# Anytime Anywhere- Remote Monitoring of Attendance System based on RFID using GSM Network

Zatin Singhal
Student, Computer Engineering Department, M. M. Engineering College, M. M. University, Ambala, India-133207

Rajneesh Kumar Gujral
Assoc. Professor, Computer Engineering Department, M. M. Engineering College, M. M. University, Ambala, India-133207

## ABSTRACT
RFID means Radio Frequency Identification is a wireless identification technique which becomes very popular these days and is used for the identification of physical objects like products, humans etc by the use of radio frequency. This technique is much more advantageous, safe, secure and easy with lower overhead in contrast with the other conventional technique used. It is much faster and it has two components i.e. RFID tag and RFID reader. In this paper, we have proposed a push based SMS sending approach by GSM cellular network to remote monitoring of attendance of student based on RFID.

## Keywords
RFID Reader, GSM Network, SMS, Remote data monitoring.

## 1. INTRODUCTION
Remote monitoring system is a real-time monitoring system that monitors the system from a remote/mobile location. The conventional method of taking attendance by calling names or signing on paper is very time consuming and insecure, hence inefficient. Radio Frequency Identification (RFID) based attendance system is one of the solutions to address this problem. This system can be used to take attendance for student in school, college, and university. It can also be used to take attendance for workers in working places. Its ability to uniquely identify each person based on their RFID tag type of ID card make the process of taking the attendance easier, faster and secure as compared to conventional method. Students or workers only need to place their ID card on the reader and their attendance will be taken immediately. With real time clock capability of the system, attendance taken will be more accurate since the time for the attendance taken will be recorded. The system is connected to the computer through RS232 and store the attendance taken inside database. The proposed system utilized GSM short message service to perform remote data monitoring. The communication software written in VB language achieved efficient control of serial interface port and real-time synchronization of remote data into system database.

The computer and GSM (Global System for Mobile communication) Module i.e. SIM 300 are connected by RS232.

The monitoring station includes a Computer, RFID Reader, GSM Module, Database designed in MS Access. The software of the station is designed by using VB (Microsoft Visual Basic 6.0).

## 2. RELATED WORK
This section describes previous work done regarding attendance system. Attendance records are necessary to conclude and authenticate students as well as employees of organization. Therefore, many researches have been done research in this area to improve and replace the traditional system of attendance by RFID technology. Mohd Helmy et al. [1] describes the integration of mobile device with software for recording examination attendance is sufficient. In a test, it was found that it reduces time, manpower, cost (printing and paper), and eases the examination procedures. Qun Hou et al. [2] tells the establishment of remote monitoring platform based on a GSM short message mode that can monitor and control the remote communication between the central monitoring station and remote monitoring stations. The remote monitoring station can send the short message because GSM network can interconnect and roam all over the country, and its network ability is very strong; the user will no need another network. In [3] proposed a system which utilizes the GSM short message service and microcontroller to achieve remote real-time data monitoring. The PC server program written in VB language performs real-time data processing and control and records monitoring results into database. T.S. Lim et al. [4] expressed low cost RFID Based Attendance System prototype, the system provides several advantages over conventional method of taking attendance in class. The prototype developed in this project is compact and light weight. Besides, it can run using power adapter or battery power. Therefore, it is very portable and can be carried to the class for taking the attendance. Zhang Yongqiang et al. [5], designed a wireless fingerprint-based attendance system to record and obtain the attendance data using finger prints or known as biometric. Man et al. [6] designed a time management and access monitoring system using microprocessor card to monitor students' or staffs' movement with the records that are kept in the database for administrator reference in campus, office or certain area. All data captured by this system could be accessed by teachers; headmaster and parents.

Jonathan Sidi et al. proposed a system that was capable to record students' attendance using interactive input, generating reports, viewing students' and lecturer' profiles, and providing students timetable [7]. The system records attendance using barcode scanner. RFID technology has a lot of advantages said by [9], such as simultaneous collection of large quantities of data with high accuracy, contactless, etc. RFID technology has an increasing influence to our lives and gradually replaces barcode in supermarket and logistics management. Most of current RFID applications are for

access control and goods location tracking. In fact, RFID provides the function of individual goods identification and online changeable data storage. We should make a better utility to these additional functions. They expect that the next generation of RFID applications should incorporate intelligent. Intelligent RFID applications could bring in new research and commercial opportunities. Moreover, it helps to further reduce costs, enhance customer services and could provide insight for updating business models. The establishment of remote monitoring platform based on a GSM [10] short message mode that can monitor and control the remote communication between the central monitoring station and remote monitoring stations. The Central monitoring station can receive the monitoring data of remote monitoring stations and stores them in the database. The remote monitoring station can send the short message in time or timing through the keyboard operation, and it can receive the setting command from the central monitoring station and complete the setting operation. Because GSM network can interconnect and roam all over the country, and its network ability is very strong, the user will no need another network. The system can improve the network coverage for customers greatly, and it not only can save expensive network building cost and maintenance costs but also the user number is not limited. In [11], there are three important essential factors to consider, (1) knowing RFID feature, (2) process redesigned and construction of environment, (3) information technology uses. Know RFID features to avoid the troubles. For example, there are many tags under the reader. That will result in collision. But we just constructed a build space and deign new processes to avoid it. In this paper, we wanted to initial a concept of RFID strategy and deployment. Do not focus on the RFID hardware. It is important to consider a suitable approach for the business, when implementation of RFID. Although it is success in this practical case, but there are many problems in the running. For example, if the reader didn't detect the tags. If the tags failure. What should we do? How to tackle in the management is a real thing. In [13], authors presented an automatic, digital, intelligent and scientific integrated management information system by using RFID-based system. It provides a valuable service to the equipment departments with safe and high-quality management through the systemized process of equipment management and maintenance.

The application of RFID and digital certificate help us to reduce human errors. Ultimately, it can basically solve the problems in the traditional system and increase the efficiency of equipment management and maintenance. In the regard of security and efficiency, the REMIS is an effective solution for automatic management system using RFID and digital certification. The RFID technology enables the management processes more rapidly and conveniently. In [14], authors describes remote monitoring of temperature and humidity system as the Phillips core LPC2148 controller in order to achieve high-quality environment, collects the temperature and humidity by receiving and sending short messages and man-machine interface. It can monitor remotely on-site temperature and humidity which the system receives instructions and uploads real-time information between GSM module Siemens SIM 300 and monitoring center station. Developing RFID-enabled application for handling RFID data in real-time at point of action without integrated software platform is a very time consuming effort [16]. Among all RFID-enabled applications, there exists some common functionality that can be included in the integrated software platform to simplify the application development and reduce the development time as well as cost. The common features in the integrated software platform may continue to evolve as more application developed and more experience gained. Using an integrated software platform to develop RFID-enabled applications would easier to justify the investment via implementation cost reduction and new benefit realization. It is a critical approach to accelerate the future RFID adoptions as the applications of technology are still emerging. The system aims at establishing remote monitoring platform based on a GSM short message mode that can monitor and control the remote communication between the central monitoring station and remote monitoring stations [16]. The Central monitoring station can receive the monitoring data of remote monitoring stations and stores them in the database, and also can call and print then at any time. At the same time, the system can on-line monitor the status of the remote monitored object, and it can send setting commands to the remote monitoring station by the mode of sending short messages. Remote monitoring station can be able to send the measured data dealt with by the MCU of the monitored object and send them to central monitoring station by the mode of the short message. The remote monitoring station can send the short message in time or timing through the keyboard operation, and it can receive the setting command from the central monitoring station and complete the setting operation. Because GSM network can interconnect and roam all over the country, and its network ability is very strong, the user will no need another network. The system can improve the network coverage for customers greatly, and it not only can save expensive network building cost and maintenance costs but also the user number is not limited.

## 3. HARDWARE STRUCTURE OF REMOTE MONITORING SYSTEM

The system hardware includes RFID Reader, SIM 300 GSM module with Antenna, Connecting wires, SIM Card, Power Supply.

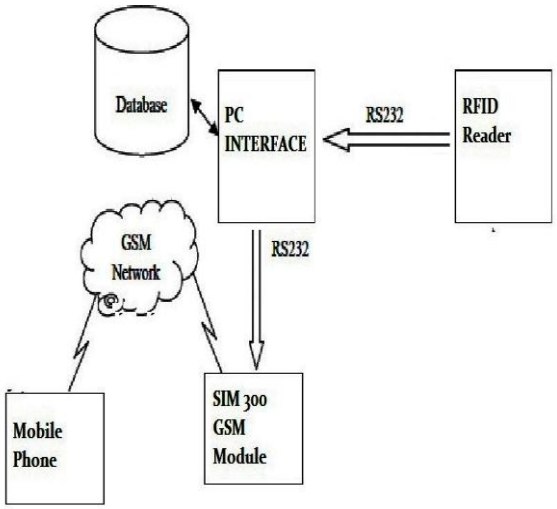


**Figure 1: structure of remote monitoring system**

### 3.1 RFID Characteristics

Radio frequency waves are the waves whose frequency band lies in the range of 3 KHz to 300 GHz, thus it is a wireless technique of identifying objects. It uses electrostatic and electromagnetic coupling and a variety of modulation and encoding techniques between chip and the reader for

transferring the data. Electrostatic refers to the phenomena of static (without acceleration) electric charges. Modulation is defined as the technique of transferring the data to longer distance by introducing the carrier wave to the modulating wave. Encoding is defined as converting the data from one suitable form to another suitable form. Various encoding schemes are Polar form, Non-Polar form, NRZ encoding, Manchester encoding, etc. There are two components in RFID system and that are explained as below:

**1. RFID Tag** is an IC chip that has unique hexadecimal or electronic product code (EPC) contained in it. Here 'UNIQUE' refers that each and every code word of the tag is independent of other code word. The tag acts as a key that is capable of opening a particular lock. So, it is also named as RFID key. The tag is classified into 2 categories: **Active tags** and **Passive tags**.

**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 detectable to a longer range.

**Passive tags** are passive in nature i.e. they don't have any battery source built in them. They transmit low frequencies so they are detectable up to few meters of distance

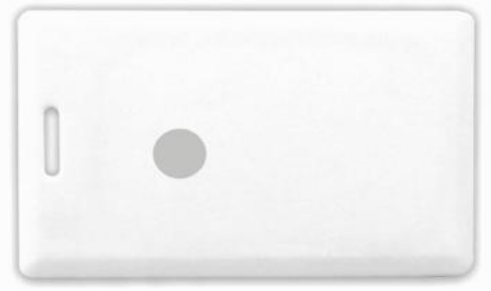

**Figure 2: RFID Tag/Key**

**2. RFID Reader** is a system which transmits and receives the data to the tag or key by radio waves.

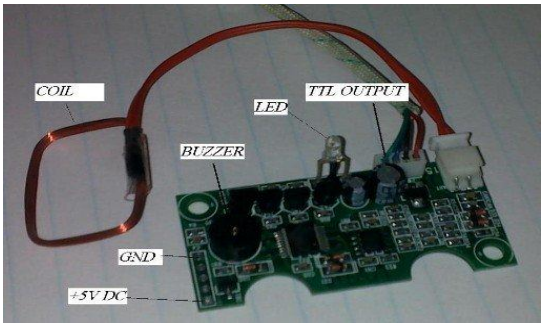


**Figure 3: RFID Reader**

## 3.2 GSM Characteristics

Global System for Mobile communications [8] (GSM) is an international standard for mobile communication. Originally, the acronym GSM stood for Groupe Spécial Mobile, a group formed by the Conference of European Posts and Telegraphs (CEPT) in 1982 to research the merits of a European standard for mobile telecommunications. Commercial service using the GSM system did not actually start until 1991. Instead of using analog service, GSM was developed as a digital system using TDMA technology.

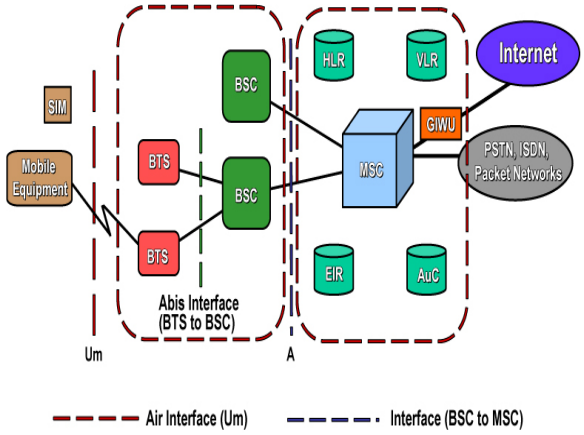


Figure 4: GSM Architecture

The acknowledgement is based on GSM short messages from cell phones, and the equipment used is SIM 300, is an industrial GSM module which provides four transmission modes including voice, data, short message, and FAX. It works in frequency band GSM 900MHZ or I800 MHZ, power voltage 3.4V to 4.5V and baud rate is 300 bps to 115 kbps, where between 1200 to 115 kbps is automatically configured.

Short Message Service (SMS) is a text messaging service component of phone, web, or mobile communication systems, using standardized communications protocols that allow the exchange of short text messages between fixed line or mobile phone devices. SMS text messaging is the most widely used data application in the world, with 2.4 billion active users, or 74% of all mobile phone subscribers. To communicate with an SMSC, an SMSC protocol is required. Most of these SMSC protocols are proprietary to the company that developed the SMSC. One widely used SMSC protocol is SMPP (Short Message Peer to Peer). It was originally a proprietary SMSC protocol created by Logica (an SMSC vendor). Now SMPP is an open SMSC protocol whose development is controlled by a non-profitable organization SMS Forum.

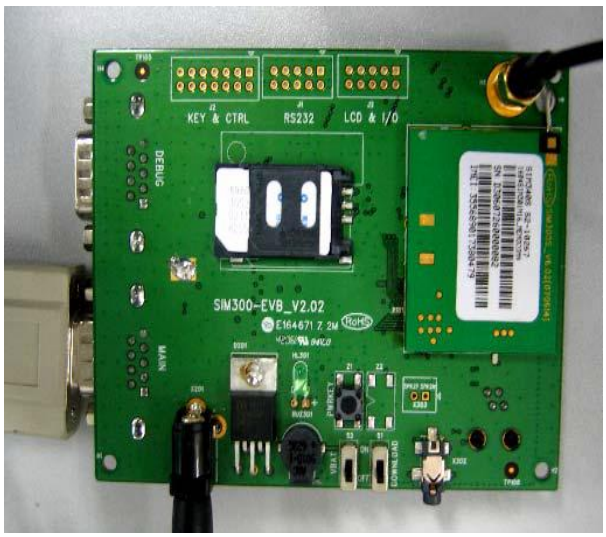


**Figure 5: GSM Module i.e. SIM 300**

AT command sets are used in data transmission, and the transmission rate is 2400bps, 4800bps, 9600bps, or 14400bps. SIM 300 **provides** a standard RS232 interface. The serial interface of SIM 300 is directly connected to the serial interface of PC computer.

## 3.3 Software Structure Of Remote Monitoring System

Software designed for the system is in Microsoft Visual Basics 6.0. The text mode is chosen for the transmission of SMS. AT commands are used here for the communication purpose.

AT+CMGF=1: for the selection of text mode of SMS.

AT+CMGS=”mobile number”: used to send the message on the given mobile number and after that Ctrl+Z is used to transmit the SMS.

## 3.4 Program and database

Database is the backbone of the system because it is having all the data fields like ID, Name, Mobile Number, Password and the attendance record. In this system, we are using MS Access as a database back end and Microsoft VB as front end for the user. In VB, there are three forms designed. The main form contains labels, buttons, data grid, ADO data connection, textbox, and timer and MSCOMM components. ADODC is used to retrieve data from database and the data taken is viewed on data grid. The UART (RS-232) is used to send and receive data. The RFID data is send to the system and then it will match with the database if it exists then the success message is shows else new records add/update button will appear and correspondingly the record is added and SMS will be sent.

Following are the screens designed in VB:

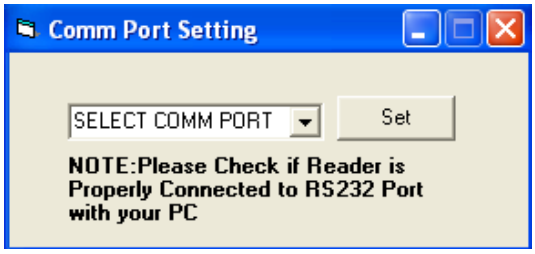


**Figure 6: Comport selection Window**

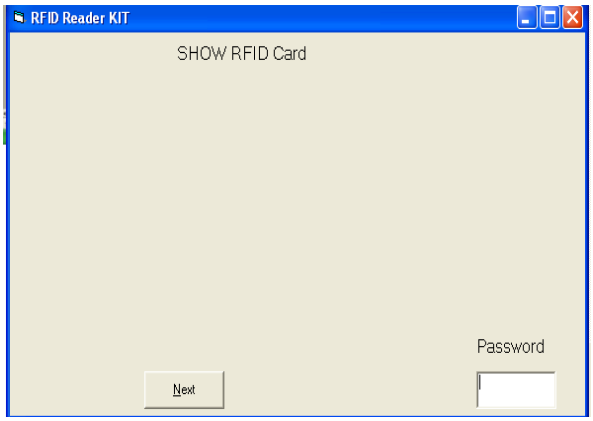


**Figure 7: Fresh screen when no attendance has been taken**

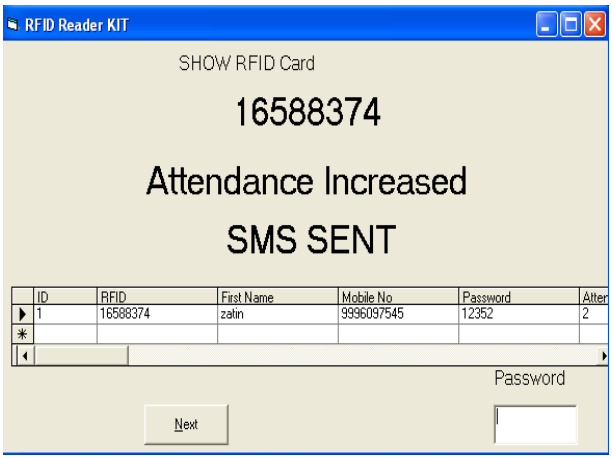


**Figure 8: Attendance taken and sent SMS notification**

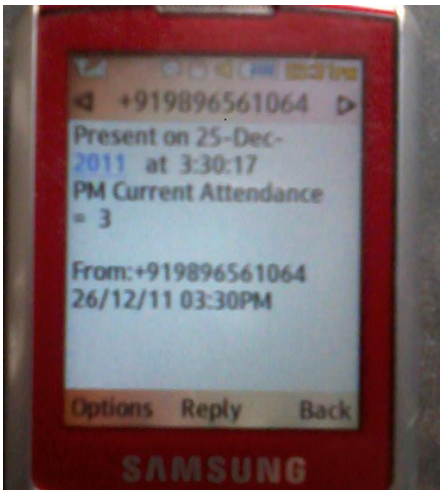


**Figure 9: Attendance notification on client’s mobile phone**

## 4. CONCLUSION

The designed system provides an acknowledgement to the client whose attendance has been taken and when. It also describes the total sum of attendance that is done by the client. There is a lot of benefits of the system i.e. students attendance record to the parents on daily basis, employee’s attendance notification as they punch: reduces the overhead in the compilation of attendance at the end of the month also the employee know that how much amount of salary he will get as he/she knows the total duration of work done.

With the help of this proposed model, one can easily monitor data from any remote location via SMS, there is no need of direct contact, internet or any kind of request send by user as it is push based technique.

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