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**RESEARCH ARTICLE**

# RFID and GSM Based Library Management

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## Abstract

Among the various technological devices and systems, Global System for Mobile Communication (GSM) is believed as an efficient and fast enough technique that can perform efficient, real time object identification and fast reporting. RFID technology facilitates automatic wireless identification using electronic passive and active tags with suitable readers. Advantage of Library Management System using RFID over Barcode technology are no line of sight required for reading, each tag can carry a lot of data (read/write). To improve the library facility automation we proposed a module which has RFID reader in addition, general library software with GSM support.



## Introduction

Libraries are essential in our life to improve our knowledge. At present, Barcode Technology is used for Library management system. Barcodes are widely used in library automation systems now but they affect severely due to line of sight issues. Here we tried to solve the issues which arise in the library by using RFID and GSM based library Management System. In some libraries RFID is used for automation but it is not implemented with alert system. The present system monitors issue of books in the circulation counter. Remind the user for renewal and returning of books is important factor to manage library system. 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.

GSM module or Internet connection are used for sending alert message. While issuing books, the RFID reader will get the information from the tag and it is sent to the data processing system. While returning of a book, the Reader gets information from the tag and is given to the processing system to update. The system sends SMS to the students to remind their due date and penalty due amounts if they failed to do renewal.GSM modem suitable for long duration data transmission.

## RFID

### 1) RFID Reader

The primary purpose of an RFID system in this application area is to detect the presence and absence of the student data to be transmitted wirelessly by mobile device, called a tag, which is read by an RFID reader and

processed according to the programmed instructions on the personal computer (PC). The ease with which RFID can be integrated into current operations depends on the openness and flexibility of the technology infrastructure especially the PC that will be used to Collect and collate RFID data. In RFID systems, an item is tagged with a tiny silicon chip plus an antenna collectively called a tag. The tag can be mobile or stationary and be scanned by stationary or mobile readers respectively, using radio waves. The tag can be encoded with a unique identifier, allowing tagged items to be individually identified by the reader. In each scanning case, a reader must scan the tag for the data it contains and then send that information to a database, which interprets the data stored on the tag. The tag, Reader and database are the key components of an RFID system. The electronic tag can be read during motion; no batteries are needed; no line of sight required for Wireless communication between the tag and the reader; Tags are almost indestructible, can be read even if covered with dirt or submerged. The tag is activated when it passes through a Radio Frequency (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 otherwise it gives a notification that the tag is not valid. The usage of RFID tags for storing information about the student and providing access only to the student based on the database.

*2) PIC Microcontroller*

The PIC16F877 is an 8-bit CMOS flash microcontroller from microchip Corporation. The core architecture of the PIC16F877 is based on a high performance Reduced Instruction Set Computer (RISC) CPU with only 35 single word (14-bit) instruction. Since the PIC16F877 uses RISC architecture , most of its instruction take only one instruction cycle for execution, except for the instruction that are used for program branching, which take two instruction cycles for execution. The PIC employs pipeline technique to execute the instruction, i.e., when the execution of one instruction is going on, the next instruction to be executed is fetched from the program memory.

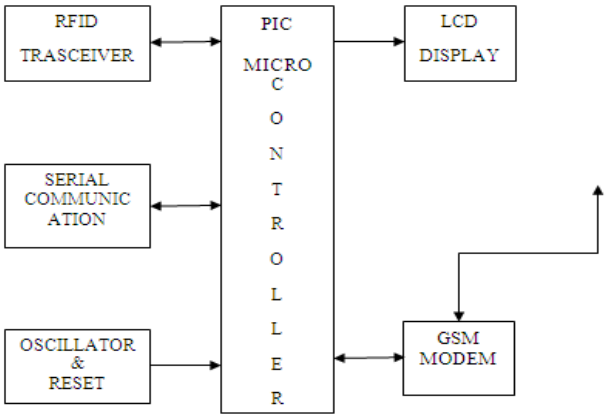


**Figure 1. Block Diagram**

## SERIALCOMMUNICATION

**Serial communication is often used either to control or to receive data from an embedded microprocessor. Serial communication is forms of I/O in which the bits of a byte begin transferred appear one after the other in a timed sequence on a single wire. Serial communication has become the standard for inter computer communication. Serial communication is the process of sending data one bit at a time, sequentially, over a communication channel. This is in contrast to parallel communication, where several bits are sent as a whole, on a link with several parallel channels. Serial communication is used for all long-haul communication and most computer networks, where the cost of cable and synchronization difficulties makes parallel communication impractical. Serial computer buses are becoming more common even at shorter distances, as improved signal integrity and transmission speeds in newer serial technologies have begun to outweigh the parallel bus's advantage of simplicity (no need for serializer and deserializer, or SerDes) and to outstrip its disadvantages (clock skew, interconnect density).**

**TYPES OF SERIAL COMMUNICATION**

- Synchronous mode

- Asynchronous mode

In synchronous transmission, data is sent in block at a constant rate, i.e., the frequencies of transmission and reception are the same. Transmission and reception take place simultaneously. The beginning and end of a block are identified with specific byte or bit patterns. In general, synchronous transmission is used for high transmission speed of more than 20 Kbits/second. In asynchronous transmission, each data character has a bit to identify its start and one or two bits to identify its end. Here, each character is identified individually. The character can be sent at any time, without checking the receiver, reception and transmission are not synchronized.

RS-232 is a standard that standard that describes the function of the signal and handshake pins for serial data transfer. A major problem with RS-232C is that it can transmit data reliably for only about 50ft (16.4 m) at its maximum rate of 20,000 Bd. If longer lines are used, the transmission rate has to be drastically reduced. This limitation is caused by the open signal lines with a signal common ground that are used in RS-232C.

*STANDARD SERIAL INTERFACE*

The serial port is full duplex, meaning it can transmit and receives simultaneously. It is also receive-buffered, meaning it can commence reception of a second byte before a previously received byte has been read from the register. (However, if the first byte still hasn't been read by the time reception of the second byte is complete, one of the bytes will be lost.) The serial port receive and transmit registers are both accessed at Special Function Register SBUF. Writing to SBUF loads the transmit register, and reading SBUF accesses a physically separate receive register. The serial port can operate in 4 modes:

Mode 0:

Serial data enters and exits through RxD.TxD outputs the shift clock. 8 bits are transmitted/received (LSB first). The baud rate is fixed at 1/12 the oscillator frequency.

Mode 1:

10 bits are transmitted (through TxD) or received (through RxD): a start bit (0), 8 data bits (LSB first), and a stop bit (1). On receive; the stop bit goes into RB8 in Special Function Register SCON. The baud rate is variable.

Mode 2:

11 bits are transmitted (through TxD) or received (through RxD): start bit (0), 8 data bits (LSB first), a programmable 9th data bit, and a stop bit (1). On Transmit, the 9th data bit (TB8 in SCON) can be assigned the value of 0 or 1. Or, for example, the parity bit (P, in the PSW) could be moved into TB8. On receive; the 9th data bit goes into RB8 in Special Function Register SCON, while the stop bit is ignored. The baud rate is programmable to either 1/32 or 1/64 the oscillator frequency.

Mode 3:

Mode 3 is the same as Mode 2 in all respects except baud rate. The baud rate in Mode 3 is variable. In all four modes, transmission is initiated by any instruction that uses SBUF as a destination register. Reception is initiated in Mode 0 by the condition RI = 0 and REN = 1. Reception is initiated in the other modes by the incoming start bit if REN = 1.

*MAX232 IC:*

The MAX232 is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits, so that devices works on TTL logic can share the data with devices connected through Serial port (DB9 Connector).

*LIQUID CRYSTAL DISPLAY*

A Liquid crystal display is interfaced to microcontroller unit that are used to display whether the tag is valid or not. A liquid crystal display (LCD) is a thin, flat panel used for electronically displaying information such as text, images, and moving pictures. Its uses include monitors for computers, televisions, instrument panels, and other devices ranging from aircraft cockpit displays, to every-day consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones. Among its major features are its lightweight construction, its portability, and its ability to be produced in much larger screen sizes than are practical for the construction of cathode ray tube (CRT) display technology. Its low electrical power consumption enables it to be used in battery-powered electronic equipment.

*GSM (Global System for Mobile communications)*

GSM is the most popular standard for mobile phones in the world. Global System for Mobile Communications is a 2nd Generation cellular mobile system. Global System for Mobile (GSM) is a second generation cellular standard developed to categorizes Voice services and data delivery using digital modulation. It has got full international

Capability. The main application of GSM in our project is that it provides Support of Short Message Service (SMS). A GSM modem is a wireless modem that works with a GSM wireless network.

*SIM900A GSM Module:*

The SIM900 GSM module which is manufactured by SIMCom. SIM900 is a quad-band GSM/GPRS engine that works on frequencies GSM850MHz, EGSM 900MHz, DCS 1800MHz and PCS 1900MHz. SIM900 features supports the GPRS coding schemes CS-1, CS-2, CS-3 andCS-4. The configuration of 24mm x 24mm x 3mm, SIM900 can meet almost all the space requirements in User's applications, such as M2M (Mobile to Mobile), smart phone and other mobile devices.

## CONCLUSION AND FUTURE WORK

Today's library RFIDs are very suitable for library application since they have longer read ranges. Although RFID technology has matured and offers an ideal solution for libraries to replace their barcodes. In this project we designed alert system module about Library book renewal, return and library dues. There are number of library management systems are available but here we proposed an optimized solution using RFID and GSM mobile technology. It solves almost all the library related problems. In developed countries like USA, England, German and Japan RFID and GSM technologies are widely used for library management. But in India we don't implemented any automated system for RFID based library management system. Keeping this in mind we have proposed this system with low cost. Our future work is to design a complete college automation system using RFID, GSM and web enabled services.

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