

Biometric Based Attendance Management System using Cloud

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Abstract—Biometrics is the technical term for body measurements and calculations. Biometric technology refers to identification and verification of individuals by analyzing the human body characteristics.

In modern times, there has been an increase in the number of identity theft experienced on a day to day basis. Companies, Organizations and Institutions are generally concerned over the levels of employee absence in the workplace, where security is essential, access to restricted areas are controlled and monitored through a system. Most institutions find it hard to managing student's attendance during lecture periods. Manually taking attendance by hand and preserving it over a long period adds to the difficulty and wastes a lot of time. For these reasons an effective system is proposed in this paper to solve the problem of manual attendance. Here a system would take attendance electronically with the help of a fingerprint recognition system and all records are saved in cloud or locally in the device.

A staff biometric attendance would contain a system to calculate attendance of the staff and do further calculations such as monthly attendance summary and calculate wages based on attendance, etc. In addition, this system if implemented properly could increase productivity, can reduce truancy, lateness in organization and institution.

Keywords-Attendance, System, Fingerprint, Biometric, Firebase, Android Application, Web Application.

I. INTRODUCTION

Today many industries, companies and institutions are experiencing a technological advancement and changes in which they carry out their business process. With the rise of globalization, it is essential to find an effective and simpler system to improve their productivity.

Despite this there are many industries, companies and institutions that take attendance manually in attendance registers by calling out their names. This process is very time consuming and also insecure, hence inefficient. [11] There are many issues that happen when we use a register.

[11] "For example, in Educational institutions teachers generally call out the names of the student's one after the other and note down their presence after they answer in a handy way. An alternate method would be passing the attendance sheet around the class for the students to sign besides their names. But these methods have a major drawback where the students tend to give proxy for their classmates who are not present on that day".

In industries and companies, employee absence and buddy punching are a huge issue as this would directly reduce the company's productivity and also effect the calculation of overtime, payroll system and manpower analysis all are dependent on Staff attendance management system.

A solution to overcome these limitations/problems is through an electronic attendance management system which can store users records and do the necessary calculations. [11] In this direction, this paper presents a fingerprint based biometric system that records the attendance electronically and

store it in a cloud database for easier access. For example, in an Educational institutions or Company a user must place his / her finger on the finger print scanner to obtain their attendance. This system would capture the finger print in an instant and tries to match it (using the Smack Finger Algorithm) with an existing record in order to identity the user. By this we can overcome the issues such as proxy or buddy punching.

II. RELATED WORKS

[1] Here in this paper the authors "Abdellah Guebla, Abdallah Meraoumia, Hakim Bendjenna and Salim Chitroub" has proposed two biometric systems for identifying a person's identity by using Finger-Knuckle-Print. For this, they have implemented two methods for feature extraction and combining the sub-systems outputs is carried out at matching score level. The authors have done a comparative study that shows the combination of Finger-Knuckle-Print has a good capability to identify a person's identity.

[2] The authors "Yash Mittal, Aishwary Varshney, Prachi Aggarwal, Kapil Matani and V. K. Mittal" in this paper proposed a scalable solution for identification and authentication purposes. This system which they have implemented is capable of replacing RFID based attendance management system. It can be extended to multiple location and employ the technology in various situations. In educational institutions a Classroom Attendance Management System presents a solution for taking classroom attendance at a lecture and can be used during examinations. The fingerprint scanner captures new fingerprints when a user places his finger on the

scanner. The captured image is then compared against the templates already stored in the database. The author has also extended to online website where the user can generate a report. Performance evaluation results of both ACS and CAMS are encouraging.

[3] The authors “Tsai-Cheng Li, Huan-Wen Wu, Tiz-Shiang Wu” describes about the importance of Attendance management in an office or school environment as a means to impart some sort of discipline. As discipline can sometimes directly affect productivity. The author also comes to a conclusion that employees highly agree with using the biometric technology machines to manage attendance. He also addresses the issues regarding the hygiene.

[4] Here in this paper the authors “L.S. Ezema, C.K.A. Joe-Uzuegbu, J. N. Eneh and I. Amanze” have proposed and implemented a reliable, secured, fast and efficient system replacing a manual and unreliable system. The system can be implemented in many organizations and institutions. This system will save time, reduce the amount of work the administrator has to do and will replace the stationery material with an electronic device. Hence, a system with expected results has been developed but there is still room for improvement.

[5] RFID based e-monitoring system for municipal solid waste management. Indian has a population of an astounding 140 crores and Urban India alone generates 188,500 tons per day (68.8 million tons per year). In conventional approach a number of trucks collect the MSW and then transport and transfer these MSW in a pre-specified location, but all the above jobs are not properly monitored. Such as:

- Dumping the MSW in unspecified location (near residential area) create health issues.
- Negligence in collection of wastes by Municipal laborer’s as per schedule. (In long term landfills leak and pollute groundwater and the surrounding environment).

As a result, day by day MSW produced in India is increasing and getting circulated within India rather than recycling / disposing it.

The authors “M.L. Ali, M. Alam and M.A.N.R Rahaman” have proposed a solution to this problem. Using RFID technology with PIC micro-controller and presents the development of an electronic monitoring (e-monitoring) system to overcome the above problem. Therefore, municipal authority can monitor the SW collecting status through the system and can generate different reports to improve the performance of their service.

III. SYSTEM ARCHITECTURE

The system architecture diagram is shown in Figure. 1.

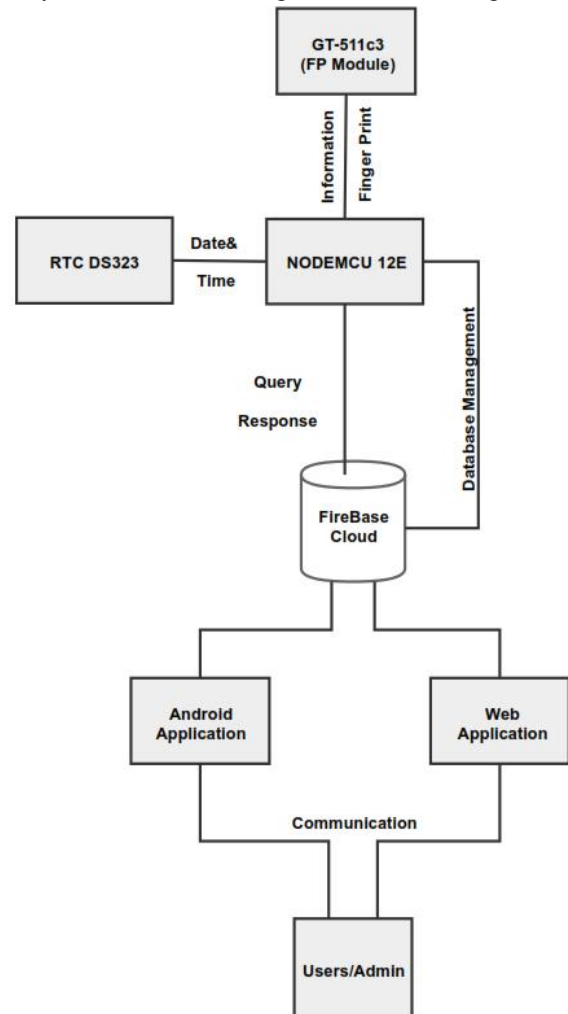


Figure 1. Complete System Architecture.

The design of the attendance management system using fingerprint based biometric system consists of the following modules:

A. NodeMCU ESP8266 ESP - E12

NodeMCU is an open source IoT platform which includes firmware which runs on the ESP826 module and hardware which is based on the ESP-12 module.

In this project, NodeMCU acts as a base station which serially collects the data from the Fingerprint (GT-511C3) module and computations are carried out. This data will be uploaded to cloud database. As NodeMCU is connected to internet any information going out or incoming must pass through NodeMCU. Therefore, it acts as a trigger that mark the attendance based on authentication provided by Fingerprint module.

B. Fingerprint Scanner Device GT — 511C1R

We choose the Fingerprint Scanner Device GT (511C1R) because it is very cheap and provides a well-documented manual.

[10] “It provides a high-speed, high-accuracy fingerprint identification using the SmackFinger 3.0 Algorithm. It can store up to 200 different fingerprints. It is able to recognize a fingerprint in whatever 360-degree position. Downloads and uploads of fingerprint scans can be done by using the serial interface”.

This module can be integrated with most of the microcontrollers. It mainly consists of the following functions:

- 1) Enrollment Process
- 2) Identification Process
- 3) Delete Process

C. RTC Time Module – DS3231

RTC stands for Real Time Clock which is system clock (most often in the form of an integrated circuit) that keeps monitoring the current time. [9] The clock works as either the 24-hour or 12-hour format with an AM/PM indicator. Operating Temperature Ranges 0°C to +70°C which uses 3.3 v. It is compatible with most of the microcontrollers on the market. It has an integrated temperature compensated crystal oscillator and crystal.

We have used DS3231 module which is a low-cost and provides extremely accurate time and date which is used to track the student’s records.

D. Cloud Database

Firebase by Google is the cloud being used here. Real time attendance information from the FP module is constantly uploaded to firebase. The attendance statistics of students is maintained in database and this information in cloud is queried as required by the user.

E. Android App (User Interface)

An Android Application is used to act as an interface for the user. The user must go through a registration procedure via the Android Application. Once registered the user should use the credentials given during the registration process to authenticate himself in the app. After the authentication he / she will be given access to their attendance stats.

F. Web Application (User Interface)

A Web Application (Website) is used to act as an interface for the user. The user must go through a registration procedure via the Web Application. Once registered the user should use the credentials given during the registration process to authenticate himself. After the authentication he / she will give given access to their attendance stats.

The working of the entire system is depicted in the flow chat in fig 2.

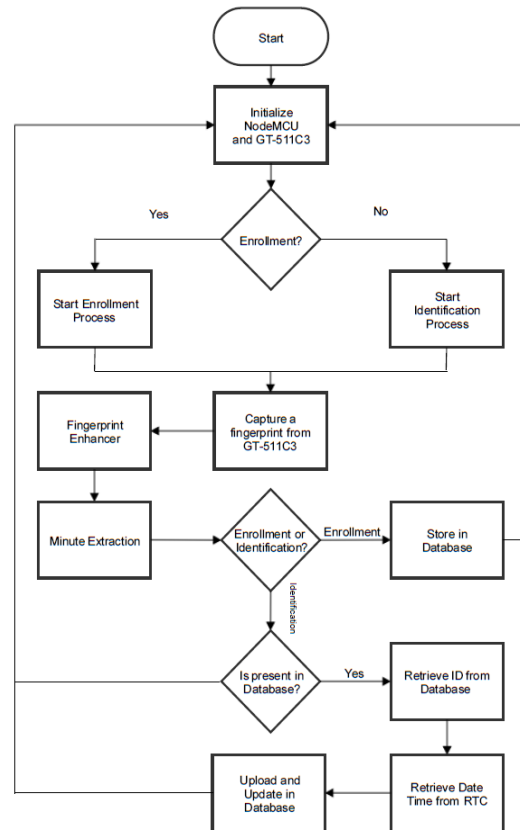


Figure 2. Flowchart of Entire System.

IV. INTERIOR WORKING OF FINGERPRINT MODULE

A. Image Procurement

Images of the Fingerprint are taken using the (GT-511C1R) module of various users. This Fingerprint module (GT-511C1R) has an internal storage which can store 200 images in it. These images are used for enhancement in the next stages.

B. Image Enhancement using Histogram Equalization

The image taken is enhanced using Histogram Equalization which is used to enhance contrast.



Figure 3. Original Fingerprint Image (Left) and Image after Equalization (Right)

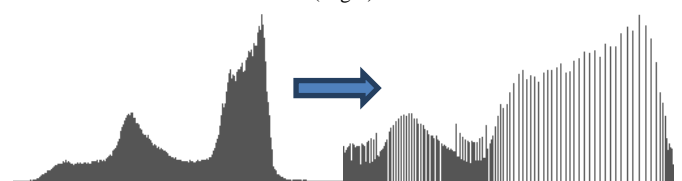


Figure 4. Original Histogram (Left) and Histogram after Equalization (Right)

It is plotting number of pixel against the grey level. The overall contrast of the image is made uniform there for enhancing the image. Then the image suitable for minutiae extraction.

C. Edge Detection

One of the best methods for Edge Detection is Prewitt Operator. In order to match the input image with already saved image the edges have to be detected. There are two types of masking:

- 1) *Horizontal Edges*
- 2) *Vertical Edges*

Edges are calculated by using difference between corresponding pixel intensities of an image. All the masks that are used for edge detection are also known as derivative masks. Because as we have stated many times before in this series of tutorials that image is also a signal so changes in a signal can only be calculated using differentiation.

D. Extraction of Miniature Points and Matching

[8] "Once the extraction of edges is done, the points are marked in it. The points detected are known as miniature points. These miniature points are extracted and compared with the stored images. In order to find the matching process, the correlation factor and the Euclidean distance has to be found out. Based on the tolerance value the matching results can be found out".

V. IMPLEMENTATION

A. Enrollment Process

The Enroll process seen in Figure 2 consist of obtaining a fingerprint scan 3time. An image is formed by merging these three images into one. [10]"Before the Enroll module, function is called it is necessary to obtain the occupied entries in the database by means of the getEnrollCountfunction.

[10] If getEnrollCount function would return an integer less than 200, then the checkEnrolled function is called changing the ID parameter until the function doesn't return an error. This error indicates that ID has already been assigned. Finally, the Enroll function with the ID entry number obtained and called".

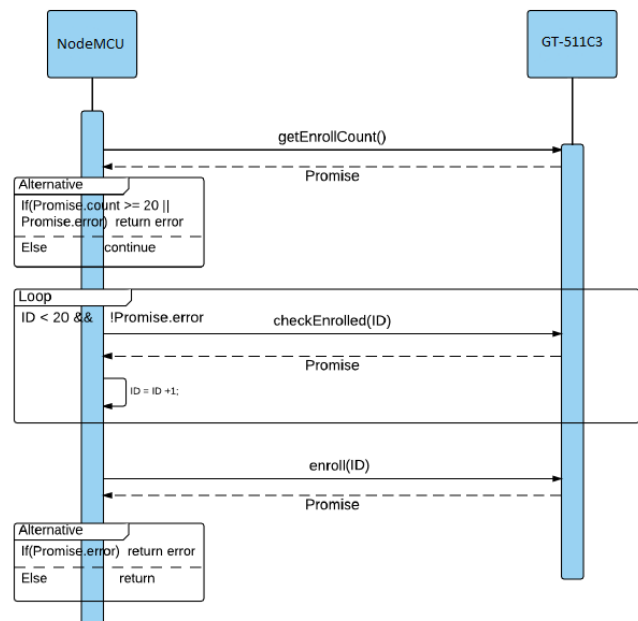


Figure 5. [10] Enroll Process

First the Enroll function of the GT-511C3 will switch on the LED and it waits for the finger to be placed for scanning. After a scan is made and stored in the memory. The LED would turn off and it then would turn back on, indicating that the device is ready to perform a scan. This process is repeated for three times then the scanner merges the 3 scans into one image.

B. Identification Process

The Identification process seen in Figure 3.

At first, the scanner will turn on the LED using the LedOFF function. Then it waits for the finger to be placed on the scanner. Once the scanner captures the fingerprint it compares the image to the images stored in the database using the SmackFinger 3.0 Algorithm. At last, the scanner will return an identification associated with the fingerprint. If the fingerprint is not in the database it would return an error meaning the Identification failure or the fingerprint is not registered in the scanner.

C. Deletion Process

The Deletion process can perform two function deleteID and deleteAll. The deleteID is executed when we want to delete a specific fingerprint. Another function is called when we want to delete all the fingerprint in the database.

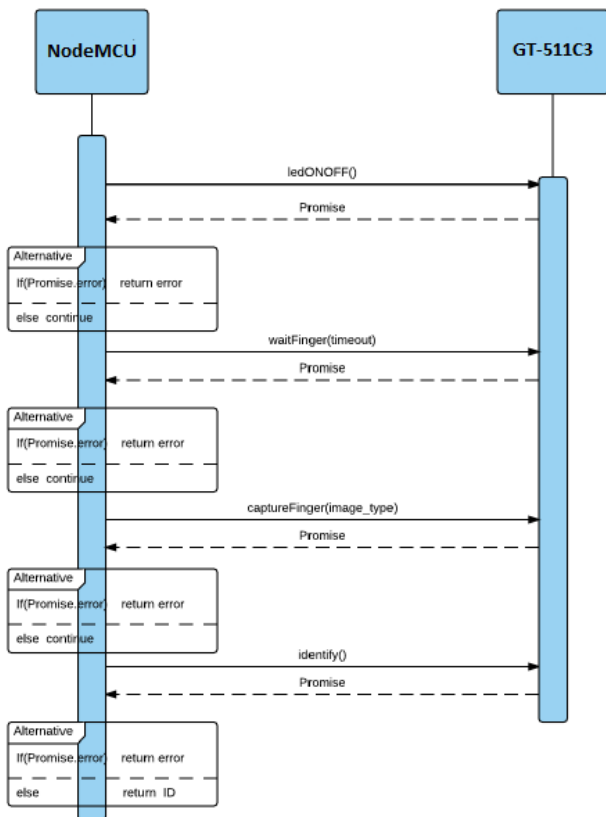


Figure 6. [10] Identify Process

VI. RESULTS AND SNAPSHOTS

The functionality of the project a fingerprint-based attendance management system with cloud access in order to mark and monitor attendance of every user.

The features of this system are:

- Flexible and Easy to use.
- Efficient & Effective way to record Attendance using Firebase Realtime Database.
- Processes the data in the attendance database to determine specific requirements such as percentage of attendance, number of hours and date worked.
- Real Time Android Application for user.
- Real Time Web Application for user.

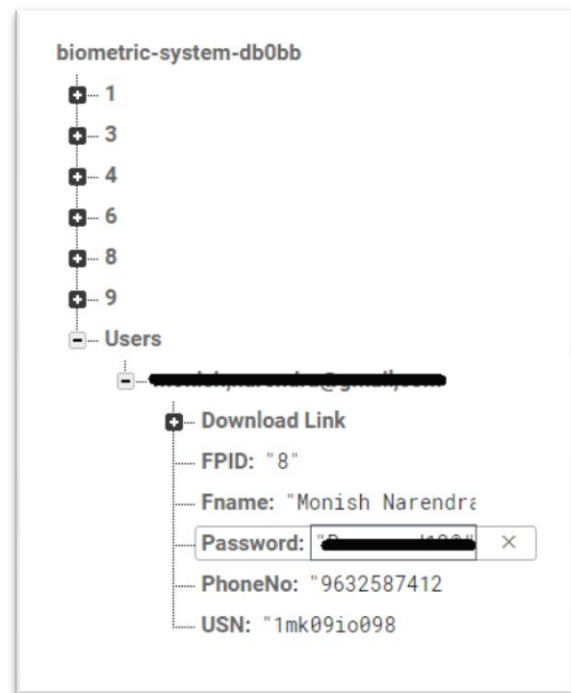


Figure 7. User information at Firebase RealTime Database

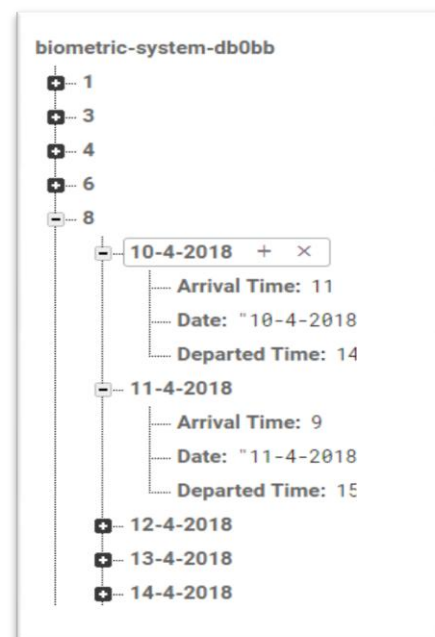


Figure 8. Arrival and Departed time in Firebase Database

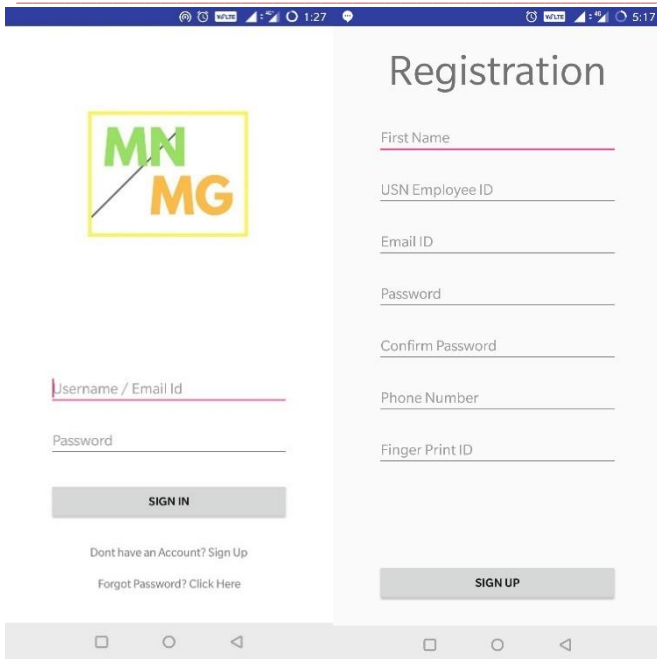


Figure 9. Left Screen Shots is the Login Activity of the Android App
Figure 10. Right Screen Shot is the Register Activity of the Android App

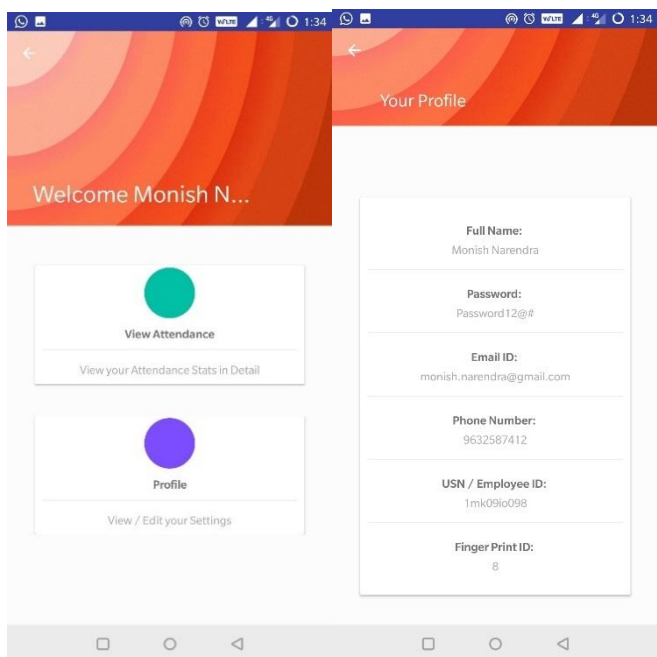


Figure 11. Left Screen Shots is the MainActivity of the Android App
Figure 12. Right Screen Shot is the ProfileActivity of the Android App

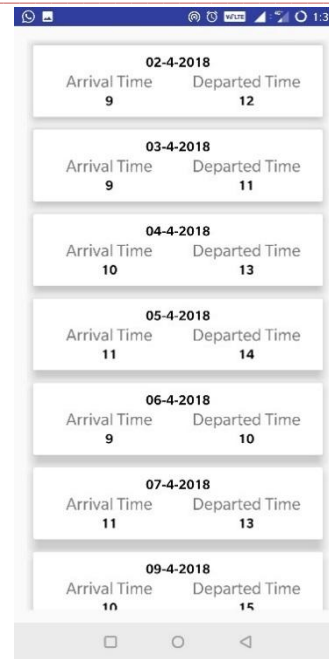


Figure 13. List of Days he / she has Attended (Date, Arrival Time and Departed Time) of the Android App

As soon as the user opens the Android Application he / she will be faced with the login page (fig. 9) where the user must enter their username and password. The credentials (username and password) are acquired through the registration page (fig. 10).

Once the user is logged in he / she will be directed to the main / home page (fig. 11) where they have two options “View Attendance” and “View Profile”. Profile page (fig. 12) will display entire details of the user. Attendance page (fig. 13) will have entire attendance stats of the user.

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CONCLUSION

In this paper, we have presented a fingerprint-based attendance management system. This system extracts the local characteristics of a fingerprint and stores it (Enrollment) which is later used for verification (Identification). Once the finger is placed on the scanner. The captured image is then compared against the templates already stored in the database and it

returns a unique id. After the identification is done the time and date is retrieved from RTC and uploaded to firebase real-time database.

The functionalities of the system can be further enhanced through the following recommendation:

1) *Portability:*

The module could be remotely connected to a PC wirelessly (Bluetooth, Wi-Fi, WLAN) so the administrator can have access to the attendance data without physically interfacing the Module with PC.

2) *SMS Feature:*

The Module can be interfaced with a GSM Module to send SMS to the Security Personnel anytime an unregistered finger tries to sign-in or out or to parent notifying him/her of his/her child's attendance records.

3) *Location Feature in App:*

The Android Application can be enhanced to detect the location of the user. So, the Admin can have general idea so as to where the person may be.

- [10] FingerScanner: Embedding a Fingerprint Scanner in a Raspberry Pi , Published on 6 February 2016, Retrieved from <https://www.mdpi.com/1424-8220/16/2/220/pdf>
- [11] Karthik Krishnamurthi, S.Irudaya Mary, B.N.Sumalatha, Adler Pereira, "Fingerprint Based Attendance System", IJARCCCE , Vol. 4, Issue 3, March 2015 , Retrieved from <https://ijarccce.com/upload/2015/march-15/IJARCCCE%20149.pdf>

REFERENCES

- [1] Abdellah Guebla, Abdallah Meraoumia, Hakim Bendjenna and Salim Chitroub, "Using of Finger-Knuckle-Print in Biometric Security Systems," IEEE Transl. J. Fez, Morocco, 30 March-1 April 2016
- [2] Yash Mittal, Aishwary Varshney, Prachi Aggarwal, Kapil Matani and V. K. Mittal, "Fingerprint Biometric based Access Control and Classroom Attendance Management System," IEEE Transl. New Delhi, India, 17-20 Dec. 2015
- [3] Tsai-Cheng Li, Huan-Wen Wu, Tiz-Shiang Wu, "The study of Biometrics Technology Applied in Attendance Management System," IEEE Transl. New Delhi, India, 31 July-2 Aug. 2012
- [4] L.S. Ezema, C.K.A. Joe-Uzuegbu, J. N. Eneh and I. Amanze, "Fingerprint Based Attendance Management System," International Journal of Scientific & Engineering Research, Volume 6, Issue 7, July-2015
- [5] M.L. Ali, M. Alam and M.A.N.R Rahaman, published in Electrical & Computer Engineering (ICECE), 2012 7th International Conference on, "RFID based e-monitoring system for municipal solid waste management".
- [6] Parvin Renold,R.Joshi Rani, published in Information & Communication Technologies (ICT), 2013 , "An internet based RFID library management system".
- [7] Adebisi O.A, Oladosu D.A, Busari O.A and Oyewola Y.V, published in International Journal of Engineering and Innovative Technology (IJEIT), 2015, "Design and Implementation of Hospital Management System".
- [8] L. Zhang, "Finger-knuckle-print: A new biometric identifier", International Conference on Image Processing (ICIP), pp. 1981-1984, 2009
- [9] Extremely Accurate I2C-Integrated RTC/TCXO/Crystal (2006) Retrieved from <https://web.wpi.edu/Pubs/E-project/Available/E-project-010908-124414/unrestricted/DS3231-DS3231S.pdf>