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Fingerprint Based Locker With Image Capture

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ABSTRACT: As today fingerprint based system provides high accuracy in terms of security. Also there is a high demand for integration of fingerprint matching techniques for making secure authentication systems. Therefore, we have introduced the bank locker system which integrates the fingerprint reader in it so as to provide a good level of security. The main goal of fingerprint bank locker with image capture is to provide security with no manual security flaws. It is easy to use and requires no special training or equipment. This system needs fingerprint authentication while operating the bank locker as well as captures the images of person who is handling the locker and saves it in memory card which can be later viewed with card reader to the bank authorized person. The functionality of system is that it will scan the fingerprint and if it matches with registered fingerprint the bank locker opens and also captures the image of user. The system uses a Raspberry pi for this purpose. The microcontroller processes data sent by the fingerprint reader to check if user is registered, unregistered users are not allowed access. Controller operates the motors to open the locker door on encountering registered valid users. If the fingerprint does not matches with register fingerprint of user it will shows the error message as unauthorized user and immediately capture the picture and send to the author.

KEYWORDS: Raspberry pi, Fingerprint, Locking System, SD Card, GSM, HDM

I. INTRODUCTION

In the real world, peoples are more concerned about their safety for their valuable things like jewellery, money, important documents etc. So the bank lockers are the safest place to store them. The arrival of fast growing technologies makes users to have high security systems [4] with electronic identification options. These identification technologies include Bank Lockers and ATM [6] as well as other intelligent cards, user IDs and password based systems, and so on. But, unfortunately these are not protected due to hacker attacks, thefts, and forgotten passwords. In spite of all these faults or failure and malfunctions or crash these systems are still existing; however, the biometric or fingerprint authentication based identification is the most efficient and reliable solution for stringent security. Biometrics measure individual's unique physical or the characteristics to recognize or authenticate their identity.

The physical characteristics are fingerprint hand, face, iris etc and the characteristics are signature, voice keystroke patterns etc. Biometric system operates in verification mode or identification mode. In the verification mode system validates person's identity by comparing the captured biometric template which is pre stored in the system data base. In the identification mode the system recognize an individual by searching entire template data base for match and the system performs one to many comparisons to establish the individual identity or fails if the subject is not enrolled in the system data base. So we are using fingerprint security system [3].

The objectives of fingerprint based locker with image capture

- To provide security with no manual security flaws.
- Implementing bank locker security using fingerprint, face detection and GSM technology [1] based security system than the traditional system.

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II. EXISTING METHOD

In existing system buzzer alerts are used in case of any unauthorized persons tries to open locker. Here RFID [2] is used for detecting authorized persons. This RFID can be used by anyone so that no safety and security is available.

Drawbacks for existing method are

- Consumes more time
- When unauthorized person tries to open the locker it cannot capture the images of that person so we use proposed method.

III. PROPOSED METHODOLOGY

In this proposed system we have used fingerprint image capturing techniques with the help of raspberry pi. So that if any unauthorized person tries to open locker then the mail will be sent along with the persons face. Block diagram of proposed system is shown in Figure 1.

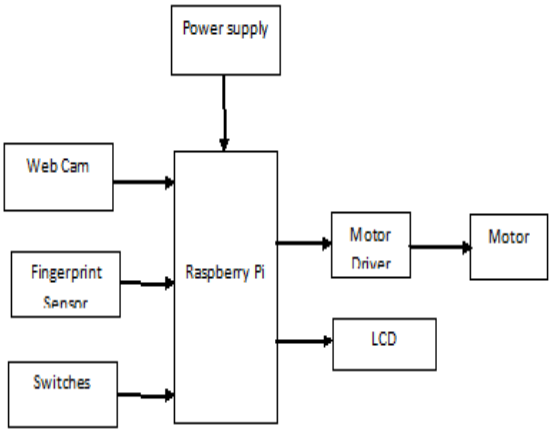

Figure 1: Block Diagram of Proposed System

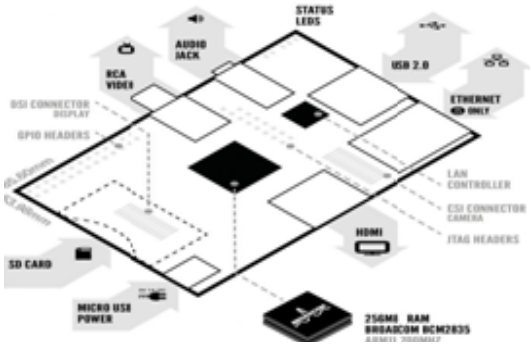

Figure 2: Block Diagram of Raspberry Pi

Raspberry Pi is a credit-card sized computer manufactured and designed in the United Kingdom by the Raspberry Pi foundation with the intention of teaching basic computer science to school students and every other person interested in computer hardware, programming and DIY-Do-it Yourself projects.

The Raspberry Pi is manufactured in three board configurations through licensed manufacturing deals with Newark element 14(Premier Farnell), RS Components and Egoman. These companies sell the Raspberry Pi online. Egoman produces a version for distribution solely in China and Taiwan, which can be distinguished from other Pi's by their red coloring and lack of FCC/CE marks. The hardware is the same across all manufacturers.

The Raspberry Pi has a Broadcom BCM2835 system on a chip (SOC), which includes an ARM1176JZF-S 700 MHz processor, Video Core IV GPU and was originally shipped with 256 megabytes of RAM, later upgraded (Model B & Model B+) to 512 MB. It does not include a built-in hard disk or solid-state drive, but it uses an SD card for booting and persistent storage, with the Model B+ using a Micro SD.

The Foundation provides Debian and Arch Linux ARM distributions for download. Tools are available for Python as the main programming language, with support for BBC BASIC (via the RISC OS image or the Brandy Basic clone for Linux), C, Java and Perl.

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Block diagram of raspberry pi is shown in Figure 2 and its description is given below.

1) Processor/SOC (System on Chip):

The Raspberry Pi has a Broadcom BCM2835 System on Chip module. It has a ARM1176JZF-S processor. The Broadcom SOC used in the Raspberry Pi is equivalent to a chip used in an old smart phone. While operating at 700 MHz by default, the Raspberry Pi provides a real world performance roughly equivalent to the 0.041GFLOPS. The Raspberry Pi chip operating at 700 MHz by default, will not become hot enough to need a heat sink or special cooling.

2) Power source:

The Pi is a device which consumes 700mA or 3W or power. It is powered by a Micro USB charger or the GPIO header. Any good Smartphone charger will do the work of powering the Pi.

3) SD Card:

The Raspberry Pi does not have any onboard storage available. The operating system is loaded on a SD card which is inserted on the SD card slot on the Raspberry Pi. The operating system can be loaded on the card using a card reader on any computer.

4) GPIO:

General-purpose input/output (GPIO) is a generic pin on an integrated circuit whose behavior, including whether it is an input or output pin, can be controlled by the user at run time. GPIO pins have no special purpose defined, and go unused by default. The idea is that sometimes the system designer building a full system that uses the chip might find it useful to have a handful of additional digital control lines, and having these available from the chip can save the hassle of having to arrange additional circuitry.

The production Raspberry Pi board has a 26-pin 2.54 mm expansion header, marked as P1, arranged in a 2x13 strip. They provide 8 GPIO pins plus access to I²C, SPI, UART), as well as +3.3 V, +5 V and GND supply lines. Pin one is the pin in the first column and on the bottom row. Pin description of Raspberry pi is shown in Figure 3.

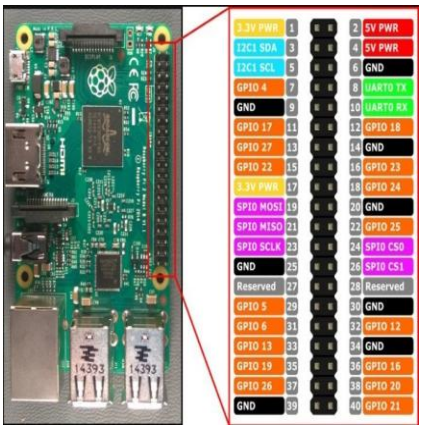

Fig 3: Pin description

Fig 4: Hardware Layout

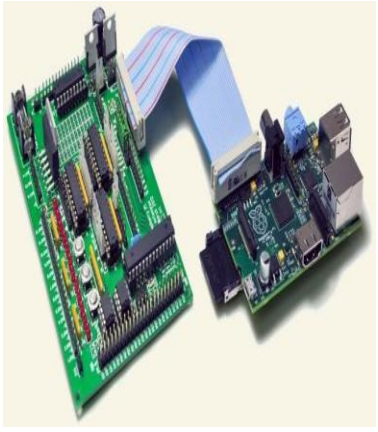

Fig 5: Gertboard (left) & Raspberry Pi

5) DSI connector:

The Display Serial Interface (DSI) is a specification by the Mobile Industry Processor Interface (MIPI) Alliance aimed at reducing the cost of display controllers in a mobile device. It is commonly targeted at LCD and similar display

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technologies. It defines a serial bus and a communication protocol between the host and the device. A DSI compatible LCD screen can be connected through DSI, although it may require additional drivers to drive the display.

6) RCA Video:

RCA Video outputs (PAL and NTSC) are available on all models of Raspberry Pi. Any television or screen with a RCA jack can be connected with the Raspberry Pi.

7) Audio Jack:

A standard 3.5 mm TRS connector is available on the RPi for stereo audio output. Any headphone or 3.5mm audio cable can be connected directly. Although this jack cannot be used for taking audio input, USB mics or USB sound cards can be used.

8) Status LEDs:

There are 5 status LEDs on the Raspberry Pi that show the status of various activities. They are “OK” ,"ACT" ,,“POWER” (PWR),Full Duplex ("FDX"),“LNK” (Link/Activity), “10M/100”.

9) USB 2.0 Port:

USB 2.0 ports are the means to connect accessories such as mouse or keyboard to the Raspberry Pi. There is 1 port on Model A, 2 on Model B and 4 on Mo del B+. The number of ports can be increased by using an external powered USB hub which is available as a standard Pi accessory.

10) Ethernet:

Ethernet port is available on Model B and B+. It can be connected to a network or internet using a standard LAN cable on the Ethernet port. The Ethernet ports are controlled by Microchip LAN9512 LAN controller chip.

11) CSI connector:

CSI – Camera Serial Interface is a serial interface designed by MIPI (Mobile Industry Processor Interface) alliance aimed at interfacing digital cameras with a mobile processor. The Raspberry Pi foundation provides a camera specially made for the Pi which can be connected with the Pi using the CSI connector.

12) JTAG headers:

JTAG is an acronym for ‘Joint Test Action Group', an organization that started back in the mid 1980's to address test point access issues on PCB with surface mount devices. The organization devised a method of access to device pins via a serial port that became known as the TAP (Test Access Port). In 1990 the method became a recognized international standard (IEEE Std 1149.1). Many thousands of devices now include this standardized port as a feature to allow test and design engineers to access pins.

13) HDMI:

HDMI –High Definition Multimedia Interface
HDMI 1.3 a type A port is provided on the Raspberry Pi to connect with HDMI screens.

Figure 4 shows entire hardware layout of Proposed System.

Gertboard – A Raspberry Pi Foundation sanctioned device designed for educational purposes, and expands the Raspberry Pi's GPIO pins to allow interface with and control of LEDs, switches, analog signals, sensors and other devices. It also includes an optional Arduino compatible controller to interface with the Pi. The Gertboard can be used to control motors, switches etc. for robotic projects. Figure 5 shows the interconnection of Gertboard with Raspberry Pi via USB. USB Hub – Although not an official accessory, it is a highly recommended accessory for the Pi. A powered USB Hub with 7 extra ports is available at almost all online stores. It is compulsory to use a USB Hub to connect external hard disks or other accessories that draw power from the USB ports, as the Pi cannot give power to them.

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IV. EXPERIMENTAL RESULTS

The functionality of system is that it will scan the fingerprint [5] and if it matches with registered fingerprint the bank locker opens and also captures the image of user. The system uses an Raspberry pi for this purpose. The Raspberry pi processes data sent by the fingerprint reader to check if user is registered, unregistered users are not allowed access. Raspberry pi operates the motors to open the locker door on encountering registered valid users. If the fingerprint does not matches with register fingerprint of user it will shows the error message as unauthorized user and immediately saves the picture in memory card.
So, the system is very beneficial for stopping the locker robbery by providing security. Figure 6 shows the testing results of proposed system fingerprint based locker with image capture.

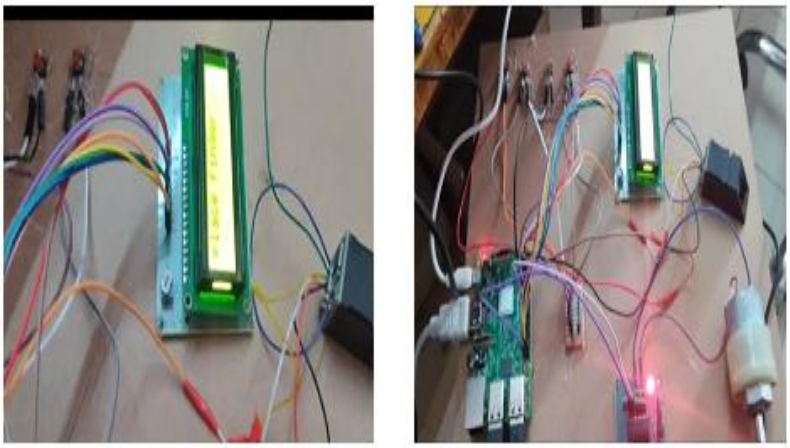

Fig 6: Testing Result

Advantages of the proposed work are

- Easy to use and requires no special training or equipment.
- Fingerprint is unique for every person. It cannot be imitated or fabricated.
- High accuracy in terms of security.
- No manual errors
- No false intrusion

Applications of the proposed work includes in all bank for Lockers, in all bank ATMs, in all Educational Institution, in jeweler shops, in all Shopping malls, in all IT Sectors, in house, Schools treasury, Colleges treasury and in industries, VIP vehicles, in hospital, offices.

V. CONCLUSION

A security system is proposed by using Image capturing and Fingerprint. It is a low cost, low in power conception, compact in size and standalone system. The microcontroller compares the fingerprints scanned by it with its flash memory. If these fingerprints are correct, the microcontroller provides necessary control signal to open the bank locker otherwise the door remains locked and image is saved in SD card after capturing. The proposed system can be used in other places such as offices and diamond jewellery shops. In addition to this the future scope of this paper is to develop smart bank locker security system based on “IRIS and Retina” Scanning for visual identification of the person.

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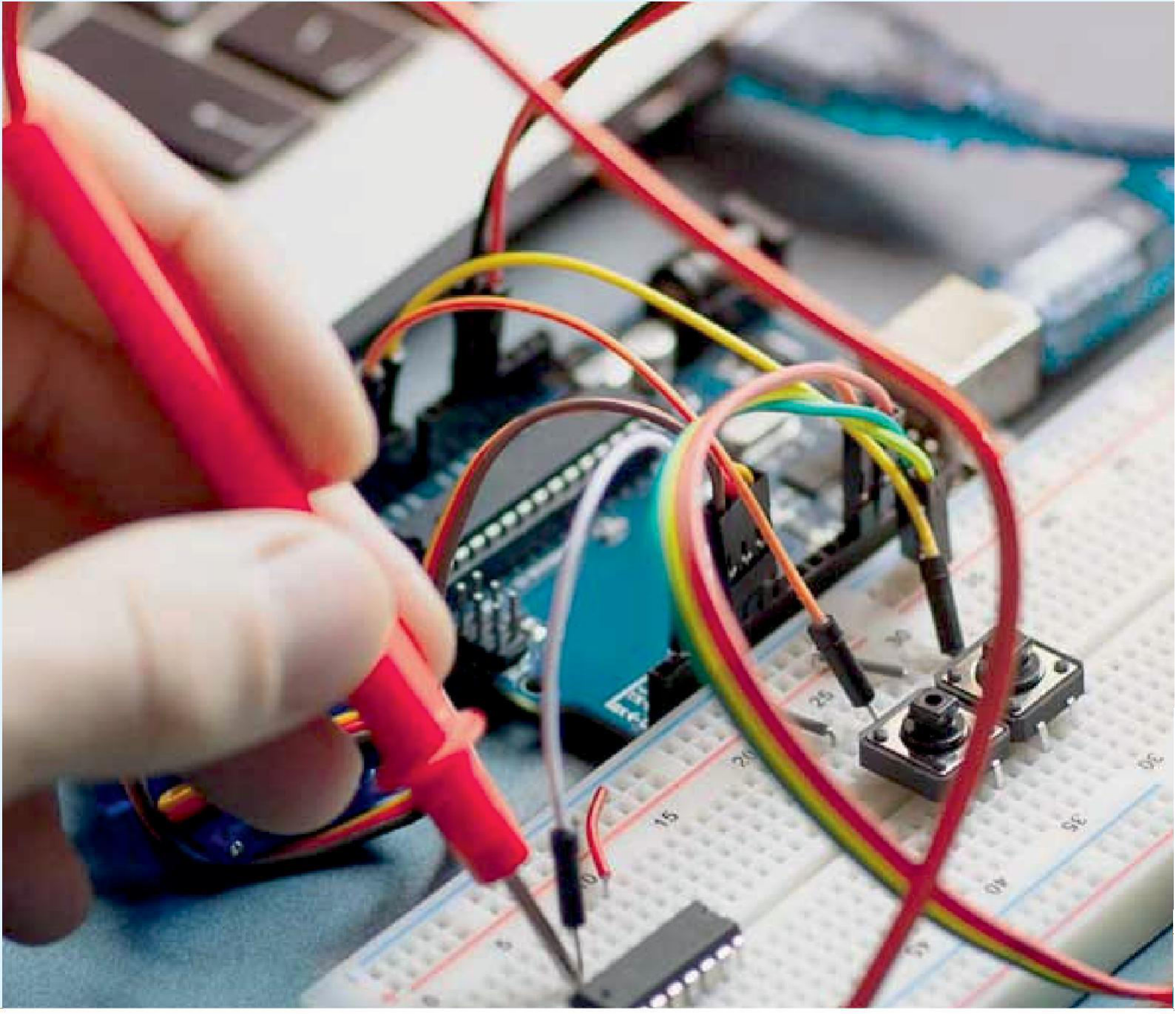

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