

# Design of RFID Based Student Attendance System with Notification to Parents Using GSM

Ravishankar Yadav

Student, EXTC, MPSTME, NMIMS  
Mumbai, India

Sumita Nainan

Asst. Prof. Department of EXTC, MPSTME, NMIMS  
Mumbai, India

**Abstract**—RFID means Radio Frequency Identification. It is a wireless identification technique which has become very popular these days. It is used for smart system that can be used to identify, monitor secure and do object inventory by the use of radio frequency. This technology is also used in Library Management System, Bank locker security system etc. This technique is safe, secure, faster and easy to use with lower overheads in contrast with the other conventional techniques such as bar code, biometrics etc. It has two components i.e. RFID tag and RFID reader. RFID reader is the device capable of reading and retrieving information stored inside the RFID tags. This paper presents a design of an Automatic Attendance System for both students and professor with parent notification sent via GSM.

**Keywords**—RFID (Radio frequency identification); RFID Reader; RFID Tags; GSM and Student Attendance system

## I. INTRODUCTION

Radio frequency identification (RFID) refers to the use of radio frequency wave to identify and track the tag implanted into an object or a living thing [1]. It is a wireless means of communication that use electromagnetic and electrostatic coupling in radio frequency portion of the spectrum to communicate between reader and tag through a variety of modulation and encoding scheme. Radio Frequency Identification (RFID) is the combination of 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.

In the system of RFID Based Student Attendance System with Notification to Parents Using GSM, the passive type RFID reader is used whose maximum range of detection is around 10cm. It operates at frequency of 125 kHz and 12V power supply [2]. This system has ability to uniquely identify

and take attendance of the students. The users only need to place their RFID tag on the RFID reader to take attendance. They do not need to go through the long list to look for their name. Hence, it is a very time efficient system. Attendance will be taken if the encoded tagged ID scanned, matches the

tagged ID stored in the memory. Otherwise, an error message will be displayed.

In recent years, RFID is one of the automatic identification technologies. There is a wide research and development in this area trying to take maximum advantage of this technology, and in coming years many new applications and research areas will continue to appear. RFID system has been successfully applied to different areas as diverse as transportation, health-care, agriculture, and hospitality industry to name a few. RFID also brings about some concerns, mainly the security and privacy of those who work with or use tags in their everyday life which is proposed in [3]. RFID is used to uniquely identify tagged objects or people. RFID systems have been widely used in many application areas such as inventory control, product tracking through manufacturing and assembly, parking lot access and control, Bank Locker Security System, Automatic Toll Collection System (ATCS), Library Management system (LMS), Attendance Management System etc. as discussed in [4,5,6].

The aim of this paper is to monitor student's attendance by using RFID for administration. Notification will be sent to parents as well as school's authority in case of absence of students and faculty in the class.

The rest of the paper is discussed as follows: section II describes in brief RFID technology, section III discusses the system design and finally conclusion is discussed in section IV.

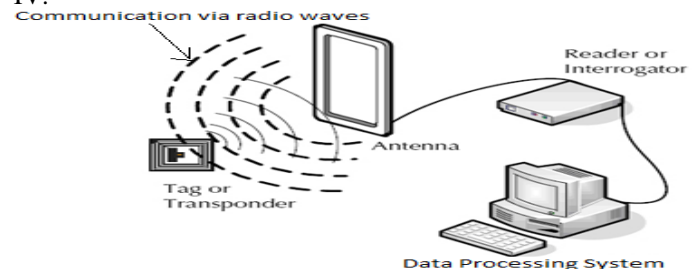


Fig. 1. RFID system components

## II. RADIO FREQUENCY IDENTIFICATION

RFID stands for Radio Frequency Identification. RFID is a means of Identifying a person or object using Radio Frequency Transmission [7]. RFID is used to collect information automatically by radio frequency data communication between a mobile object and an RFID reader to identify and track them. They are most commonly referred to as reader and tag respectively in [8]. The RFID system is shown in fig.1. There are Tags and Reader in the system. A typical reader is a device that has one or more antennas that emit radio waves and receive signals back from the tag. To retrieve the data stored on an RFID tag, a reader is needed. RFID is used to read or write information on a tag and passing that information to a system for storage and processing. Generally, RFID system consists of 2 parts Interrogator and Transponders. Interrogator and Transponder are also known as RFID Reader and RFID Tag respectively.

### A. RFID Reader

RFID Reader is a scanning device that uses the antenna to realise the tags that are in its vicinity [9]. It transmits signals at certain frequencies. RFID readers are usually ON, continuously transmitting radio energy and awaiting any tags that enter their field of operation. EM 18 RFID Reader is shown in fig. 2. EM 18 RFID reader is the device capable of reading and retrieving information stored inside the RFID tags. There are two types of RFID readers, the active and the passive RFID readers.



Fig 2. EM 18 RFID Reader

Active RFID reader can detect an active RFID tag at few meters to line of Sight while passive RFID reader can only detect passive RFID tag at a few centimetres away from the reader. It operates at frequency of 125 kHz and 12V power supply [2]. The effective detection range of the reader is around 10 cm from the antenna. The RFID reader used in the system is a low cost reader for reading passive RFID tags.

### B. RFID Tags

RFID Tag is an IC chip that has unique hexadecimal or electronic product code (EPC) contained in it. Here "UNIQUE" refers to each and every code word of the tag and is independent of other code word. The tag acts as a Key that is capable of opening a particular locks [10]. So, it is also named as RFID key. The sequence is a numeric serial,

which is stored in the RFID memory. The microchip is available inside RFID tag which is shown in below fig. 3. The microchip includes minute circuitry and an embedded silicon chip. Each tag can store a maximum of 2KB of information in the microchips. The tag memory can be permanent or re-writable, which can be re-programmed electronically by the reader multiple times. Tags are designed specific to an application and the environment it is proposed in.

There are three types of RFID tags which are active, semi-passive and passive. Active tags are active in nature i.e. they do not require any external source, they have their own in-built battery. It can transmit high frequencies so it can be detected at a longer range. Passive tags are passive in nature i.e. they don't have any battery source built in them. They draw their power from the electromagnetic field generated by the RFID reader. They have no active transmitter and rely on altering the RF field from the transceiver in a way that the reader can detect.

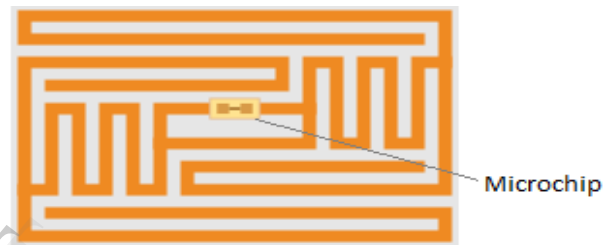


Fig. 3. RFID tags

They transmit low frequencies so they can be detected up to few meters of distance. Tags are available in various shapes and sizes which are shown in fig. 4. A Semi-Passive tag exists, which has the features of both Active and Passive tags. Semi-Passive Tags have their own power source that powers the microchip only. They have no transmitter and as with Passive tags they rely on altering the RF field from the Transceiver to transmit their data. The different types of RFID Tags [11] are shown in table 1.

TABLE I. FEATURES OF TYPES OF RFID TAGS

Feature	Passive	Active	Semi-Passive
Read Range	Short (Up to 10cm)	Long (Up to 100m)	Long (Up to 100m)
Battery	No	Yes	Yes
Life Validity	Up to 20 years	Between 5-10 Years	Up to 10 Years
Storage	128 bytes read/write	128 Kbytes read/write	128 Kbytes read/write
Cost	Cheap	Very Expensive	Expensive
Application	Attendance Management System	Monitor the condition of fresh produce	Measurement of temperature periodically

Tags operate on Low frequency (LF) (30 KHz-300 KHz), High frequency (HF) (3MHz-30MHz), Ultra high frequency

(UHF) (300MHz-3GHz) and Microwave (2.4 GHz-5GHz) [12].

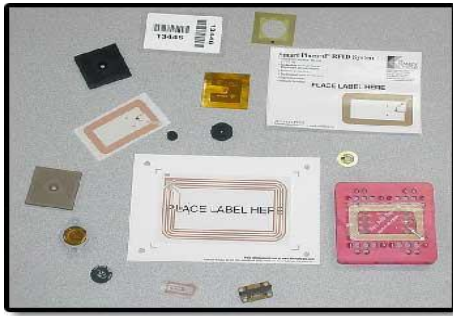


Fig. 4. Different shapes of RFID tags

### III. SYSTEM DESIGN

In order to implement the RFID Based Student Attendance System with Notification to Parents Using GSM, the hardware and software are discussed below.

#### A. Hardware design

This system consists of automatic attendance system for both students and professor. While entering the class room both the student and professor have to mark their attendance using their RFID cards. This attendance will be forwarded to a central computer after processing it through the microcontroller where it will be stored. If a student is absent in the class then notification will be sent to his/her parents.

The architecture of the system is shown in fig. 5. This system consists of a tag affixed on identity card to communicate wirelessly with a reader, in order to retrieve the tag's identity. RFID is used to take the attendance of the student. Student information is stored in the RFID tag and this information is read by the RFID reader. The ATMEGA 128 microcontroller takes input from the RFID reader, processes it and sends it to both PC and the GSM module through MAX232 for storing the attendance and for sending SMS through the GSM module. Here, we can also use the PIC microcontroller easily but we are using ATMEGA 128 microcontroller because the Atmel AVR.

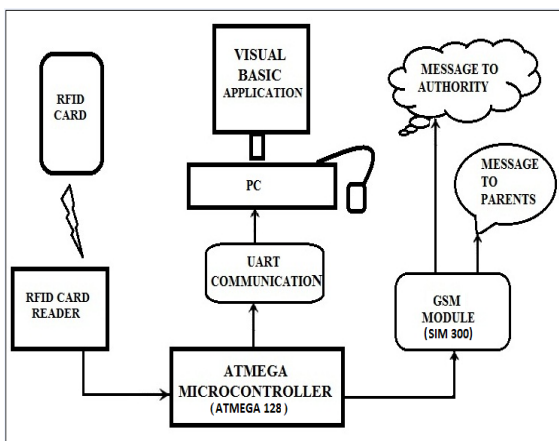


Fig. 5. Block diagram of the system

ATmega128 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega128 achieves throughputs approaching 1MIPS per MHz allowing the system designed to optimize power consumption versus processing speed. This one is cost effective. The MAX232 IC is used to convert the TTL/CMOS logic levels to RS232 logic levels during serial communication of microcontrollers with PC.

GSM (Global System for Mobile communications) is used to send SMS to student's parents about their absence in class. GSM SIM 300 is an open, digital cellular technology used for transmitting mobile voice and data services. GSM operates in the 900MHz and 1.8GHz bands. GSM supports data transfer speeds of up to 9.6 kbps, allowing the transmission of basic data services such as SMS.

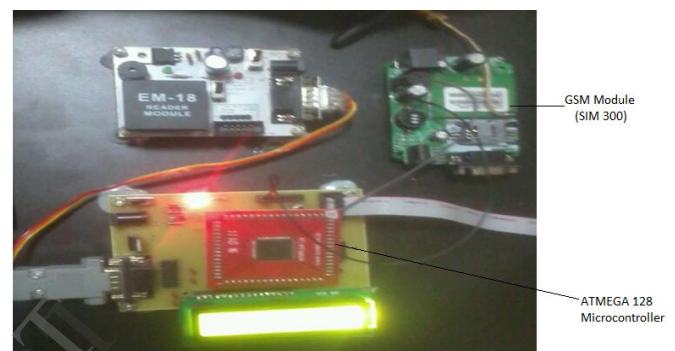


Fig. 6. Hardware of the system

The hardware of the system is shown in fig. 6. This system consists of EM 18 RFID Reader, GSM SIM 300 module, Max 232 and ATMEGA 128 microcontroller with LCD. Working of the system is discussed below. When students scan the RFID tags to RFID reader, data will be sent to ATMEGA 128 microcontroller through Max232 and it will be displayed on LCD. Microcontroller sends the data to database in the PC for matching student details and information is stored in the database. After matching, PC sends notification to controller and it will be displayed on LCD 'present' After 10 minute, those students are absent, PC sends message through Max232 to microcontroller. Microcontroller sends the message to Parents through GSM.

#### B. SOFTWARE DESIGN

Direction flow of the program is shown in fig. 7. 'C' sharp has been used as the programming language.

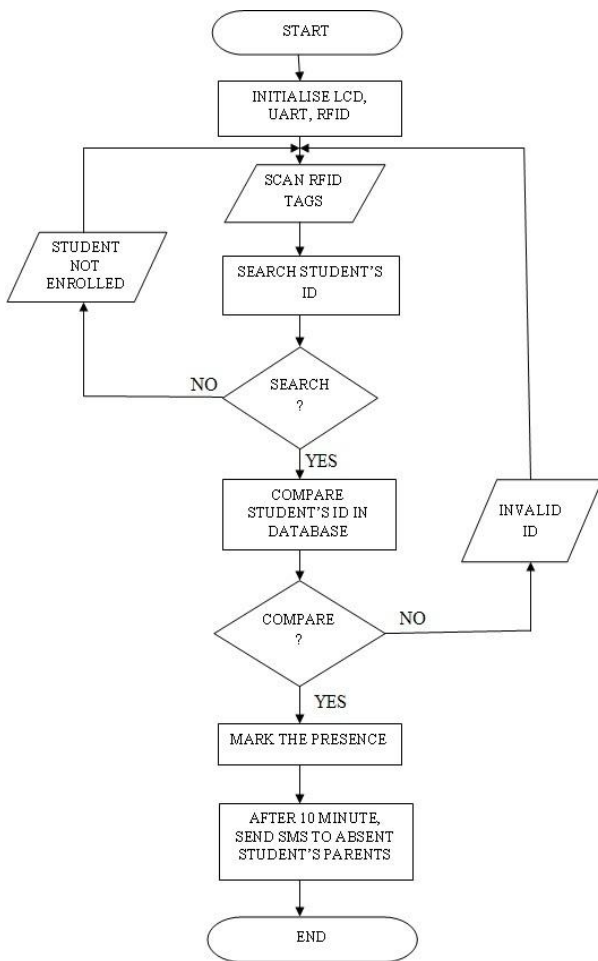


Fig. 7. Directional flow of the system

The proposed system has been explained with the help of following steps.

Step 1-Initialise RFID Reader

Step 2-Initialise LCD

Step 3-Initialise UART

Step 4-Scan RFID tags

Step 5-Send scanned of RFID data to microcontroller

Step6-Using microcontroller perform the filtering operation to remove unwanted field and extract student's id

Step 7-Search student tags id in permanent database with scanned RFID student's tags.

Step7.1-Search student's id, if found go to step 8 else go to step 4.

Step8-Compare detected student's tag, id's, date and time with class time table and if match found then go to step 9 else go to step 4.

Step9- Check person type and mark the presence.

Step10- Repeat step 4 to step 9 for all row of RFID data.

Step 11- After 10 min check for present student and if student is absent then send message to parents that your child is absent.

Following screens are designed in Visual Basic (VB). The database has been prepared by entering the user's name and password in the login page as shown in fig. 8.

Fig. 8. Login page

The student database has been prepared by entering the student's ID, name, department etc. in the student information entry form as shown in fig. 9.

Display window of the students shows the student's ID, name, Roll no., department etc. in the student information display window as shown in fig. 10.

Figure 9. Student information form

Fig 10. Student information display window

#### IV. CONCLUSION

The proposed system can provide a new, accurate, and less cumbersome way of taking student attendance in school and shift the paradigm of student's lecture attendance monitoring in classroom. A low cost RFID Based Attendance System prototype has been successfully developed. The prototype of the system can provide several benefits over the conventional method of taking attendance. This system will help in automatic storage of attendance and parents will be notified in case of absence. In this system using the AVR controller, ensures fast operation, cost effectiveness and low power consumption.

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