# IoT Based Automatic Student Attendance Monitoring System

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*Abstract*— Today, students (class) attendance is become more important part for any organizations/institutions. Recording and monitoring of class attendance is an area of administration that requires significant amounts of time and effort in a school/university environment. To solve this problem we are using RFID technology. RFID technology is a powerful tool to manage student's attendance throughout the working school day and it will also enhance classroom security. RFID is a technology that allows for a tag affixed on identity card of student to communicate wirelessly with a reader. Reader will read the tag number and send to raspberry pi. Program running in raspberry pi will mark the corresponding student to present. At the end, SMS notification is send to all students' parents those who are absent.

*Keywords*—Student, Internet of Things (IoT), Radio Frequency Identification (RFID), Attendance, Raspberry Pi, SMS Gateway, Arduino Uno.

## I. INTRODUCTION

Internet of Things (IoT) enables us to develop a system without human interference. In other words IoT is an environment that has the ability to transfer data over a network without human to human or human to computer interaction. The IoT allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for direct integration between the physical world and computer based system and it provides more efficiency, accuracy as well as economic benefits. IoT is used in all most all areas such as agriculture, industry, business, transportation [11], environmental parameter monitoring [10] and also used in medical field to detect diseases like glaucoma [12,13,14] and monitoring health parameters of the patient [15].

Attendance plays a major role in educational institutions for students and industries for employees. The most common way of taking attendance in the classroom is by calling out the roll numbers of students. Problem with existing attendance system is that wrong attendance can be entered. The process of manually attendance taking is time consuming. Another drawback is maintaining the attendance records become cumbersome.

To avoid all such problems, A RFID based IoT System is implemented. It is an automated attendance system works on RFID cards. Initially an RFID card is given to each user, student or employee and RFID reader is placed on the door of the classroom or school or company. Whenever student or employee wants to enter room he/she has to show the RFID card to the reader. The RFID reader will read the RFID card number and the time at which the employees / student has logged in and mark their attendance to present.

Rest of the paper is organized as follows, Section I contains the introduction to internet of things, Section II contain the related work of Automatic Student Attendance Monitoring System, Section III explain the methodology with flow charts and algorithms, Section IV describes results and discussion of proposed system, Section V concludes proposed work with future directions

## II. RELATED WORK

A number of related works exist in literature, specifically to the area of attendance monitoring problem. The following paragraphs describe the related work proposed by the various authors.

Authors [1] proposed an idea of integrating the ubiquitous computing systems into classroom for managing the student's attendance using RFID technology. In this work, RFID technology manages student's attendance throughout the working school day. A real time intelligent system is developed in addition with RFID hardware to record

student's attendance at class rooms and laboratories in a school/university environment.

Authors [2] proposed an idea of Face recognition based Attendance Monitoring and Management System. The Raspberry pi module is used for face disclosure and affirmation. The camera is connected to the Raspberry pi module for face capturing. The understudy database is assembled. The database consolidates name of the understudies and there pictures. This raspberry pi module will be presented at the front side of class to take the attendance. Camera will capture the face of each student and this picture is compared with database set. If matches occurred then corresponding student attendance is marked. Latter, the list of attendance will be displayed in the webpage through IOT (Ethernet, Wi-Fi).

Authors [3] proposed an idea of "Fully Automated Attendance Record System using Template Matching Technique". In this work, authors designed a system that will automatically arrange the record and calculate the average attendance of each student. Main objective of this Attendance Record System is to replace the manual model of attendance record keeping. The proposed work describes an efficient image processing algorithm that reads the scanned hard copy accurately and further calculates the absence or presence accordingly.

Authors [4] proposed a system which takes attendance electronically with the help of a fingerprint sensor. This system will capture the fingerprint of each student and all captured records are saved on a computer server. Fingerprint sensors and LCD screens are placed at the main entrance of each class room. Here, student has to place finger on the fingerprint sensor. Captured finger print compared with already stored data set. If a match found then student attendance is updated in the database and he/she attendance is notified through LCD screen.

Authors [5] introduced a new approach for automatic attendance management system with computer vision algorithms. The proposed system works on real time face detection algorithms. They are integrated on existing Learning Management System (LMS). Proposed system will automatically detect and update the student's attendance.

Authors [6] developed an RFID technology for student's attendance system. Radio Frequency Identification is a wireless objects identification technique. This technique is very popular technique and is used for the identification of physical objects. This technique works on radio frequencies and it is much more advantageous, safe, secure and easy with lower overhead compared to other conventional technique.

Authors [7] described a method for Student's Attendance System. This system works on face recognition technology

using Principal Component Analysis (PCA) algorithm. The proposed system will record the attendance of the students in class room environment automatically and update the database accordingly. This system also allows the facilities to access the information of the students.

Authors [8] proposed an idea of fingerprint recognition for Student's Attendance System. Fingerprint recognition technique is one of the most reliable personal identification methods in biometrics. In this paper, a wireless fingerprint based attendance monitoring system is designed and implemented. This system based on biometrics and wireless technique to take the attendance of students.

Authors [9] developed a technique for staff attendance, E-Attendance System (EAS) works on existing technology by using smartphone. This system is capable to record the attendance of staff using their smartphone device with Bluetooth feature. But authors not explained anything about student's attendance.

## III. METHODOLOGY

Objective of the proposed work with RFID technology is to take the attendance of student's automatically and sends the absent information to student parents. Figure 1 shows the system architecture of proposed method. The components used and working procedure are explained in the following sections.
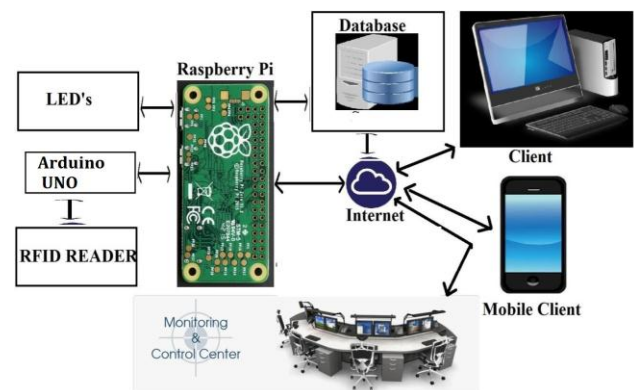


Figure 1.   System Architecture

### A. Raspberry Pi

Raspberry Pi is a credit card-sized low cast computer. This device is a perfect tool for scientists to develop applications in several fields. Following are the various components on the Raspberry Pi board:

**ARM CPU/GPU:** This is a Broadcom BCM2835 System on a Chip (SoC). This system is made up of an ARM central processing unit (CPU) and a Videocore 4 graphics processing unit (GPU). The central processing unit (CPU)

handles all the computations including execution of programs. This makes a device to work efficiently and the GPU handles graphics outputs.

**GPIO:** These are exposed general-purpose input/output connection points.

**USB:** This is a common connection port for peripheral devices such as mouse and keyboard. In this work, Model 3 is used. It has 4 USB ports. Mouse, keyboard and Arduino USB cable are connected to 3 of 4 USB ports.

**HDMI:** This connector allows us to connect pi to a high-definition television or other compatible device using an HDMI cable.
In this work, the LCD monitor is connected to HDMI Port. This LCD monitor is helpful during programing and execution time to view the programs, edit the programs, set up the project and check the output of the programs.

**Power:** Model 3 works on 5v Power supply. Model 3 include the Power Port of 5v Micro USB power connector into which we can plug compatible power supply.

**SD card slot:** This is a full-sized SD card slot in to which SD card is mounted. An SD card with an operating system (OS) installed is required for booting the device is mounted on this slot. In this work, Raspbian Jessie operating system is downloaded in to 32GB SD card and mounted on the SD Card slot. Later, this operating system is updated and upgraded to take the additional and missing features in the basic OS version.

**Ethernet/Wi-Fi:** Model 3 supports both Ethernet and Wi-Fi features. In this work, Wi-Fi is used for data transmission and reception.

### B.  Arduino UNO

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins, 6 analog inputs, a USB connection, a power jack, an ICSP header and a reset button. In this work, RFID-RC522 is connected to Arduino UNO board because RFID-RC522 is currently not working on Raspbian Jessie operating system. So, RFID-RC522 is connected to Arduino board then Arduino board is connected to raspberry pi device through Ardunio USB cable. This RFID-RC522 Reader continuously read the data and it will send the data to Arduino board. Later, Arduino will send the data to raspberry pi through Ardunio USB cable. At the end, raspberry pi process the data and perform the attendance marking operation.

### C.  RFID Reader

RFID is a radio frequency technology that is used to collect information automatically by radio frequency data communication between a mobile object and an RFID reader,

to identify, categorize and track object. They are called tag and reader respectively. To retrieve the data stored on an RFID tag, need a reader. A typical reader is a device that emits radio waves and receives signals back from the tag. RFID reader is used to read information on a tag and passing that information to a system for storage and processing.

### D.  Database

A database is a collection of information that is organized so that it can be easily accessed, managed and updated. In this work, we are using phpMyAdmin and MySQL database for storing and managing student's attendance information.

### E.  LED's

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p–n junction diode, which emits light when it is activated.

### F.  Monitoring and Control Center

A Controlling centre is a central location from which network administrators manage, control and monitor one or more networks. The overall function is to maintain optimal network operations across a variety of platforms, mediums and communication channels. In this work the values from RFID reader is processed using Raspberry Pi 3 then these values are send to controlling centre through Local Area Network (LAN).The values are displayed in LCD screen which is present in controlling centre.

### G.  Client System

These are the devices, through which users can access the information.

**Algorithm for Morning Attendance:**
**Step 1:** Start
**Step 2:** Read server time T= Read_System_Time( )
**Step 3:** if T=07:00:00 AM then create attribute morning with date and automatically set all cell values to 'a' {absent} for all students
**Step 4:** Until T=10:00:00 AM read the RFID Tag Number (when student swipe the card) and set the corresponding student entry in the database to 'p' {present}
**Step 5:** End
In this work, same algorithm is used to take afternoon attendance of the students but with different time set up.
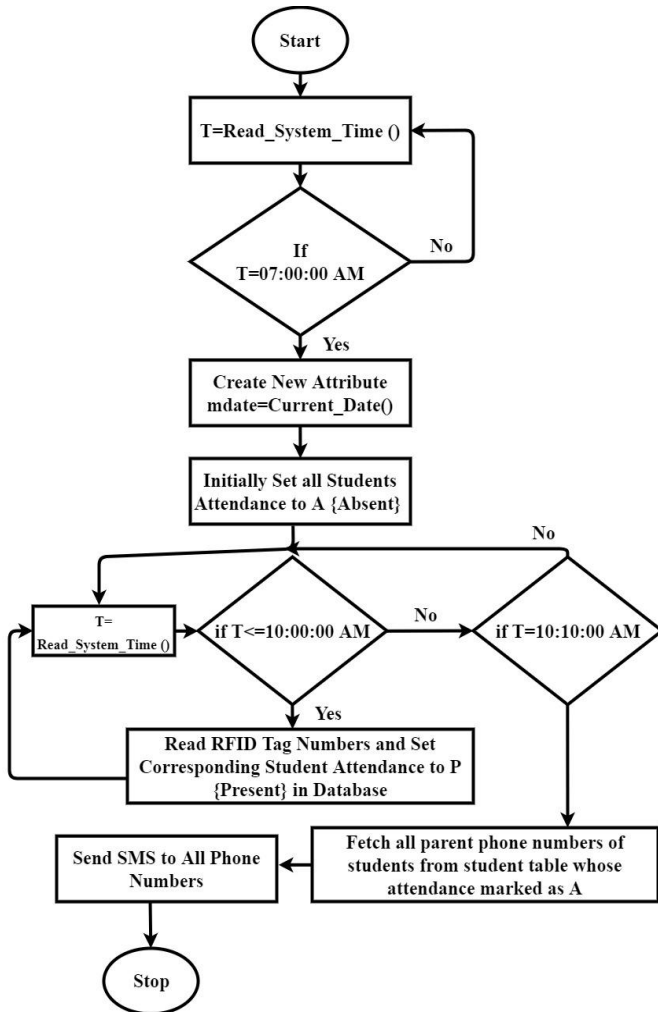
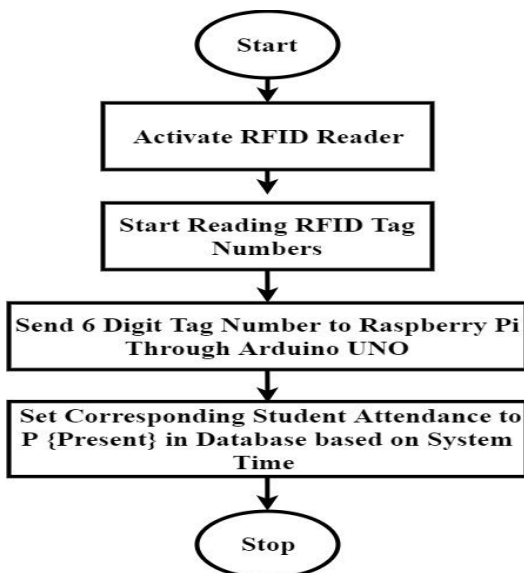Figure 2. Flow Chart for Attendance Marking and SMS Notification
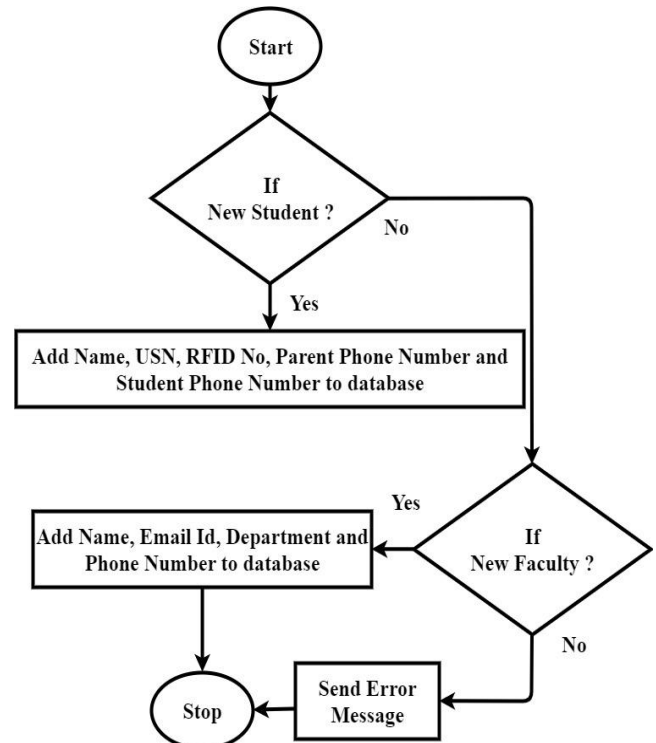


Figure 4. Flow Chart for Student and Faculty Registration
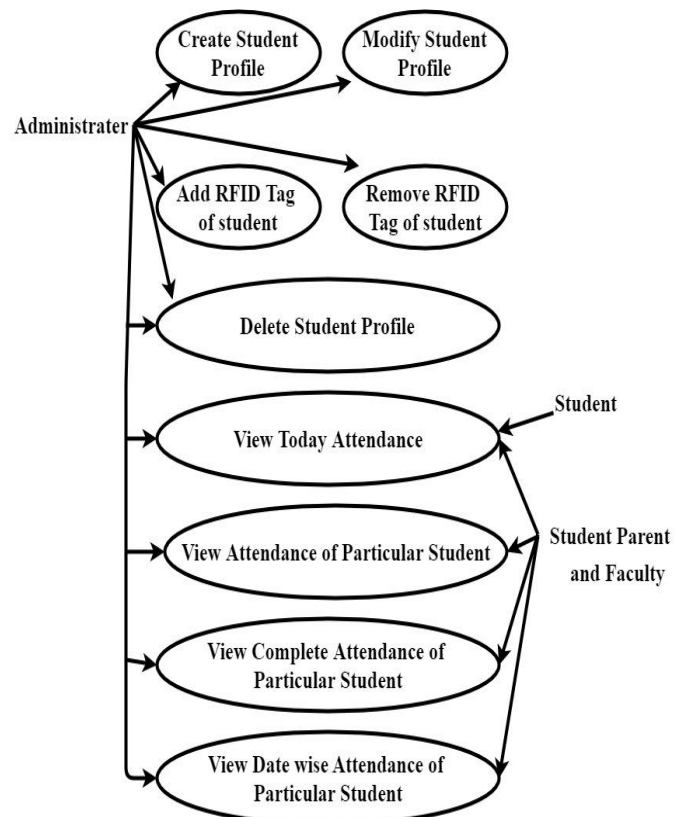


Figure 3. Flow Chart for Reading RFID Tag Numbers



Figure 5. Use Case Diagram

**Algorithm for Sending SMS:**
**Step 1:** Start
**Step 2:** Read server time T= Read_System_Time( )
**Step 3:** if T=10:10:00 AM then retrieve all parent phone numbers of students from student table whose attendance marked as 'a'
**Step 4:** send the notification message to all selected parent phone numbers
**Step 5:** stop

## IV.    RESULTS AND DISCUSSION

This section describes the results obtained from the proposed work. This work is implemented by using apache2, php5, MySQl, phpmyadmin, Arduino IDE software's.    This technique is faster compared to other techniques and it has two components i.e. RFID tag and RFID reader to record attendance of every student. In this paper we have proposed IOT based attendance management system, which updates the student's attendance in cloud spread sheets, which could be accessed from anywhere and this system also send absent notification SMS to the respective parent's mobiles.
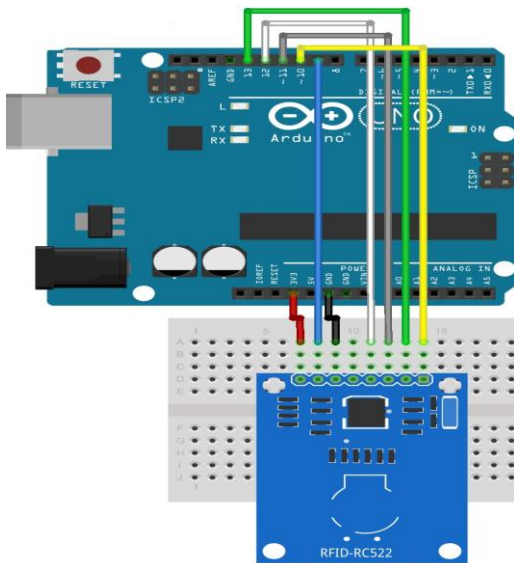


Figure 6.    RFID-RC522 Connection to Arduino UNO

RFID-RC522 is connected to Arduino UNO as shown in the Figure 6. RFID-RC522 is an eight pins device and it is directly connected to Arduino UNO. The pin configuration for RFID-RC522 and Arduino UNO connection is shown in table 1. Totally 7 pins are connected to Arduino UNO, IRQ pin of RFID-RC522 is not used in this proposed technique.

Table 1. Connection of MFRC522 Pins to Arduino

| RFID-RC522 | Arduino |
|---|---|
| 3.3V | 3.3V |
| RES | D9 |
| GND | GND |
| MISO | D12 |
| MOSI | D11 |
| SCK | D13 |
| SDA (SS) | D10 |
| IRQ | Not used |

Connection of Arduino UNO and Raspberry Pi is as shown in the Figure 7. The Arduino UNO and Raspberry Pi are connected by using USB cable. Later, Raspberry Pi device is connected to monitoring and control center system through internet. Initially for every student, RFID tag is given. So every time a student uses RFID card, MFRC522 will read the serial number associated with the tag/card and it will send the serial number to Raspberry Pi. Later, program running on the Raspberry Pi will mark the particular student attendance into the database with the time stamp. The use of camera is necessary to take a picture of the student using the card. This will reduces proxy attendance attempts. The attendance data in the database is used to create many types of reports like specific day attendance, current day attendance, monthly attendance, weekly attendance, complete attendance and real time notification to parents.

The RFID Reader is activated and read the serial number associated with RFID tag when students placed the RFID tag near the radio frequency (RF) field, which is generated by the antenna embedded within the RFID Reader. Later, Arduino will send the serial number to raspberry pi. The python program running on raspberry pi checks whether the tag is valid or not by comparing the serial number obtained from Arduino with serial numbers of students present in database table. If the tag is valid, it will immediately mark the student attendance to present for the course and green LED will glow for few seconds indicates that student attendance is marked. If the tag is invalid, red LED will glow for few seconds that indicates that tag has not been registered to any student or it may be broken. If the tag is invalid, students' needs to contact administrator for clarification or requesting new tag.
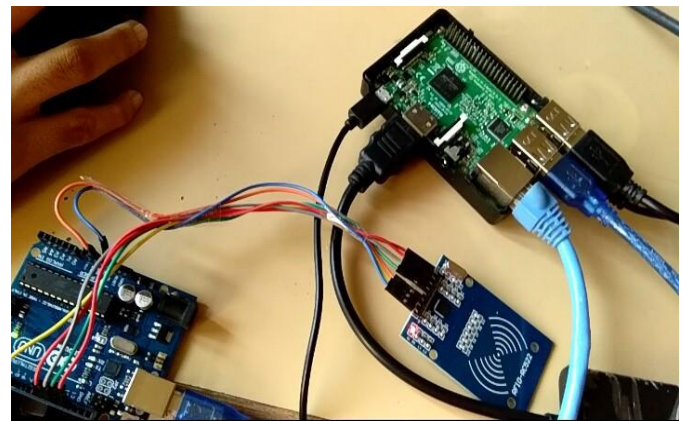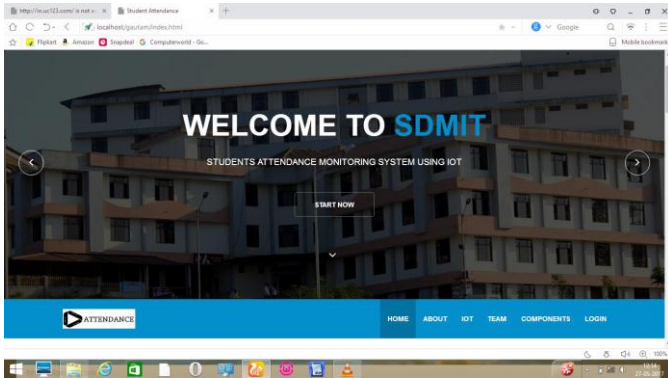


Figure 7.    Developed System

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Figure 8.   Home Page



Figure 10.  Login Page

Figure 8 shows the home page and Figure 9 shows the Registration page. Parents, faculty or who want to monitor the attendance of the student has to register first to this system by providing name, email id, phone number and department (for faculty, optional field). To maintain the security of institution, password providing authority is given to administrator. Administrator will verify the registered users through telephone and provide the unique password for authorized users.

Once user got password from the admin, they can log on to attendance monitoring system using user name and password through login page as shown in the figure 10.

In this system, registered use can check the current day attendance status of the student as shown in figure 11, Complete Attendance of Particular Student by providing the USN (University Seat Number) of particular student as shown in the figure 12. All Students attendance based on one Particular Date by providing date as shown in the figure 13 and complete attendance of All Students as shown in the figure 14. Figure 15 shows the Absent SMS Notification sent to parent mobile.
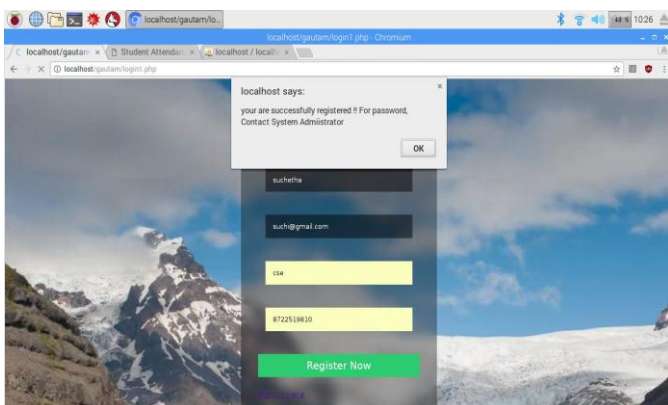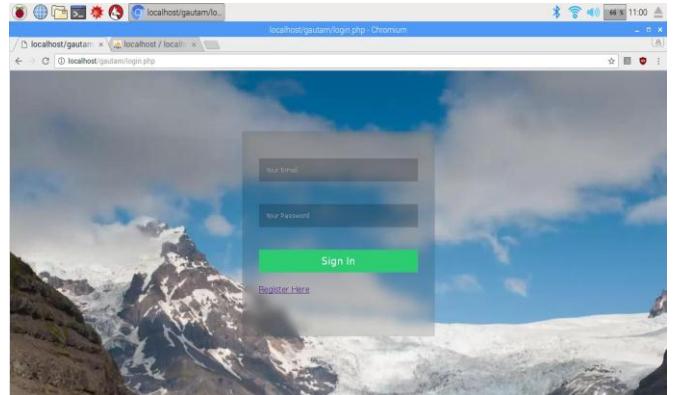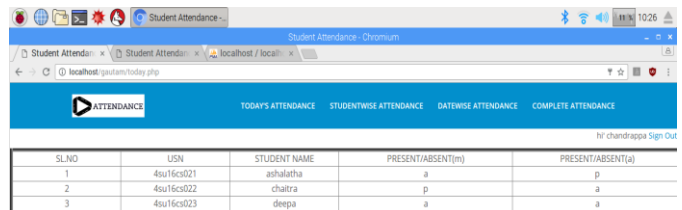


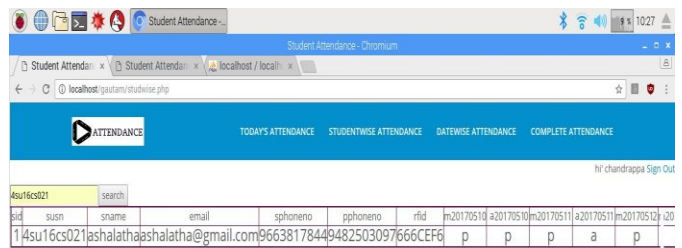Figure 11.  Current Day Attendence of Students



Figure 12.  Complete Attendance of Particular Student
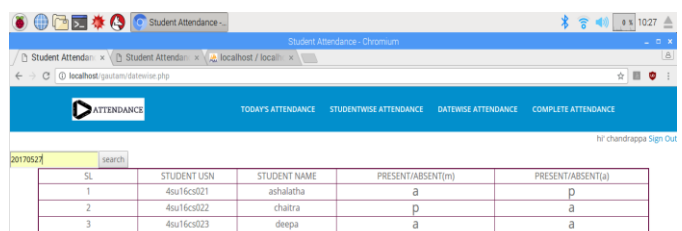


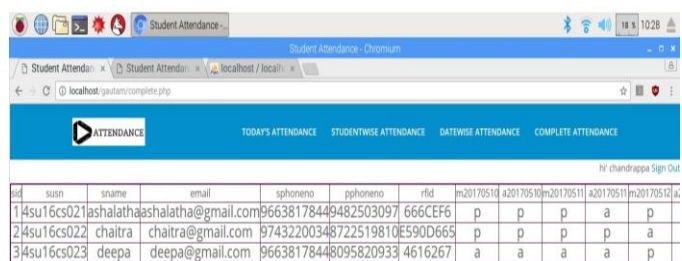Figure 13.  All Students attendance based on one Particular Date



Figure 9.   Registration Page



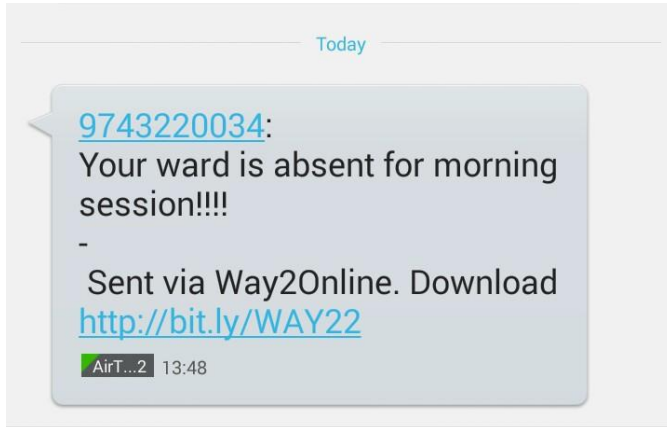Figure 14.  complete attendance of All Students

Figure 15. Absent SMS Notification Format

## V. CONCLUSION AND FUTURE SCOPE

It is an architecture of inter connected network of RFID readers within an educational institution. It is a fully automated IoT based student's attendance monitoring system. It will provide more services to educational institutions processes. This system is easy, accurate and does not require more cost for development, maintenance and repair.

Every good engineering design innovation has limitation.one limitation associated with this innovation is passiveness. This system is passive RFID based Attendance Monitoring System. The frequency range of RFID Reader is limited to 12 to 15cm. Hence the limitation of the proposed work would be improved upon in future by using high frequency active RFID tags against passive low frequency RFID tags for better performance and flexibility of users.

### ACKNOWLEDGMENT

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