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Automatic Attendance Management System Using Active RFID and GSM

S.Rubendran [1], M.Joly [2]

UG Student, Dept. of EEE, Saveetha Engineering College, Chennai, Tamilnadu, India[1]

Assistant Professor, Dept. of EEE, Saveetha Engineering College, Chennai, Tamilnadu, India[2]

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 GSM 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.

I. INTRODUCTION

1.1 EMBEDDED SYSTEMS

An embedded system is a computer system designed to perform one or a few dedicated function often with real-time computing constraints, a general purpose computer such as a personnel computer, is designed to be flexible to meet a wide range of end users. Embedded systems form the base of many devices in common use today. Embedded systems are controlled by one or more main processing cores that are typically either a micro controller or a digital signal processor. The key characteristics are however being dedicated to handle a particular task, which may require very powerful processors.

1.2 Existing System:

The existing system deploys the usage of RFID (Passive) in implementing automatic student course attendance recording system that allows students to simply fill their attendance by swiping or moving their ID cards over the RFID reader which are located at the entrance of lecture halls. This method is widely used as it eliminates the time wasted during manual collection of attendance.

1.3 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.

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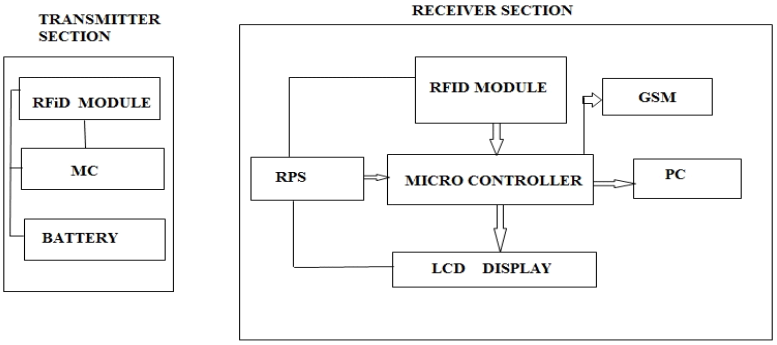
II. BLOCK DIAGRAM AND HARDWARE

2.1 INTRODUCTION

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 GSM 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 GSM 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.



2.2 BLOCK DIAGRAM

2.3 WORKING:

Each student will hold a unique RFID tag and whenever student enters the RF receiver zone the attendance will be registered automatically. The data which has been received from the student's unique card will be stored in the receiver buffer. The data is then compared with the pre-assigned data in the database and based on that the attendance is register to the particular student.The transmitter will hold a unique address which will be transmitted by the means of radio frequency to a particular region. The 2.3GHZ transponder will continuously respond to the incoming data and will gather the data from the transmitter. The data will then be stored in the microcontroller buffer. This unique id will be displayed in the LCD screen. Then this data will be sent to the database. The database will register the attendance based on the time it was swipe. The missing registration will be marked as absent.
Once the report has been verified by the staff and the SMS command has been given, the data will be sent to the GSM module and a SMS will be sent to the loaded mobile numbers based on the status in the database, such that PRESENT/LATE/ABSENT.

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2.4 HARDWARE

2.4.1 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 LCDThe 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.

2.4.2 SIM 900 – RS 232

GSM/GPRS RS232 Modem is built with SIMCOM Make SIM900 Quad-band.GSM/GPRS engine, works on frequencies 850 MHz, 900 MHz, 1800 MHz and 1900 MHz. It is very compact in size and easy to use as plug in GSM Modem. The Modem is designed with RS232 Level converter circuitry, which allows you to directly interface PC Serial port .The baud rate can be configurable from 9600-115200 through AT command. Initially Modem is in Auto baud mode. This GSM/GPRS RS232 Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS as well as DATA transfer application in M2M interface.The modem needs only 3 wires (Tx,Rx,GND) except Power supply to interface with microcontroller/Host PC. The built-in Low Dropout Linear voltage regulator allows you to connect wide range of unregulated power supply (4.2V -13V).Using this modem, you will be able to send & Read SMS, connect to internet via GPRS through simple AT commands.

SERIAL COMMUINCATION

- TXD: Send data to the RXD signal line of the DTE
- RXD: Receive data from the TXD signal line of the DTE

Serial port of the GSM engine supports auto bauding for the following baud rates: 1200, 2400, 4800, 9600,19200, 38400 and 57600bps. Factory setting is auto bauding enabled. This gives you the flexibility to put the GSM engine into operation no matter what baud rate your host application is configured to.

2.4.3 MAX 232

The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply TIA/EIA-232-F voltage levels from a single 5-V supply. Each receiver converts TIA/EIA-232-F inputs to 5-V TTL/CMOS levels. These receivers have a typical threshold of 1.3 V, a typical hysteresis of 0.5 V, and can accept ±30-V inputs. Each driver converts TTL/CMOS input levels into TIA/EIA-232-F levels.

2.4.4 RFM70

RFM70 is a GFSK transceiver module operating in the world wide ISM frequency band at 2400 - 2483.5 MHz Burst mode transmission and up to 2Mbps air data rate make them suitable for applications requiring ultralow power consumption. The embedded packet processing engines enable their full operation with a very simple MCU as a radio system. Auto re-transmission and auto acknowledge give reliable link without any MCU interference. RFM70 operates in TDD mode, either as a transmitter or as a receiver. The RF channel frequency determines the center of the channel used by RFM70. The frequency is set by the RF_CH register in register bank 0 according to the following formula: F0= 2400 + RF_CH (MHz).The resolution of the RF channel frequency is1MHz. A transmitter and a receiver must be programmed with the same RF channel frequency to be able to communicate with each other. The output power of RFM70 is set by the RF_PWR bits in the RF_SETUP register. Demodulation is done with embedded data slicer and bit recovery logic. The air data rate can be programmed to 1Mbps or 2Mbps by RF_DR register.

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A transmitter and a receiver must be programmed with the same setting.

2.5 SOFTWARE

2.5.1 INTRODUCTION

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.

2.5.2 Features of Visual C#:

Visual C# allows blocking of unsafe code (like C++/CLI) via the unsafe keyword and offers support for pointers. Partial Interfaces is a unique feature of Visual c#. Iterative for-Loops can contain multiple conditionals. It can use checked and unchecked contexts for fine-grained control of overflow/underflow checking. It supports multi-line and intra-line comments. There are no global functions or variables, everything belongs to a class. It is compiled in an intermediate language (CIL) independent of the language it was developed or the target architecture and operating system. Automatic garbage collection is possible. Pointers no longer needed (but optional).Header files ".h" declaration is not needed. Definition of classes and functions can be done in any order. Declaration of functions and classes are not needed. Classes can be defined within classes. There are no global functions or variables, everything belongs to a class. All the variables are initialized to their default values before being used (this is automatic by default but can be done manually using static constructors).You can't use non-boolean variables (integers, floats...) as conditions. This is much cleaner and less error prone. Formalized concept of get-set methods, so the code becomes more legible. More clean events management (using delegates). Usually it is much more efficient than java and runs faster. CIL (Common (.NET) Intermediate Language) is a standard language, while java byte codes aren't. It has more primitive types (value types), including unsigned numeric types. Indexers let you access objects as if they were arrays. Conditional compilation is possible. Simplified multithreading is an important feature. Operator overloading is possible. It can make development a bit trickier but they are optional and sometimes very useful. Use of pointers if you really need them, as when calling unmanaged (native) libraries which doesn't run on top of the virtual machine (CLR).

III. DISPLAY OF REGISTRATION USING 16X2 LCD

3.1 INTRODUCTION:

A liquid-crystal display (LCD) is a flat panel display, electronic visual display or video display that uses that light modulating properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display images as in general-purpose computer display or fixed images which can be displayed or hidden, such as present words, digits and 7-segment display as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements. LCDs are used in a wide range of applications including computer monitors, televisions, instruments panels, aircrafts cockpit displays and signage. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators and telephones and have replaced cathode ray tube (CRT) display in most applications. They are available in a wider range of screen sizes that CRT and plasma display, and since they do not use phosphors, they do not suffer burn-in. LCDs are however susceptible to images persistence. The LCD screen is more energy efficient and can be disposed more safely that a CRT. Its low electric power consumption enables it to be used in battery powered electronic equipment. It is an electronically modulated optical device made up of any number filled liquid crystals and arrayed in front of light source (back light) or reflector to produce images in color or monochrome. Liquid crystals were first discovered in 1888. Each pixel of an LCD typically consists of a layer of molecules aligned between two transparent electrodes and two polarizing filters, the axes of transmission of which are (in most of the case) perpendicular to each other. With actual liquid crystal between the polarization filters, light passing through the first would be blocked by the second (crossed)

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polarized. Before an electric field in applied, the orientation of the liquid crystal molecules is determined by the alignment at the surface of electrode. In a twisted nomadic device (still the most common liquid crystal device) the surface alignment directly at the two electrodes are perpendicular to each other, and so the molecules arrange themselves in helical structure or twist. This induces the rotation of polarization of the incident light and device appears gray. If the applied voltage is large enough, the liquid crystal molecules in the centre of the layer are almost completely untwisted and the polarization of the incident light is not rotated and is out passed through the liquid crystal layer. The light is then mainly polarized perpendicular to the second filter, and is blocked and thus the pixel will appear black.

IV. ACTIVE RFID IN AMS

4.1 INTRODUCTION:

The emergence of electronic paradigm for learning compared to traditional method and availability of almost all information on the information superhighway (Internet), nowadays these have caused students to be less motivated to come to the lecture rooms than ever before. Laziness on the part of students, nonchalance to school work, extra social activities that have no importance in aiding the objectives of the institution and a lot more, may prevent students from attending lectures. Sequel to these, lecturers and administrators in most developing countries have had to come up with ways to ensure a healthy participation from students, and make sure that the student-lecturer interactive relationship is kept intact. This in some cases have come in simple forms like roll calls, while in more interesting cases, can be formats like surprise quizzes, extra credit in class, etc. These strategies are however time consuming, stressful and laborious because the valuable lecture time that could otherwise been used for lectures is dedicated to student attendance taking and sometimes not accurate. In addition to all these challenges, the attendances are recorded manually by the tutor and therefore are prone to personal errors. There arises a need fora more efficient and effective method of solving this problem. A technology that can solve this problem and even do more is the RFID technology. RFID is an automated identification and data collection technology, that ensures more accurate and timely data entry. RFID is not actually a new technology; it only quickly gained more attention recently because of its current low cost and advances in other computing fields that open up more application areas. RFID combines radio frequency and microchip technologies to create a smart system that can be used to identify, monitor, secure and do object inventory. At their simplest, RFID systems use tiny chips called tags that contain and transmit some piece of identifying information to an RFID reader, a device that in turn can interface with computers . The ability of RFID systems to deliver precise and accurate data about tagged items will improve efficiency and bring other benefits to business community and consumers alike in the not distant future. In this paper, we present an intelligent RFID based lecture attendance management system. The application of RFID Technology to student course attendance monitoring problem especially in developing countries in our proposition will lead to elimination or reduction of the quality time wasted during manual collection of attendance. We have created student database management system that is not prone to errors or capable of being manipulated by anyone and above all aids in better management of classroom statistics for allocation of attendance. In RFID systems, an item is tagged with a tiny silicon chip plus an antenna collectively called a tag.

V. AMS DATABASE

5.1 INTRODUCTION:

The AMS Database is developed with Visual C# at the back end. It is designed to create a detailed directory containing the details of the students, by the concerned staff member. The database can be manually manipulated by the staff member, which makes the system very dynamic. The port settings and baud rate settings are also changeable which makes the data transfer between the reader and the database and also the database and GSM modem respectively, very fast with all the data intact.

5.2 BASIC STRUCTURE:

The three basic functional units of attendance management system as shown in the opening window of the AMS database are listed below. The port setting which determines the intermediary between the computer system and the RFID Reader is also selected in the opening window.

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- Students database
- Attendance maintenance
- Existing result

5.3 STUDENT DATABASE:

The student database consists of information about each student. The serial number of each tag is related to one particular student in the database. The database has the contact information of each student which facilitates the corresponding of details about the presence and absence of the student every day. The details of the parent or guardian of the student are specified in the database. The student names are arranged in the database in alphabetical order and are assigned with unique roll numbers. The concerned faculty can de-assign students from their specific tag, and reassign the tag to other students if needed using the option RESET. And hence the same tag can be used by many students once the course duration of one student is over. Once new information has been entered and saved using the option SAVE, it is listed below along with the other entries. After the necessary changes have been made in the database CLOSE option is used for exiting from the database window.

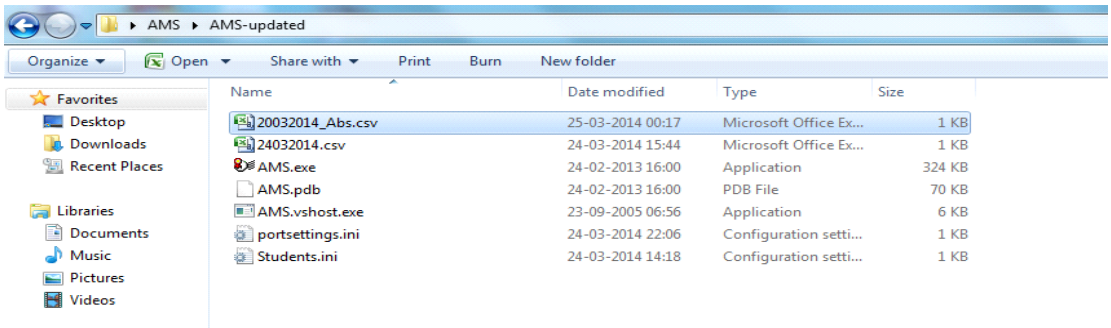
5.4 ATTENDANCE MAINTENANCE:

The attendance maintenance of the system is manually verified by the concerned staff member. The swipe in time limit can be manually preset by the staff member. Varying the time limit every day is possible, which makes the system dynamic. The option SEND ABSENTISM ALERT is used for reporting the absence of the student to the parent by sending an SMS. This option is usually used after verifying the attendance score of the students that is generated each day. The Baud rate setting is used for choosing appropriate range of the bits of the RFID code to be transferred per second to the reader.

5.5 EXISTING RESULT:

The Existing Result option is used to generate the attendance score of the students each day, in the form of a Excel sheet. The date for each day is set in the page after which the GENERATE option is chosen. An Excel sheet consisting of the student details, the attendance status of the student and the condition of the card is generated for each day. This sheet is verified by the concerned staff member before sending the absent alert.

5.6 EXCEL REPORT LOG:



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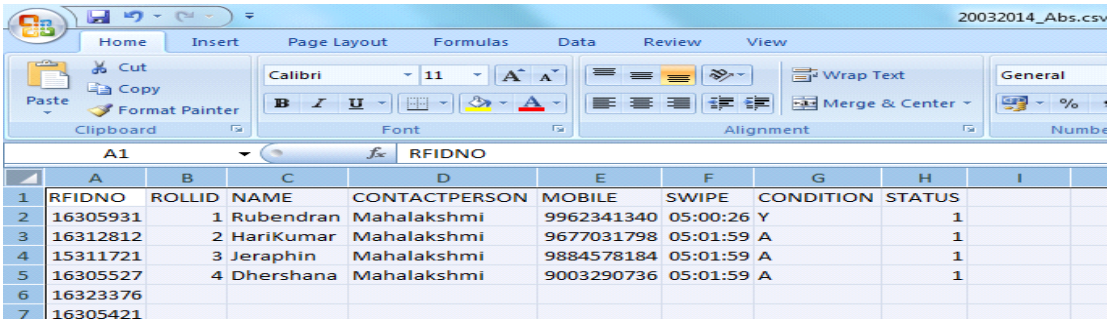
FIRST HOUR ATTENDANCE LOG



20032014_Abs.csv

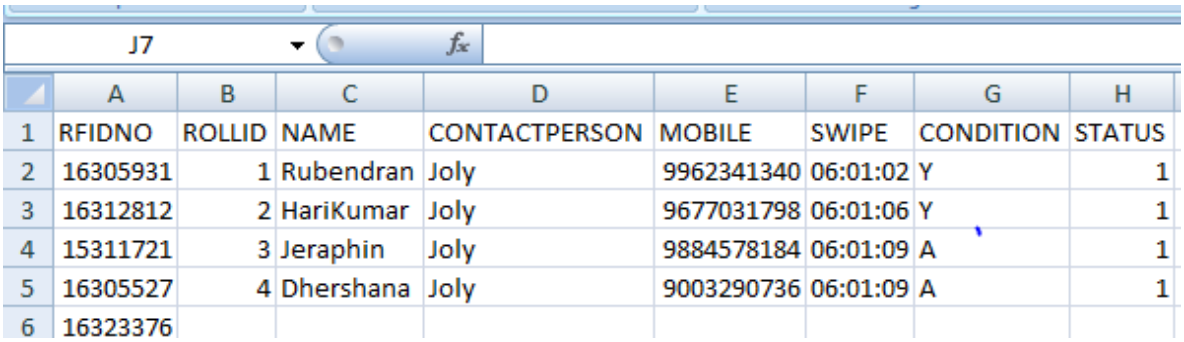
Home | Insert | Page Layout | Formulas | Data | Review | View

Cut, Copy, Format Painter, Paste — Clipboard | Calibri, 11 — Font | Wrap Text, Merge & Center — Alignment | General — Number

A1 | RFIDNO

	A	B	C	D	E	F	G	H	I
1	RFIDNO	ROLLID	NAME	CONTACTPERSON	MOBILE	SWIPE	CONDITION	STATUS	
2	16305931	1	Rubendran	Mahalakshmi	9962341340	05:00:26	Y	1	
3	16312812	2	HariKumar	Mahalakshmi	9677031798	05:01:59	A	1	
4	15311721	3	Jeraphin	Mahalakshmi	9884578184	05:01:59	A	1	
5	16305527	4	Dhershana	Mahalakshmi	9003290736	05:01:59	A	1	
6	16323376								
7	16305421								

SECOND HOUR ATTENDANCE LOG



J7 | fx

	A	B	C	D	E	F	G	H
1	RFIDNO	ROLLID	NAME	CONTACTPERSON	MOBILE	SWIPE	CONDITION	STATUS
2	16305931	1	Rubendran	Joly	9962341340	06:01:02	Y	1
3	16312812	2	HariKumar	Joly	9677031798	06:01:06	Y	1
4	15311721	3	Jeraphin	Joly	9884578184	06:01:09	A	1
5	16305527	4	Dhershana	Joly	9003290736	06:01:09	A	1
6	16323376							

VI. IMPLEMENTATION

The Attendance Management System uses Active RFID and GSM. 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 GSM 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.

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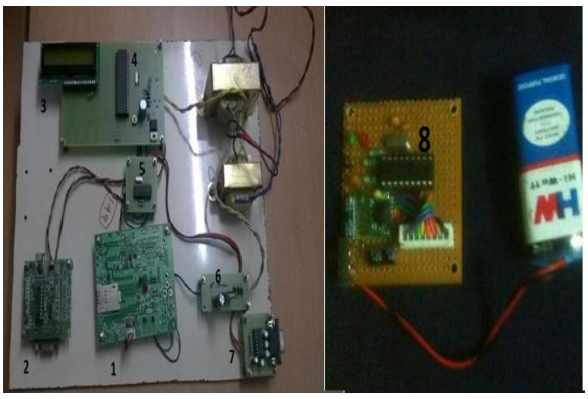

VII. CONCLUSION

As the RFID technology evolves, more sophisticated applications will use the capability of RFID to receive, store and forward data to a remote sync source. In this project, we have utilized the versatility of Active RFID in implementing automatic student's attendance recording system that enables the filling of attendance when the student enters the range of the RFID reader which is located at the lecture halls with their tags. The parents are well informed about the activities of their wards by receiving Absence Alerts by the usage of GSM that is incorporated in the system, we hope that this system can shift the paradigm of student's attendance monitoring in schools and colleges and provide a new, accurate and less cumbersome way for the process.

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