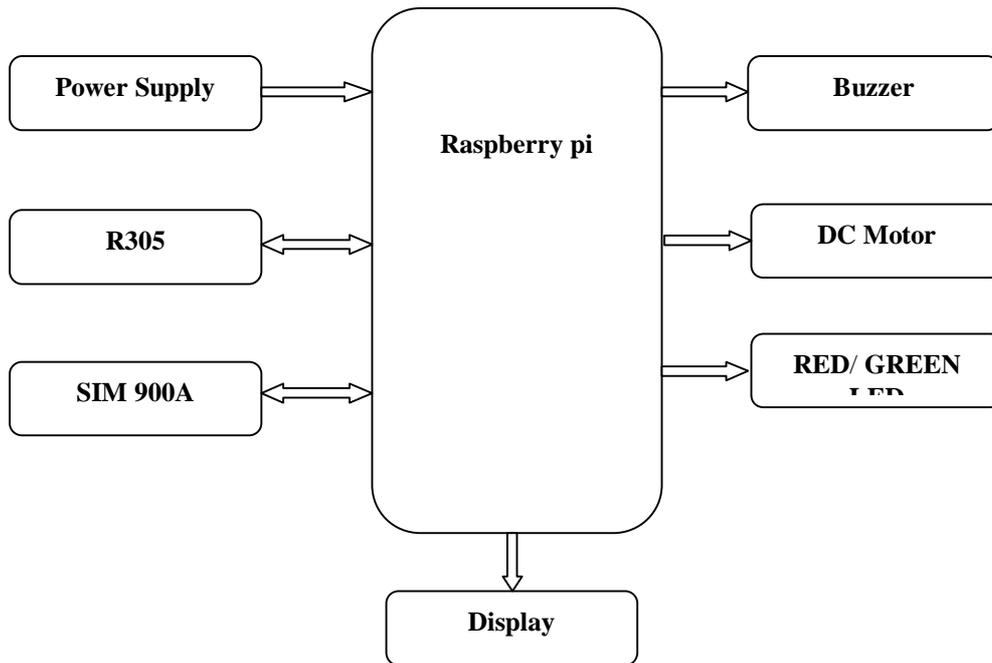


Figure1: Biometric based security system

The above architecture shows that the schematic of the Biometric based security implementation system. This system implementation divided into three parts, 1) enroll, 2) matching and 3) delete. In the first step, we can enroll 256 finger prints by using R305 sensor. It'll ask to put our finger two times for registration. In 3rd step, if you want to delete we can delete the registered finger print. In 2nd step, whenever you given finger print, it'll check whether it is authenticated or not with the database. If it matches then it will display user details, unlocks the door and Green LED will ON. If it doesn't match then an SMS will be sent to registered mobile number using SIM 900A modem and Buzzer alert is given to intimate to security guards and neighbors.

3.1 Raspberry pi

Raspberry pi acts like a central processing unit. If we interface keyboard, mouse and display it'll act as a computer. That's why we are calling credit card sized computer. The raspberry pi has different versions for each version they upgraded the board. Present available version is raspberry pi 3; it contains 1GB LPDDR2 RAM, BCM 2837 processor, up to 32GB SD card for memory support. It consists four USB ports, one Ethernet port, HDMI display and serial camera/display interfaces. Mainly this board is used for IoT applications. We can develop application programming using python and it uses Raspbian OS (Open source).

3.2 Finger print sensor (R305)

This optical sensor uses TTL UART based communication for direct interfacing with microcontrollers or PC using MAX 3232 circuit. It uses four wires for interfacing to microcontroller/PC; VCC, GND and TX, RX. While interfacing, transmitter of the r305 is connected to microcontroller/PC receiver and r305 receiver is connected to microcontroller/PC transmitter. It requires 5v hence it consumes less power, high speed, low cost compare to other biometric sensors, efficient and it can capture image with 500dpi resolution. This sensor maximum 250 finger prints can store. For each enrollment of a finger, it will take two times for confirming the finger print. It will verify the finger print within 0.3sec. We can load the database by using SFG Demo tool (open source), or we can create the database with coding. Using SFG Demo, we can enroll, delete and verify, database and capturing/storing finger print images.

3.3 GSM MODULE

A GSM (Global System for Mobile Communications) modem is a standard type of modem which consist a SIM slot for inserting a SIM card, and operates at 900 MHZ frequency over a subscription to a mobile operator, like a hand held mobile phone. This module will uses TTL logic for data conversion over a RS-232 communication. Initially we have to configure baud rate, usually it uses 9600 bps. We can check whether module is working or not by giving a call to number, Once SIM card properly inserted. The GSM modems support an extended set of AT commands. These extended AT commands are defined in the GSM standards. With the extended AT commands, you can do things like:

Reading, writing and deleting SMS messages. We can give a call to others, Reading, writing and searching phone book entries.

3.4 Relay

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches. Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.

3.5 DC Motor

DC motors are configured in many types and sizes, including brush less, servo, and gear motor types. A motor consists of a rotor and a permanent magnetic field stator. The magnetic field is maintained using either permanent magnets or electromagnetic windings.

3.6 Buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or electronic. Typical uses of buzzers and beepers include alarms, timers and confirmation of user input such as a mouse click or keystroke.

4. RESULTS

The below figure shows experimental results of the system. Hardware setup for a prototype for biometric based security implementation using raspberry pi. SFG demo is used for finger print sensor. SFG demo requires 57600 baud rate for interfacing with raspberry pi.

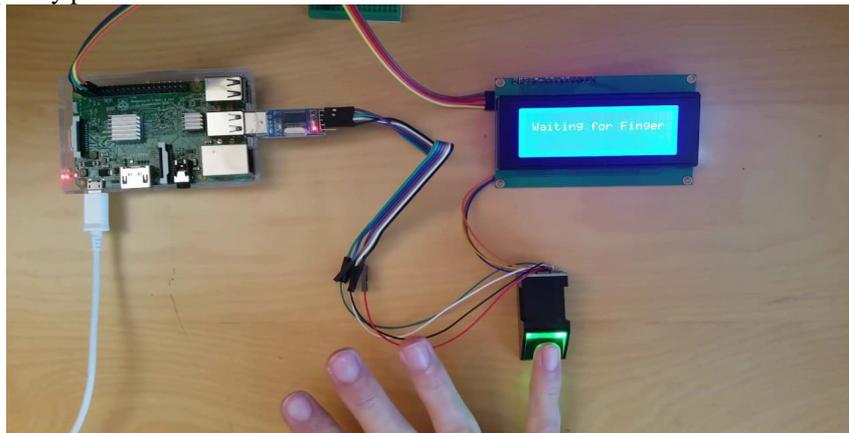


Figure2: Security system hardware setup

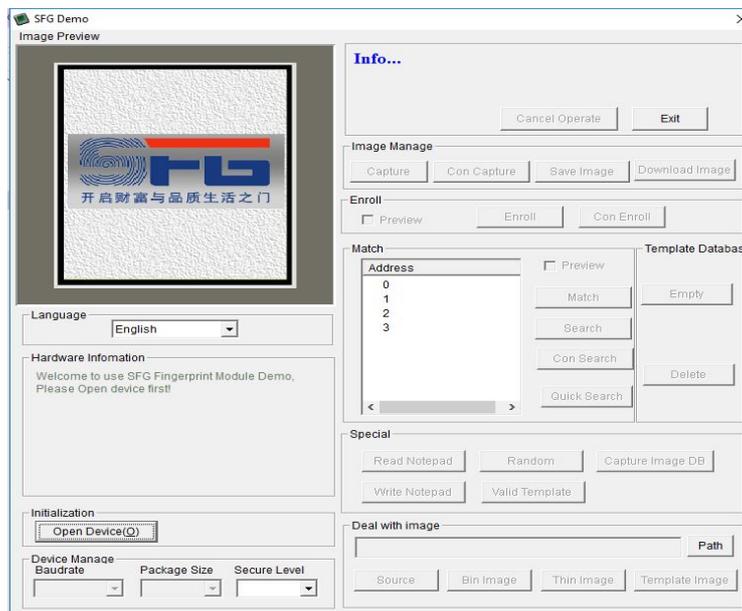


Figure3: SFG demo tool

5. CONCLUSION

From the observations, this system provides efficient solution to the security system. A prototype for biometric based home security system using R305 and raspberry pi is implemented. Cost effective and very high speed in processing finger print and verifying. Further, we can extend the database size so that we can load more finger prints then it'll applicable in attendance monitoring and security login/logout. If we implemented security systems with Internet of Things technology, it could be great flexibility and we can access, monitor from anywhere.

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