

## Design & Development of Smart Attendance Logger System

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**Abstract:** Attendance management system in form of the attendance logging is one of the important requirements in any academic organization. The traditional attendance management system in which mentor has to take attendance manually and keep the record for the same manually. Some of the traditional attendance management system is based on the RFID, in which RFID tag is required which is not cost effective. The proposed system is smart attendance logging system in which system can mark the presence and absence of the person and keep the record for the same. The suggested system is also consist of real time clock device which also update the time in form of day, month, year and hour, minute and second. The system can also keep the record of the attendance as a backup of about one month. The system can store the presence of about more than one twenty users. The suggested system is handheld device which is portable with battery backup feature, so it will not consume much time to take attendance one by one. The whole system is design on the arduino platform along with fingerprint sensor, real time clock device, LCD and external memory as EEPROM. The system is compatible with the Microsoft Excel for logging the record of presence.

**Keywords:** Attendance Logger, PLX-DAQ, Fingerprint Sensor, Real Time Clock

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### 1. Introduction

Traditional attendance system is the system in which the person submitting their attendance either manually or in form signature on paper. This type of system is excessive time consuming and there are the chances of human mistakes and malfunctioning. In such type of system person needs maintain the attendance in form of the soft copy from the hard copy. After preparing the soft copy, it requires to analyse the same for preparing attendance report. This task is very tedious and it requires so much accuracy. Biometric attendance method has many advantages over traditional time tracking system used in real time. Biometric system is very user friendly as person has to scan either his/her finger, face or eyes and system will extract all the details of specific person. In this manner biometric system is saves lots of time and save the records very accurately. It also provides better security.



Figure1. Biometric System

An attendance management system is one of the important systems of any academic organization as well as other corporate organization. An attendance management system must take the presence of the person and keep record of the attendance for the future purpose. Any smart attendance management system must be low power handheld device associated with large memory. The suggested system is smart attendance logging system which can record the presence 120 users over about one month of time duration. The suggested system consists of fingerprint sensor module, RTC module, LCD and external memory as EEPROM. The whole system is designed on the arduino platform. The designed system is bifurcated in two separate processes. One is enrolment and another is verification. The first phase of the system is consider as enrolment phase in which user need to enrol himself by registered his/her identity by giving the fingerprint image through fingerprint module. In the second phase – verification phase, user’s identity is matched with the registered fingerprint image and ultimately user’s presence will be marked. In parallel with the verification phase, user’s presence will record in the EEPROM module by capturing the accurate current time and date. The recorded data can be extracting from the EEPROM and can be recorded in Excel file. Arduino C language is taken as the programming language and PLX-DAQ software is used to capture record of the presence in the Excel file. The suggested system is reliable as compared to other traditional systems as it is designed on the low power platform and it’s a portable handheld device with large memory.

The Paper is starting with the Introduction of the system, then description of the Existing system, then Objective of the system, then Literature Reviewed for designing the proposed system, then Proposed Block Diagram of the suggested system is described, then Software Environment used for doing programming of the suggested system is described. After that Experimental Setup is demonstrated of the suggested system, then Test results & Discussion is demonstrated. Paper is concluded with the Conclusion & References.

## 2. Existing Systems

Motivation for designing such a system comes from the some of the existing systems.

### 2.1 Manual Attendance Management System

Manual attendance management system is attendance system where a person has to take attendance by person’s ID and keep manual record of the same. This process is time consuming process. A manual attendance management system is shown in Fig. 2.



Figure.2 Manual Attendance Management System

### 2.2 RFID Based Attendance Management System

RFID based attendance system requires RFID tag as well as RFID reader to communicate with each other. The existing system is not up to the mark as it requires RFID tag and reader. It works in limited range. It cannot keep the record for long time [1]. RFID Based Attendance Management System is shown in Fig 3.



Figure.3 RFID Based Attendance Management System

### 2.3 GSM Based Attendance Management System

GSM based attendance system consist of smart card, smart card readers and SIM card. Person's attendance can be marked using smart card and smart card reader. It will process on to the server and using SIM card SMS will be sent to the parents and administrator. This system is not cost effective as it requires message based resources. Attendance record process will be complex in this system [2].GSM Based Attendance Management System is shown in Fig 4.



Figure.4 GSM Based Attendance Management System

### 3. Objective

To overcome the lacking point of existing system, the objective of the suggested system is to Design and Develop smart Attendance Logger system which consist of Fingerprint module and extra memory to keep the record of daily attendance for long the long period.

### 4. Literature Review

To design smart attendance logger system the following things are essential requirement.

- 4.1 Fingerprint Module
- 4.2 Arduino UNO board & Arduino C
- 4.3 Real Time Clock (RTC)
- 4.4 External EEPROM
- 4.5 PLX-DAQ Software
- 4.6 Liquid Crystal Display (LCD) – 16 \* 2

#### 4.1 Fingerprint Module

As shown in Fig 5, R305 is used as the Fingerprint Module or Fingerprint sensor. Using this fingerprint module user can store finger print data and can configure it in 1:1 or 1:N mode for identifying the person. The module can interface with any microcontroller using 3V3 or 5V [3].



Figure.5 Fingerprint Module R305

#### 4.2 Arduino UNO Board & Arduino C

The Arduino UNO board is shown in Fig 6. The Arduino UNO board is ATmega328 based microcontroller which is working on 16MHz frequency. The board consists of inbuilt ADC and USB connection port [4].

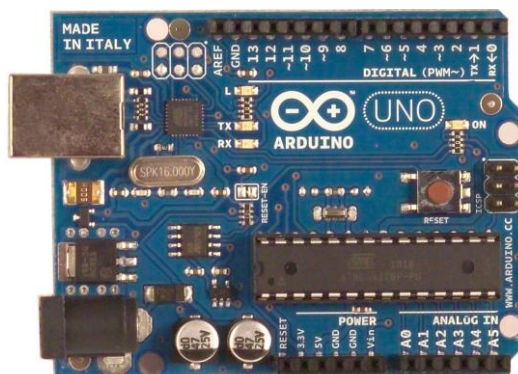


Figure.6 The Arduino UNO board

The Technical Specification of Arduino UNO board is as follows [4]:

- Microcontroller ATmega328
- Operating Voltage 5V
- Input Voltage (recommended) 7-12V
- Input Voltage (limits) 6-20V
- Digital I/O Pins 14
- Analog Input Pins 6
- DC Current per I/O Pin 40 mA
- DC Current for 3.3V Pin 50 mA
- Flash Memory 32 KB
- SRAM 2 KB
- EEPROM 1 KB
- Clock Speed 16 MHz

Arduino C is the derived programming language from C/C++ which contains in built hardware based libraries.

#### 4.3 Real Time Clock (RTC)

DS1307 is serial real time clock based on I2C protocol which provides clock information in form of day, month, year, hour, minute, second in 12 hour & 24 hour mode. The technical specification of DS1307 is as given below [5].

- Real-Time Clock (RTC) Counts Seconds, Minutes, Hours, Date of the Month, Month, Day of the week, and Year with Leap-Year Compensation Valid Up to 2100
- 56-Byte, Battery-Backed, Non-volatile (NV) RAM for Data Storage
- I2C Serial Interface
- Programmable Square-Wave Output Signal
- Automatic Power-Fail Detect and Switch Circuitry
- Consumes Less than 500nA in Battery-Backup Mode with Oscillator Running
- Optional Industrial Temperature Range: -40°C to +85°C

#### 4.4 External EEPROM

The internal user memory of Arduino UNO board is 1KB which is not sufficient to store all 120 person's presence as about one month record. So external EEPROM is required to interface with Arduino UNO board. IC 24LC1025 is used as External EEPROM to store large amount of data. The technical specification of 24LC1025 is as given below [6].

- Low-power CMOS technology:
- Maximum write current 5 mA
- Maximum read current 500  $\mu$ A
- 2-wire serial interface bus, I2C compatible
- Cascadable for up to four devices
- Self-timed erase/write cycle
- 128-byte Page Write mode available
- 5 ms max. write cycle time
- Temperature ranges: - Industrial (I): -40°C to +85°C

#### 4.5 PLX-DAQ Software

In the proposed system the person's presence can be extracted using the mechanism "Download button". By pressing the download button system will work in the extract mode and can record the presence in the Excel file in form of the RTC data. Interfacing the Arduino to Excel can be done easily using a Parallax Data Acquisition tool (PLX-DAQ). To interface the Arduino to Excel, the Arduino would first have to be programmed with the Arduino software (IDE). Once the Arduino code is uploaded into the Arduino, click on the PLX-DAQ spreadsheet icon. Choose the port the Arduino is connected to, check the Download Data box, and then click Connect.

#### 4.7 Liquid Crystal Display (LCD) – 16 \* 2

In the proposed system, 16 \* 2 size Liquid Crystal Display (LCD) is used for displaying validation messages. The pin-out diagram of 16 \* 2 sizes LCD is shown in Fig 7.

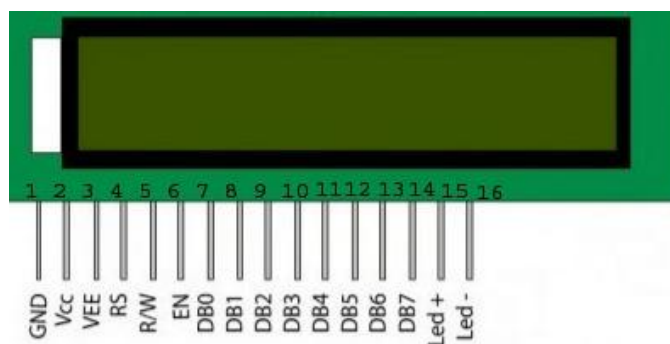


Figure.7 The 16 \* 2 LCD Pin-out Diagram

## 1. Proposed Block Diagram

The Proposed block diagram of the suggested system is shown in Fig 8, which contains Arduino UNO board as a main system core, Fingerprint Module, RTC Module, Push button Module for specific actions, LCD for printing validation message and PX-DAQ block for extracting log of attendance.

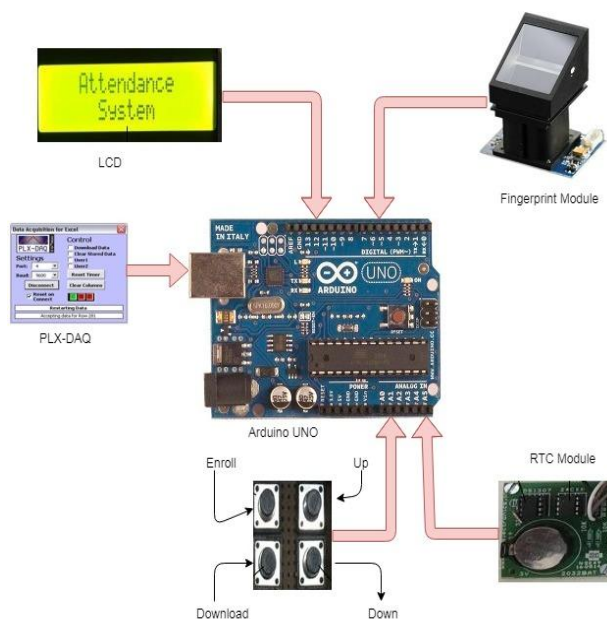


Figure.8 Proposed Block Diagram

The whole system will work in two different phases. One is Enrolment phase and another one is Verification phase. The process flow of the system is follows:

### 5.1 Enrollment Phase

- User must login to Enrolment phase by pressing the 'Enrol' button.
- After login to Enrolment phase, user must keep the finger on fingerprint module for scanning the finger as person's identity. For the surety purpose this process will repeat for two times.
- If more than one person wants to enrol then 'Up' and 'Down' button is used to increment and decrement the user ID.
- After completing the enrolment process, user need to come out from the Enrolment phase by pressing the 'Download' button which is working as 'Enter' button also.

### 5.2 Verification Phase

- After completing the registration process, Verification phase will be start.
- For verification phase, registered user need to keep the finger on fingerprint module.
- After scanning the finger, user's attendance will be recorded in form of user ID and RTC data as day, month, year, hour, minute & second in the inbuilt memory of Arduino as well as in External EEPROM.
- If user wants to extract the log of the attendance, then he/she must press the 'Download' button. Data will be recorded in form of the log in Excel file. For the whole process PLX-DAQ software must be running as backend process.
- After completing the Verification process, user need to come out from the Verification phase by pressing the 'Download' button which is working as 'Enter' button.

## 2. Software Environment

The whole software environment is created using Arduino C language. The details software flow diagram for Verification Phase is shown in Fig 9. The detail Software Flow Diagram of Enrolment Phase is as shown in Fig 10.

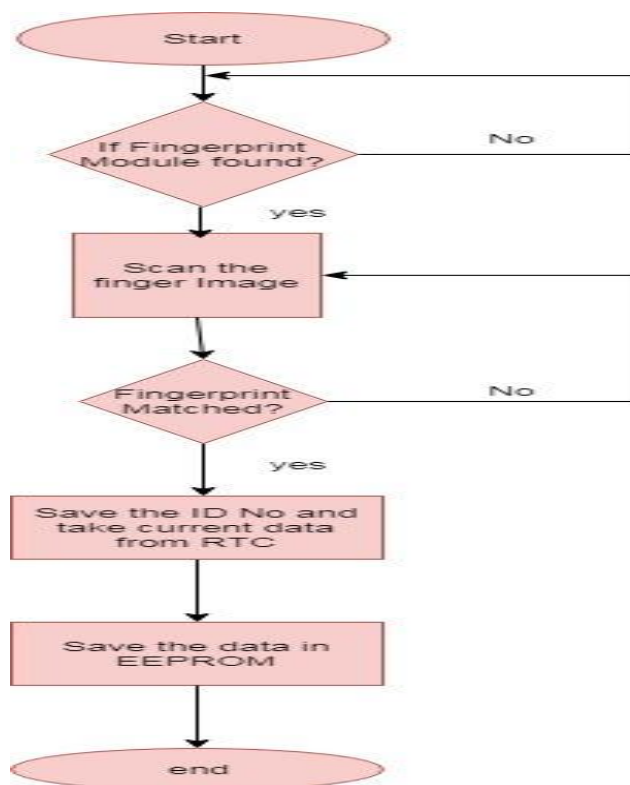


Figure.9 Software Flow Diagram – Verification Phase

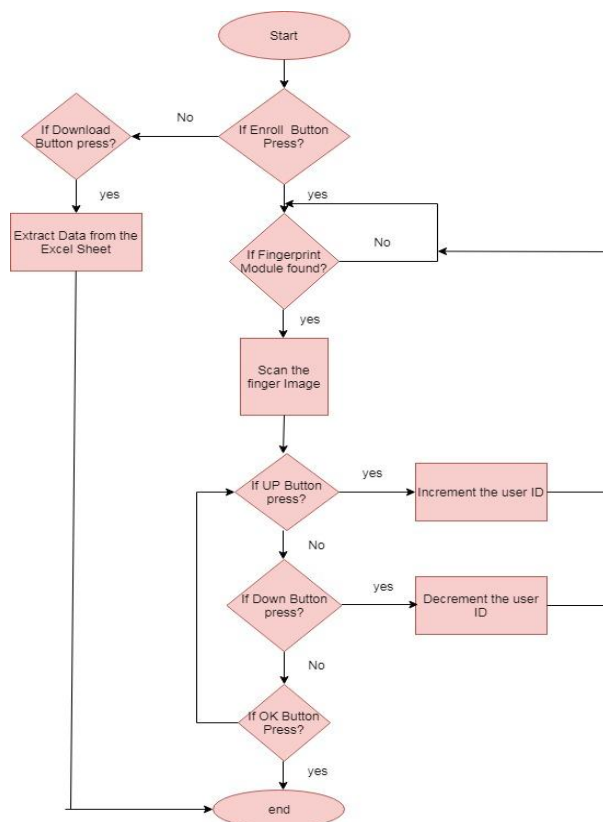


Figure.10 Software Flow Diagram – Enrolment Phase

### 3. Experimental Setup

As the suggested system is a portable handheld device, the Experimental setup is described in two separated view as follows:

#### 7.1 Front End view of the Experimental Setup

Front End view of the Experimental Setup is shown in Fig 11. It Contains Fingerprint sensor module, 16 \* 2 LCD for displaying validation messages, button modules for user ID increment as 'Up', user ID decrement as 'Down', user enrolling process as 'Enrol' and extract the person's presence as log file as 'Download'.

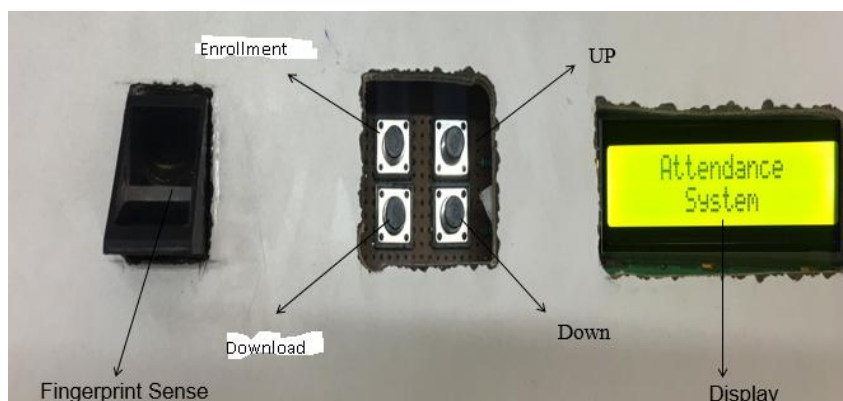


Figure.11 Front End View of the Experimental Setup

#### 7.2 Back End view of Experimental Setup

Back End view of Experimental Setup is shown in Fig 12. It Contains Arduino Board as main processing core, RTC (DS1307) module along with External EEPROM (24LC1025) for getting accurate details of time and date and storing the person's presence respectively and button module (as discussed in Front End view of experimental setup).

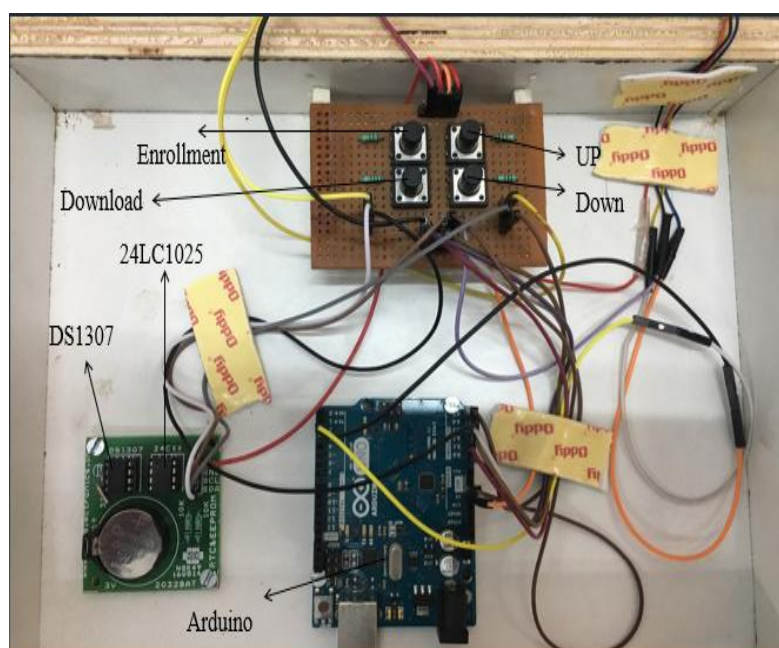


Figure.12 Back End view of Experimental Setup



#### 4. Test Results & Discussion

Test results of the proposed system are discussed in this section. Test results are bifurcated in two separated phases. One is Enrolment phase and another one is Verification phase.

##### 8.1 Test Results of Enrollment Phase

Test Results of Enrolment Phase is described in Fig 13 to Fig 19 which includes System Validation message (Fig 13), message for fingerprint module found successfully (Fig 14), RTC result which shows accurate details of date and time continuously (Fig 15), User Enrolment Process (Fig 16 & Fig 17), User ID enrolment process using User ID Incrementing and User ID Decrementing (Fig 18) and User Enrolment Process done Successfully (Fig 19).

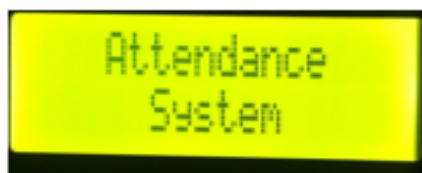


Figure.13 System Validation Message



Figure.14 Message as Fingerprint Module found

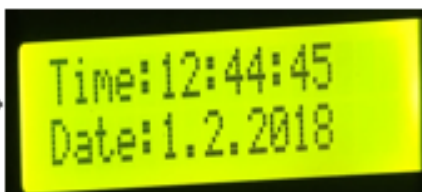


Figure.15 Accurate Date & Time from RTC



Figure.16 Enrolment Process 1 for Scanning Finger

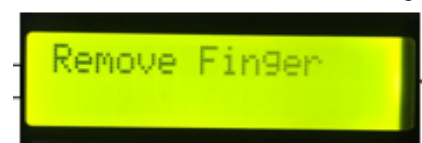


Figure.17 Enrolment Process 2 for Scanning Finger



Figure.18 User ID Enrolment Process

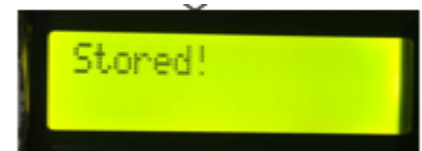


Figure.19 User Enrolment Process done successfully

## 8.2 Test Results of Verification Phase

Test Results of Verification Phase is described in Fig 20 to Fig 24 which includes System Validation message (Fig 20), message for fingerprint module found successfully (Fig 21), RTC result which shows accurate details of date and time continuously (Fig 22), Presence recorded successfully along with registered ID no. (Fig 23) and Log file of attendance sheet which is generated by PLX-DAQ software when 'Download' button pressed (Fig 24).

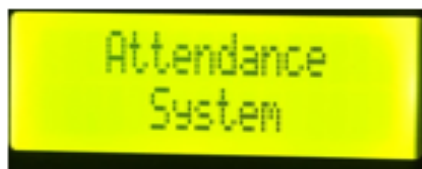


Figure.20 System Validation Message



Figure.21 Message as Fingerprint Module found

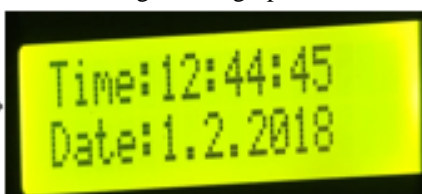


Figure.22 Accurate Date & Time from RTC



Figure.23 User's Presence recorded successfully

sr no	21-02-2018	21-02-2018	21-02-2018	21-02-2018	21-02-2018	21-02-2018	21-02-2018	21-02-2018	21-02-2018	21-02-2018
16EC01	A	A	A	A	A	A	A	A	A	A
16EC02	P	A	A	A	A	A	A	A	A	A
16EC03	P	P	P	A	A	A	A	A	A	A
16EC04	A	P	P	A	A	A	A	A	A	A
16EC05	P	P	P	A	A	A	A	A	A	A
16EC06	A	A	A	A	A	A	A	A	A	A
16EC07	P	P	P	A	A	A	A	A	A	A
16EC08	P	A	A	A	A	A	A	A	A	A
16EC09	A	A	P	A	A	A	A	A	A	A
16EC10	P	P	P	A	A	A	A	A	A	A
16EC11	A	P	P	A	A	A	A	A	A	A
16EC12	P	P	P	A	A	A	A	A	A	A
16EC13	P	P	P	A	A	A	A	A	A	A
16EC14	A	A	A	A	A	A	A	A	A	A
16EC15	A	A	A	A	A	A	A	A	A	A
16EC16	P	P	A	A	A	A	A	A	A	A
16EC17	A	P	A	A	A	A	A	A	A	A
16EC18	A	A	A	A	A	A	A	A	A	A
16EC19	A	A	A	A	A	A	A	A	A	A
16EC20	P	P	P	A	A	A	A	A	A	A
16EC21	A	P	P	A	A	A	A	A	A	A
16EC22	P	P	P	A	A	A	A	A	A	A
16EC23	A	P	P	A	A	A	A	A	A	A
16EC24	A	P	P	A	A	A	A	A	A	A
16EC25	A	P	P	A	A	A	A	A	A	A
16EC26	P	A	A	A	A	A	A	A	A	A
16EC27	A	P	P	A	A	A	A	A	A	A
16EC28	P	A	P	A	A	A	A	A	A	A

Figure.24 Attendance Log File recorded in Excel Sheet

## 5. Conclusion

Smart attendance logger system as portable handheld device is presented here. The suggested system is better than other traditional system as it is designed on low power platform along with large memory is used to store user's presence. The suggested system is handheld device which is portable with battery backup feature, so it will not consume much time to take attendance one by one. User can extract the log file of attendance sheet which can store the attendance of almost One hundred twenty users as back up of about One month. The proposed system is consist of Real Time Clock (RTC) which updates the time in form of day, month, year and hour, minute and second when person scan his finger for attendance. The accurate time at which user scan his finger and individual user ID directly captured by the PLX-DAQ software to generate the log file as attendance sheet. System can be enhanced on the IoT platform as attendance log can be extract directly on the webpage.

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