Automated Smart Attendance Monitoring and Load Cutoff Using Ultra High Frequency RFID

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Abstract- **The main objective of this project is to automatically record the attendance of the students, using active RFID tags. Each student is provided with his/her authorized RFID tag. The serial number of each tag is associated with each student's database. The active RFID readers are capable of detecting the tags within a predefined perimeter. The system is incorporated with a IOT module which is used to send reports of the absent students to their parents and by this, the parents are aware of the activities of their wards. This increases the credibility of the system. According to the space of the classroom the range of the reader is determined. This system can be used to create many types of reports like daily attendance details, monthly, weekly and real time feedback to parents. The attendance score calculation can be automated using the collected data. The lecturer can grade the student's attendance scores in a particular course based on some specific metrics like frequency of presence in class, duration of stay in class, punctuality as the database will also contain the details of the student's entry and exit time. The concerned faculty can de-assign students from their specific tag, and reassign the tag to other students if needed. And hence the same tag can be used by many students once the course duration of one student is over. The application of RFID to student attendance monitoring as developed and deployed in this project is capable of eliminating time wasted during manual collection of attendance and an opportunity for the educational administrators to capture face-to-face classroom statistics for allocation of appropriate attendance scores and for further managerial decisions.**

Index Terms- RFID; Internet of Things; WiFi network; education management

I. INTRODUCTION

Interactive Response System (IRS) [1], also called as Audience Response System (ARS) [2] which were first introduced at Stanford University in 1966, is an phsical device that allows students to submit their responses using remote decives and the IRS gives the visual format to present the result. Because the cost is high with the use of special hardware in IRS, it is ultimately failed to get a wide range of applications. Currently, smart phones have become one of the necessary tools for college students. In addition, there are some mobile smart terminals such as IPAD, Android tablet, etc. Related research pointed out that the use of smartphones has reached over the rate of 120% [3]. As a result of a large number of intelligent technology products make some students without interests to learning in the classroom, who prefer to use these smart devices to play games, surf the Internet, movies and other activities which are irrelative to classroom teaching. With the development of information technology, especially the Internet of Things (IoT) technology [4] which is widely used in transportation [5], education [6], medical [7], environment protection [8], tracking [9], indoor positioning [10], etc., how to apply the IoT technology to improve students' interest in classroom learning has become a hot topic in the field of modern higher education applications. Cloud computing has virtually unlimited capabilities in terms of storage and processing power, and is often integrated with IoT technology to perform better severvices for users [11]. To illustrate IoT systems, we will refer to Device-CloudMobile (DCM) model shown in Figure 1, as it is widely used today in commercial IoT products. Here, the IoT devices need connect to the back-end Cloud system, and support services by an user app running on mobile devices. In some case, the app connects directly with the IoT device using the device WiFi hotspot capabilities, which either processes the requests directly or bridges it to the Cloud back-end system.
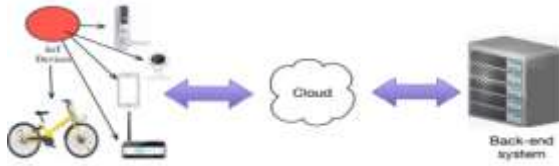
Figure 1. Device-Cloud-Mobile IoT Architectural Model

In this paper, we design and implement an IoT-based teaching management system to assist teacher to perform automatic attendance record and strengthen the motivation of students' learning. This IoT system can improve the attendance of students, and give a positive impact on students' learning process for higher education.

II. RELATED WORKS

Radio Frequency Identification (RFID) technology [12] is one of the key technologies to realize the IoT. The typical RFID systems consists of tags, readers and back-end computer system. There are two types of tag: active and passive tag, where active tag has battery and can send the information at hundreds of meters, and passive tag depends on the emitted energy of reader's antenna instead of using battery to transmit information. There are four different RFID frequency bands [13], that is low frequency (LF)—125~134 kHz, high frequency (HF)—13.56 MHz, ultra-high frequency (UHF)—433~956 MHz, and microwave frequency (MF)—2.45 GHz. Patel et al. designed an online students' attendance monitoring system in classroom using UHF RFID, which can automatically record students' attendance at lectures or laboratories [14]. However, the UHF are not widely used in universities and colleges. In fact, HF RFID cards are widely used as IDs of students in campus management. Arbain et al. implemented a web-based laboratory attendance system by integrating RFID with Arduino platform [15], which is a cable network and not convenient to be used by IoT environment. In this paper, we will use HF RFID technology integrated with the WiFi network to implement a novel RFID reader to be used for an attendance record system, and our RFID systems work in wireless method, which is convenient to be deployed in current classroom.

Quick Response (QR) [16] code is another technology to enable IoT [17]. Su et al. use QR code to quickly extract the ID of cargo and use it to implement an intelligent logistics system [18]. QR codes have been discussed in the literature [19] as a valuable method to teaching and learning. The results show that students perceived QR codes as an easy to use and useful application to support learning activities, and also suggest that the pre-service teachers not only demonstrated positive attitudes towards the integration of QR codes in learning activities but also had clear intentions to use the system in the future. Dorado et al. propose an approach for mobile learning using QR codes to develop teaching materials [20]. Downer et al. use QR code to enhance nursing and midwifery student learning [21]. In this paper, we use QR code to give quick response link to the course's online video, and use QR code to show the practice excercises which need the students to take part in the classroom activities.

III. SYSTEM ARCHITECTURE

A. Proposed System

Active RFID technology facilitates automatic wireless identification of the electronic tags by suitable readers, within the allocated range of the Reader. In this project, an attempt is made to use Active RFID tags for the purpose of recording attendance which is further more superior to Passive RFID tags. The application of Active RFID in student attendance monitoring system as developed in this project is capable of recording the attendance of the student, once the student enters the specified range of the RFID Reader. This advancement can prove to be more efficient for the allocation of appropriate attendance scores and for further managerial decisions.
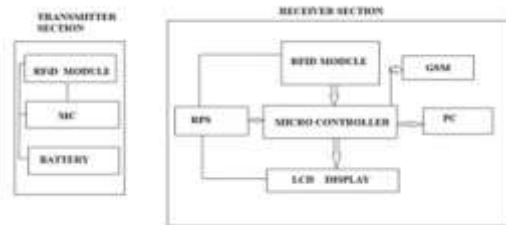

Figure 2:Block Diagram of Active RFID

Traditionally the attendance at an establishment is usually done in a book register. It is time consuming. It is very difficult to verify the attendance over long periods. This method is very time consuming and it is very difficult to verify the attendance recorded for a week or above. Maintaining attendance registers is

space consuming. Here, chances of doing malpractice in marking attendance are high. RFID and IOT based attendance system uses RFID tags for each person. A person marks the attendance by entering in to the RFID reader range i.e. entering in to a class room and the message will be send whenever the person is present or any attendance is marked. Attendance monitoring is very simple. This System assigns a unique card for each Student. A Student will carry this card along with him and when he enters the class room, the RFID card Reader will read the unique ID data. The RFID card Reader reads down the Student details. The ID will be indicated on the LCD display and the attendance report will be sent through IOT modem to parents.The back end AMS software is interfaced with a computer and AMS hardware module. Based on the details feed in the database the attendance will be marked to the students. Each class will be allocated with a specific time as tolerance limit for the attendance registration. Students need to be present in the class room by the time or post registration is marked as late attendance. The students whose entry is missed in database for a period will be marked as absent. Based on the data, an excel sheet will be generated for the staff verification. Post class hours the staff can access and verify the attendance of the students. Staffs are granted access to modify the excel sheet. Once the verification and correction are made by the staff, by pressing the SEND SMS option in the database an SMS alert will be send to the student's parent based on their attendance that is marked for the day.

IV. IMPLEMENTATION

A. RFID Reader
Full form of RFID is ―Radio Frequency Identification‖. Wireless communication is used between RFID tags and RFID Reader. Reader does not require line of sight communication with tags. It means that Reader detects the RFID tag even if there is some object between Card and Reader. Thus it is a non-contact type of reader. The Radio frequency used in our reader is 125 kHz which is a Low Frequency (LF). RFID reader interfacing with Microcontroller is done using serial port. RFID reader will communicate with Microcontroller using serial communication. When RFID tag comes in the range of Reader module, then RFID reader detects RFID

card. And at that time RFID reader sends out a series of alphanumeric unique codes on the serial port. So while adding the employees/student card number in the program memory. First we need to store this series of alphanumeric code into program memory and later on this unique series of codes will be compared with the incoming card number. RFID card reader module requires 9 volt power supply and output is given on DB9 connector port.

B. RFID CARD
There are two main types of RFID cards, Passive and Active. In this project we have used Passive RFID tags. As given in introduction, we can use normal RFID cards which are of the size of credit card. These are rectangular in shape and white in color and can be attached with the ID-card. Or even we can use RFID tags which can be attached with keychain.

C. Microcontroller
It is the main component of the project. It is the heart of the system. Microcontroller communicates with all input and output devices. Various functions of Microcontroller are as follows:
1. Displaying clock on LCD
2. Reading input from RFID reader
3. Comparing it with the data / RFID card number stored in Microcontroller memory
4. Turning on buzzer if the cards does not match
5. Logging/Storing time into memory if cards match
6. Reading input from keypad and adjusting time according to the keypad entry given by user.
7. Sending data to computer.

D. LCD Module
Here we use 2 X 16 LCD modules to display the setting data and to view change in setting data. For example Following data are displayed in the LCD The most commonly used Character based LCD are based on Hitachi's HD44780 controller or other which are compatible with HD44580.The most commonly used LCD are 1 Line, 2 Line or 4 Line LCD which have only 1 controller and support at most of 80 characters, whereas LCD supporting more than 80 characters make use of 2 HD44780 controllers. Most LCD with 1 controller has 14 Pins and LCD with 2 controller has 16 Pins (two pins are extra in both for back-light LED connections). Pin

description is shown in the table below.Table.6.4. 2 X 16 LCD Display Module PIN Details. The power source for the system is supplied by 12V transformer. The Sensor, MCU, RF Transmitter and LCD display requires 5VDC. In order to step down the 12VDC to 5VDC, the 7805 chip is used. This 7805 chip acts as a regulator to maintain stable voltage.

E. SOFTWARE

In the development cycle of the system, decisions were made on the parts of the system to be realized in the hardware design and the parts to be implemented in software. The software is decomposed into modules so that each module can be individually tested as a unit and debugged before the modules are integrated and tested as a software system in order to ensure that the software design meets its specification. The program was written in Microsoft Visual C# programming language for the front end. Programming in Visual C# provides the user with the ability to utilize a combination of visually arranged components or controls on a form, specifying attributes and actions of those components, and writing additional lines of code for more functionality. Microsoft visual studio .NET is use for designing this system. My SQL is use as backend database for storing student attendance records.

V. SYSTEM OPERATION AND TESTING

For operating this project first user has to insert the card numbers into the microcontroller memory. It can be done by company authority person or college administration person while issuing the card. Whenever a new student joins or new employee is recruited in an organization/company at that time, card will be issued. And same entry will be made in the microcontroller program memory. In the current project, these numbers are stored in the microcontroller's program memory. Which means while burning the program into memory, we need to add these card numbers into the program. Then this card will be issued to the respective person .Once the project is switched on, it will display time clock on LCD. We have provided ―4 by 1‖ keypad for setting the time. User can press the setting key and use the increment / decrement and enter button to set the current time. Once the time is set then he/she can exit from the time setting mode / time set routine. Then

the LCD will display current time set by user. Then this project operates in normal mode. Whenever user comes near RFID reader module and shows RFID tag then microcontroller will store 2 information or 2 types of data will in the microcontroller memory. First is the card number and second is the time at which user has shown the card. Same situation happens for logout. For logging out also student will show the card. In this project single RFID card reader module will be used for in and out operation. While in actual implementation in industries or colleges, user can install 2 RFID reader modules. One will be placed at the outer side and second at the inner side of the door. When a student or employee has lost his/her card. Then in such situation he/she has to report this incident to the administration person. Then admin person can remove the card number from microcontroller memory. Also when any employee / student leave the office and they forget to return the card then at time also authority person will remove the card information from microcontroller memory. So in case of lost card or person left the company without returning the card and if these cards are shown to RFID reader then buzzer will be turned on. Lets take an example that any outside/unauthorized person get a RFID card. And these cards does not have entry in our system. Or if existing employee manages to get a RFID card, and if he/she shows card, then microcontroller will check and find that this card is not stored in the memory. It means card number is not found in microcontroller memory then buzzer is turned on.

A careful observation of the trend of usage of RFID tags leads one to consider the possibility of its utilization for monitoring the attendance of students in educational institutions, with the aid of program driven computers. While every student given a specific RFID tag attends the lecture through entrance door, a serial number (related to each student's matriculation number) of tag is associated with the student database entry. So every time a student uses his/her card, the entries will be entered into the database with the time stamp. The use of webcam might be optionally necessary to take a snap of the person using the card. Webcam reduces proxy attendance attempts.

This is used to cross-verify in the event of an undesirable event or dispute. Consequently, the attendance data then can be used to create many types

of reports like daily attendance details, monthly, weekly and real time feedback to parents. The attendance score calculation can be automated using the collected data. After setting up the student attendance RFID system from the mode of operation. The tag is activated when it passes through a radiofrequency (RF) field (125 kHz in this case), which is generated by the antenna embedded within the reader box. The program checks whether the tag is valid or not. If the tag is valid, it will continue to the database program and registers the student's attendance for the course. If the tag is invalid, the program gives a notification that the tag has not been registered to any student and requires the user to either supply a valid tag. In our proposed system, we improve the student attendance system. The Radio Frequency Identification (RFID) technology is one of an automation technology that is beneficial in improving current traditional way of monitoring. As every tag has its own unique ID, it is easy to differentiate every tag holder. In addition, a Graphical User Interface (GUI) provides more efficient way to review the monitor. Thus, the integration of RFID technology and the GUI in an monitoring system will produces an automatic view.We have provided PC interfacing to this project, so that attendance of employees can be seen on computer. To view the attendance first administrative person or the user operating this project has to press the Attendance key, then LCD display will display attendance of all students/employees. LCD will display card number 1, login time then card number 2, login time and so on… It will show attendance of those people who have logged in on that particular day. LCD display is helpful if PC interfacing is not available. Which means Computer is not near system. In PC interfacing, Data is sent to computer as soon as it is shown on LCD display. Various software are available to view data received on serial port. On computer we can use hyper terminal software or we can use terminal software to view the data received on computer. Later user can copy this data into another file or he/she can directly take the print out. PC interfacing will be useful when the data is very large or when employee number is very large. At that time attendance monitoring on LCD becomes very time consuming and is not easy. However, data for all employees can be viewed on computer at a faster rate and very easily.

VI. RESULTS

The Attendance Management System uses Active RFID and IOT. The transceiver used for the transmission of data from the Active RFID tag to the Reader in the AMS is RFM70 module. The details of the students are entered in the Student Database by the concerned staff. Each student is assigned with a particular RFID number. The data was transmitted at a frequency of 2.3GHZ from the transmitter present in the student's tag. The data that is transmitted from the tag was detected by receiver module present in the reader when the student entered the range of the reader. When the student enters the specified range with the tag, the program checks whether the tag is valid or not. If the tag is valid, the reader recorded attendance automatically by sensing the student's presence in the classroom. After the student entered the range of the Reader fixed in the classroom, the RFID serial number of his card was transmitted from his tag and received by the Reader. The transmission of the data between the tag and the reader happens at the same frequency of 2.3 GHz. Then the data was received from the tag, an acknowledgement was shown in the reader. And then a notification about the registered attendance was sent to the parent of the ward immediately after the registration of the attendance. The attendance could be recorded until the specified time limit, after which the attendance is customarily invalid due to late entry. Based on the data recorded, a document is generated. This document can be accessed by the concerned staff member and required changes can be performed. The attendance score of the students for each day was generated in the form of an Excel sheet from the Existing result window. The baud rate at which data should be transmitted from the database to the IOT modem was set by the staff in advance. Once the document was verified by the staff member, the absence report was sent to the parents in the form of SMS, by using the Send Absence Alert option. The report of the student's attendance status for the day was immediately received by the parent or guardian of the student whose contact information was already loaded in the database, in the form of an SMS. The whole process of student's attendance score recording, management and reporting was carried out swiftly and efficiently.
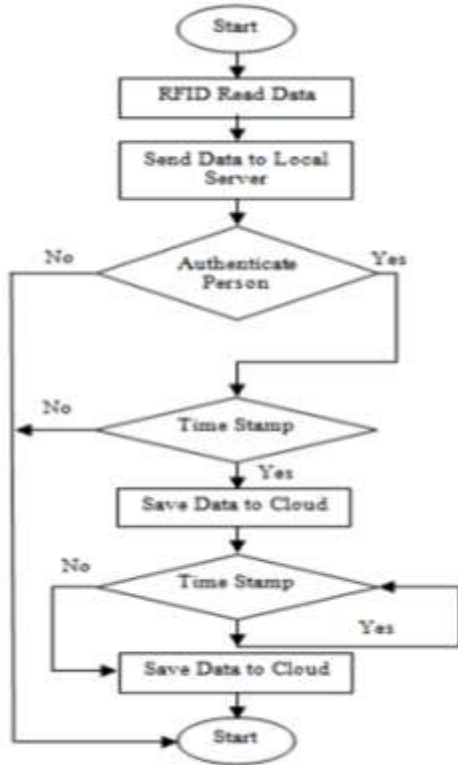
Figure3. Flowchat of proposed system

VII. CONCLUSION

The proposed system model of a good and automated student attendance system that has been constructed to reduce the difficulty of manual process. RFID based automated student attendence system has been designed to improve manual process from reduce the difficulty. Manual process attendence system has a big impact on the entire educational daily process. When educational teachers will be free from manual roll call registeration every separate student's attendance information that will save their costly time and force. It has a great impact on the entire educational process. All teachers will be free from registration every seperate student's attendance information that will save their costly time and force. Attendance information is accessible through the graphically user interface for admin when necessity. The system will show the student information to the respective teachers, student and parents after the completion of each class more over they can see every day, every week and every month from internet front end application. At that time it will minimize the absent rate from 40% to 5% that will improve a

student's work. Thus, this proposed system will help in improvement of quality education.

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