# BIOMETRIC ATTENDANCE MONITORING SYSTEM USING RASPBERRY PI AND FINGER PRINT

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*Abstract:* **Progress of Information Technology field make zeal of Information Security domain. Authentication acts an imperative role in internet security. In the following study, biometric system was utilized for verification as well as authentication purpose. This study also elucidates on working principle of biometrics on control of prominent flexible properties, scalability and reduction of cost for reducing requirements of biometric systems for numerous computational resources (such as data handling or processing capacity) cloud's computational techniques and improving biometric system process performance (i.e. biometric matching). In this rsearch, Raspberry Pi is utilized for building an economic biometric system. Raspberry Pi (RPi) is a compact micro-computer with boundless abilities similar to PC. In this study, Rpi was utilized as remote enrollment node. Cloud computing and Raspberry Pi have given a new dimension to research into Internet-of-Things (IoT) applications. By utilizing biometric technology, a novel system of IoT based biometrics was proposed. The encrypted biometric information is stored on the cloud and the authentication is created through Biometric service as host on cloud.**

*Index terms:* **Internet-of-Things (IoT); Raspberry Pi (RPi); cloud; biometrics; Finger print sensor.**

## I. INTRODUCTION

Attendance is a concept that exists in different places like institutions, organizations, hospitals, etc. during the start and end of the day to mark a person's presence. Since the past, the traditional way of taking attendance in a class includes a pen, attendance book or registers and a person. Thus the drawbacks arise as it consumes time, needs manual work and the most important, information or the attendance can be manipulated. Also, there are chances of students not responding to their attendance and later claiming for the attendance. The new procedure of taking attendance using fingerprint is easier and therefore overcomes all the above mentioned drawbacks [1-2].

This paper presents a fingerprint based biometric system that records the attendance automatically. This system consists of a Raspberry pi- the heart of the project and fingerprint sensor which is used to detect the person's identification. For example, in educational institutions, the student needs to place their finger on the fingerprint sensor to obtain their attendance. The fingerprint captured is recorded in a flash memory and then each time it is checked whether the obtained fingerprint matches with the record in the flash memory after which the student gets the attendance [3-4]. By making use of this system, we overcome the issues such as proxy so no student can give attendance for their friends who are absent. The software platform used is Raspberry-pi (Linux OS), Python programming language.

The attendance management system can be improved by adding the features that indicate if the employee or student is late. Some of the future enhancements for this are to extend the current flash memory to store the complete details of the student. The system can be enhanced to track the arrival and exit time of the student or employee for additional monitoring [5].

Further cost of the biometric can be reduced by the use of a low-cost IoT device, Raspberry Pi [7]. The allure of the Raspberry Pi comes from a combination of the computer's small size and affordable price. Raspberry Pi, a credit-card sized low-cost Linux computer can be used to develop a biometric architecture as it has provision of connecting with cameras, fingerprint scanners etc. via USB ports. It has an Ethernet port for Internet connectivity or can be connected to a Wi-Fi hotspot via USB Wi-Fi adapters. In this paper, Raspberry Pi is used as a low-cost, wireless, remote enrolment node and the biometric authentication can be hosted on the cloud as Software-as-a- Service.

The blend of Raspberry Pi and the cloud has led to the era of an emerging trend. The Internet of Things allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration between the physical world and computer-based systems, and causing in improved proficiency, precision and economic assistance. The advantages of incorporating IoT are low-cost, low space, low power and portability of the entire system of implementation. The Internet of Things will redefine identity management using biometrics to unlock bank apps, email accounts but also cars, homes and personal health databases. IoT will drive device and user relationship requirements in 20 percent of new identity and access management (IAM) implementations by year-end 2016, according to Gartner [8]. Gartner said, "Traditional authentication and authorization for user identities will continue to include devices and services, but will also incorporate expanded machine-to-machine (M2M) communications requirements into expanding digital business moments".

## II. LITERATURE REVIEW

One of the main aims of this research is to empower biometrics as an authentication method for security purposes like authenticating for cloud services, unlocking a door, accessing a particular service etc. taking into account the privacy and security challenges that face biometrics when used for remote applications.

The security and usability problems [9] of password-based authentication, which is the most commonly used authentication method for secure access, have been reviewed. Many theoretical studies in the literatures show that password-based authentication suffers from a wide-range of attacks including brute force, dictionary, sniffing, shoulder surfing, phishing, and key-logger attacks. In addition, human elements add additional security weaknesses to the password-based authentication. For example, users are likely to write down their passwords, use the same password across-multiple systems, use the same password over a long period of time, and share their passwords with their co-workers, family members, or friends. Sasse et al. [10] experimentally investigate the main causes of password problems such as memorability issues and technical/organizational requirements (e.g., forced change of password). This study concludes that Human Computer Interaction (HCI) techniques can be used to address password problems. Similarly, Yan et al. [11] empirically study passwords memorability and security. In [12] among the biometrics of face, finger, hand, voice, eye, DNA and signature, the face biometric ranks first in the compatibility evaluation of a machine readable travel document (MRTD) system on the basis of six criteria: enrolment, renewal, machine assisted identity verification requirements, redundancy, public perception, and storage requirements and performance. In [13] authors projected an image capturing technique in an embedded system based on Raspberry Pi boards.

Most of the recognition systems are centered on a PC, the portability of which is limited by its weight, size and the high power consumption. In [14], implementation of feature extraction of fingerprint and footprint in Raspberry pi has been conversed. Numerous image processing techniques are implemented on RPi using open source OpenCV library into a Linux platform. A cloud-based biometric architecture is proposed [15] on Raspberry Pi which has aid in developing a low-cost, scalable and portable biometric system. Peter Peer and Jernej Bule [6] have proposed a face recognition system on cloud, This paper tries to elaborate on the issues such as the most common challenges and obstacles encountered, when moving the technology to a cloud platform, standards and recommendations pertaining to both cloud-based services as well as biometrics, and existing solutions. In [16] authors Dr. Vinayak Bharadi and Mr. Godson D'silva has proposed an architecture for implementing online signature recognition system on a public cloud like Windows Azure. The literature reveals some works that leverage cloud data storage for storing biometric data. Griaule Biometrics [17] introduces a biometric information management system in the cloud, which leverages cloud storage to store biometric data on the cloud. Griaule's biometric information management system protects biometric data using AES encryption while stored and Secure Socket Layer while in transfer.

Raspberry Pi's performances [18] are compared with some current IoT platforms on a general level by computing power, size and overall costs of the solutions. Based on performed scrutiny, it can be stated that Udoo has the best performances among considered IoT hardware platforms, but at the same time its price is quite high. On the other side the detail analyses of Raspberry Pi have shown that as ultra-cheap-yet-serviceable computer board, with support for a great number of input and output peripherals, and network communication is the perfect platform for interfacing with many different devices and using in wide range of applications. Connecting it with WiFi and providing access to the Internet it is probable to set it up for a remote communication, what the Raspberry Pi makes very suitable for applications in IoT concept. Thus, the benefit of Raspberry Pi lies in its flexibility and unending possibility of its usage aiding the end-users to program it according their needs and budgets [19-22].

## III. PROPOSED METHOD

*Hardware requirements:*

- Raspberry-pi 3
- Finger print sensor
- Switch circuit
- Operating System SD Card

*Software requirements:*
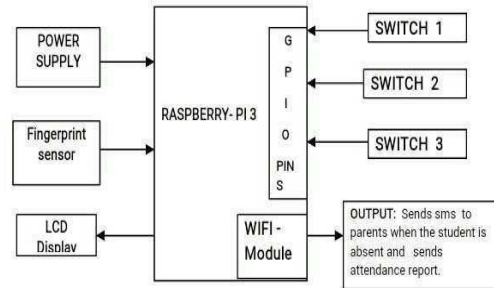
- Raspberry-pi (Linux OS)
- Python programming language

*Block diagram*



Fig. 1. Block diagram for attendance management system

*Finger print sensor*

In our design, R305 – TTL is used which is a high speed and accurate fingerprint scanner. It has an on board optical sensor to capture the image, internal 32-bit processor that process the captured image and make it in a stream of bits and stores it in an on board memory. The memory can save up to 200 different fingerprints. The processor communicates with its master in simple UART protocol. This fingerprint scanner can store up to 200 different fingerprints. This fingerprint scanner has more supplementary features like High-Speed, High-Accuracy Fingerprint Identification using the Smack Finger 3.0 Algorithm, Download Fingerprint Images from the Device, Title and Author Details, Simple UART Protocol (Default baud rate:9600).



Fig. 2. Fingerprint Sensor (R305 - TTL)

*Raspberry pi-3*



Fig. 3. Raspberry Pi3

The Raspberry Pi 3 Model B looks identical to the Pi 2 B at first glance. It is the same size and has much of the same components on board. So what is the difference? The new Pi 3 brings more processing power and on-board connectivity, saving you time with the development of your applications.

*Operating System SD Card*

As the RPi has no internal mass storage or built-in operating system it requires an SD card preloaded with a version of the Linux Operating System. One can create your own preloaded card using any suitable SD card (4GBytes or above) you have to hand. We suggest you use a new blank card to avoid arguments over lost pictures.
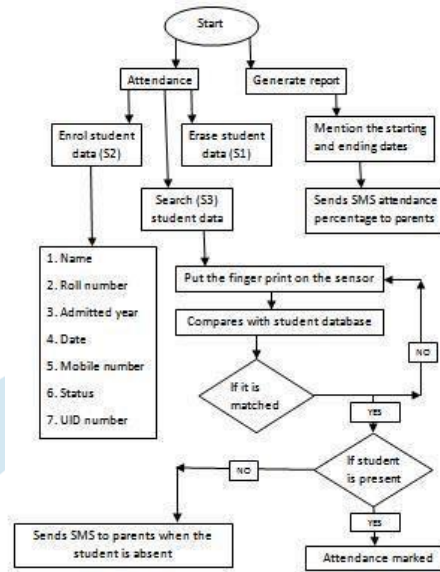
*Flowchart*



Fig. 4. Flowchart of attendance management system

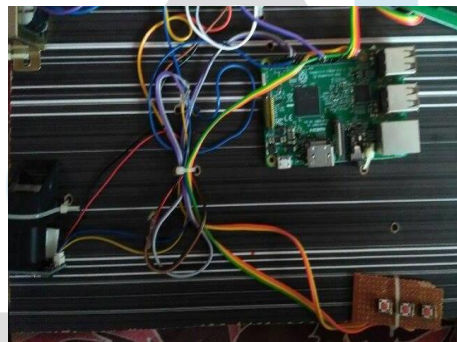## IV. RESULTS AND DISCUSSION



Fig. 5. Hardware of the project

A graphical user interface was mode so as to enable the user to understand the process visually. These are implemented in Linux based operating system as shown:
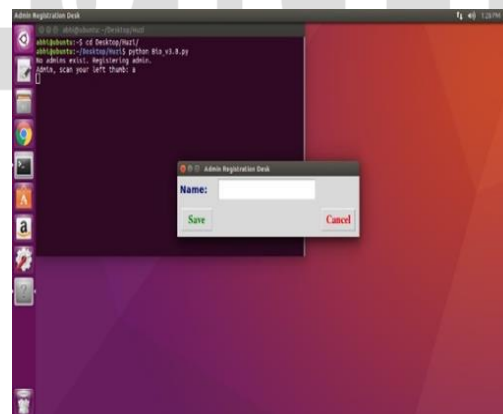


Fig. 6. Student registration wherein the student enters his name in the GUI provided
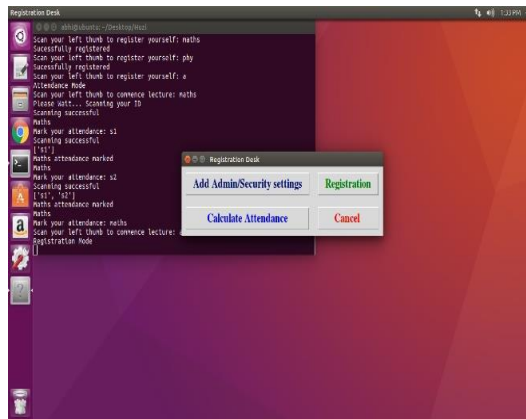
Fig. 7. Options available in the project (add admin, Register as student or professor and attendance calculation).
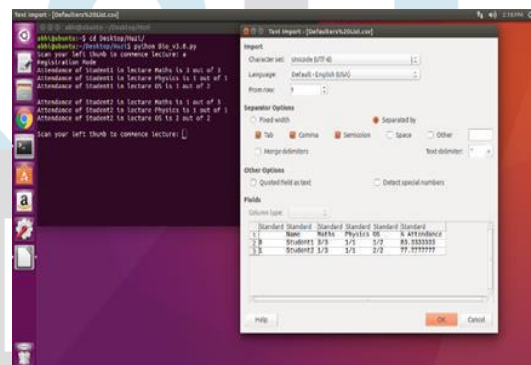


Fig. 8. Register as student or professor



Fig. 9. Calculate attendance

The finger print is compared with the database which contains the information of the students in the classroom. The result is generated as an SMS and it is send to the parents to intimate that their son/daughter is absent to college. The below image is the SMS generated for the parents. It generates attendance report daily to the HOD sir through mail to monitor the attendance percentage of a class. It generates SMS to parents to intimate their son/daughter attendance percentage. The below image shows the SMS generated for parents to intimate that their son/daughter is absent to college.
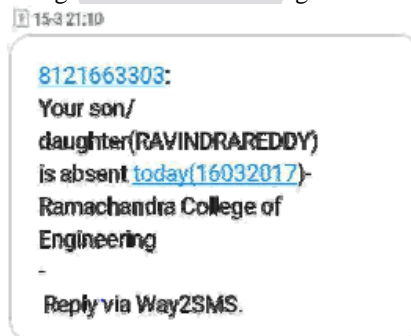


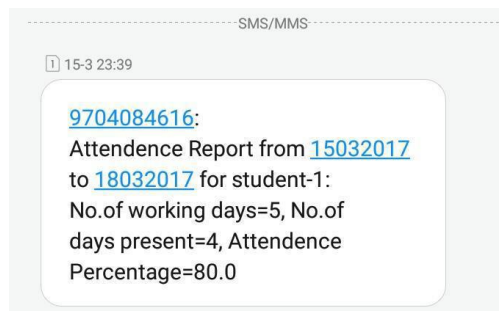Fig. 10. Screenshot of SMS generated for parents

Fig. 11. Screenshot of SMS generated for parents

## V. CONCLUSION

In this research, we presented a low-cost IoT based biometrics architecture. Raspberry Pi was successfully implemented as a remote wireless enrolment node. Also the encryption module was efficiently executed on RPi. The encrypted biometric traits was sent from RPi client to the cloud for decryption. The proposed system can be used for security and access control mechanisms like unlocking a door, logging details of a person entering and exiting a building, attendance management, accessing a particular service etc. This system can be applied at all places where authentication is required. Avalanche effect depicted that the IoT based biometric system is highly secured.

This technique described the efficient and accurate method of automatic attendance in the classroom environment that can replace the past manual methods. This novel method is secured enough, reliable and available for use. No need for specialized hardware for installing the system in the classroom. It can be constructed using finger print sensor and raspberry pi3. This system is used for various applications such as security purpose, industry, education etc.

In addition to this project, we can add the camera to detect the features of the face in order to identify the facial characteristics of the student (or) an employee. With this extension, we can provide high security and cannot be forged easily. For security reason, we can use detection & recognition system. To identify culprits on bus stations, railway stations several other public places, we can use this system. This will be helping hand to the police.

On the other hand, our system can be improved by integrating video-streaming service and lecture archiving system, to provide more profound applications in the field of distance education, online examinations, course management system (CMS) and support for faculty development (FD).

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