



# Library@16: Smart Library Management System

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**Abstract:** Nowadays, the scale of library is expanding and the quantity of books is increasingly large. Besides, with the growing popularity of open shelf reading the phenomenon of misplaced books is becoming more & more common. Thus, readers finding books and library administrators checking books are also becoming increasingly difficult. The misplaced books can be identified by using a pair of motor and a RFID reader attached on the shelf. The position of the corresponding book will be displayed on the screen. The data transfer takes place with the help of GPRS technology. However, what has been used most widely now is the library management system based on barcode, whose operation process is beyond complicated. What's more, the barcode has a short life and breaks easily, which greatly influences the efficiency of the library management.

**Keywords:** RFID, atmega16 microcontroller, Embedded c, GPRS

## I. INTRODUCTION

In this paper, we propose an RFID system based on RFID technology and GPRS technology. And we design a corresponding handheld device client software to realize a visual book search and management system. This system can not only greatly improve the efficiency of book search and management but also save the manpower and material resources to a large extent, which has a practical application value. The idea of monitoring and sensing the library environment from a location and to identify the materials, present inside the library for easy access of the library which was observed to be the most common issue. In this paper the problems & issues faced in the library environment like locating the misplaced or misshelved book or materials, reducing the manual work & ease access of the books are done and a solution is developed that could overcome these problems with the better enhanced work. Radio frequency identification (RFID) technology which is also known as electronic tag (E-Tag) technology, is a non-contact automatic identification technology. It can automatically identify the target object by radio frequency signal, and can carry out the object tracking and data exchanging at a very fast speed. The characteristics of the RFID technology are as follows: Firstly, it's a kind of non-contact data acquisition technology which can realize automatic identification and management; Secondly, any information can be written in, so that it can meet the demand of continuously increasing quantity of information and improving information processing speed; Thirdly, it can recognize targets at a very fast speed. That's to say, once the targets enter the magnetic field, readers can handle multiple label data immediately and simultaneously to realize batch identification; High security can't be ignored as well as a result that you can set password protection for the reading and writing of the tag data. In addition, it greatly improves the automation of

information collection in circulation management and solves the managing problems about the goods' information in the motor process. In theory, the RFID technology has become a research hotspot in the respect of indoor location technology owing to its advantages of high security, high reliability, easy to operate, carrying a large amount of information, information acquisition fast and accurately, wide application and long service life, which is incomparable with the conventional label technology. General Packet Radio Service (GPRS) is a packet oriented mobile data service the 2G and 3G cellular communication system's global system for mobile communications (GSM). GPRS was originally standardized by European Telecommunications Standards Institute (ETSI) in response to the earlier CDPD and i-mode packet-switched cellular technologies. It is now maintained by the 3rd Generation Partnership Project (3GPP). GPRS usage is typically charged based on volume of data transferred, contrasting with circuit switched data, which is usually billed per minute of connection time. Sometimes billing time is broken down to every third of a minute. Usage above the bundle cap is charged per megabyte, speed limited, or disallowed. GPRS is a best-effort service, implying variable throughput and latency that depend on the number of other users sharing the service concurrently, as opposed to circuit switching, where a certain quality of service (QoS) is guaranteed during the connection. In 2G systems, GPRS provides data rates of 56–114 kilobit/second. 2G cellular technology combined with GPRS is sometimes described as 2.5G, that is, a technology between the second (2G) and third (3G) generations of mobile telephony. It provides moderate-speed data transfer, by using unused time division multiple access (TDMA) channels in, for example, the GSM system. GPRS is integrated into GSM Release 97 and



newer releases. At first, the RFID readers should be placed at a certain distance based on the situation of every library. When the enquirers are to search for books, they should input the information such as the title, call number or other information of the books they want to find in the terminal equipment with related software. And the information can be sent to the system server. The system server will send the feedback information to the client device after processing. Then, the related information of the inquired books e.g. the book's name, author, date of publication, press, call number, and other basic information) can be displayed on the inquiry terminal equipment. Besides, location information of the high frequency passive RFID reader indicating the position of the book can be shown as well. The inquirer can find the bookshelf that is indicated by the RFID reader. And then all he needs to do is just finding the wanted book in the related bookshelf. When a searcher is determined to put a book in or remove one from a bookshelf, what he has to do is letting the book touch the RFID reader related to the bookshelf (based on the noncontact feature of the RFID electronic tags). Then, the high frequency passive RFID reader will immediately feedback the information which is stored in the RFID electronic tags attached to the book to the system server. And the system server will revise the information of the book's location stored in the database as soon as possible according to the feedback information. Based on this, the other inquirer can find the real-time book location information timely. Consequently, users can not only query the exact location information of the book they wanted no matter where and when, but they can find the book according to the route chart quickly and accurately. Besides this the inquirer can renew the book via GPRS. The system has solved the problems that finding books wastes too much time and energy caused by books misplaced or unclear instructions on the bookshelves. Besides, it makes up the defects of the existing system that can't provide accurate visual orientation of books. And it can greatly improve the borrowers' and the managements' search efficiency doubtlessly.

## II. RELATED WORKS

In library, the management of books is very complication and timing consuming. The location of books could be altered by librarian, students, teachers and anyone around the library. Therefore, allocating a book is not an easy task in big library. Indoor positioning is an important technology to help storage management and customer services providing [1]. RFID provides a good wireless platform to facilitate indoor positioning [1]. The problems & issues faced in the library environment like locating the mis-placed or mis-shelved book or materials, reducing the manual work & ease access of the books are done and a solution is developed that could overcome these problems with the better enhanced work [2]. In [3], a RFID Gen2 reader on a moving cart can offer tag reading rates close to

100%, provided that multiplexing (and not splitting) is used at the antennas connected to the reader, by exploiting the changes (due to mobility) of the wireless propagation channel. Library RFID systems could largely benefit of such cost-effective approach, given that only a single reader is employed. In [4], a 13.56 MHz RFID system for the management of the library is used. We evaluate the influence that papers or other RFID tags give to the resonant frequency of an RFID tag [4].

In [1], Image matching is adopted together with RSS based RFID positioning method to improve the accuracy and robustness of the book positioning system. [1], The first step is to locate the bookshelf containing the book by neural network based RFID. This is to narrow down the area for later image matching to enhance speed and efficiency. [2] The process of borrowing, returning and other details with regards to the student and book, the sequence done at admin desk is carried out in this process of implementation. For which the compatible handheld reader Motorola MC 9090 is used. The database used, is the internal database. In [2] The user when comes to the administration desk, the user need not require help from Library staffs that the user reads the tag present in the ID card of the user and proceed according to the user's requirement like renewal, borrow or return. The image of the user and details are made to display through the user interface. The tools used are like the Visual Studio 2008 in the platform of .NET framework. In [3] the RFID tag is attached on goods such as books. In this case, the resonant frequency of RFID tag is changed by goods. The resonant frequency of the tag attached to a book is not the same compared with the case of tag only. As the volume of book increases, the resonant frequency seems to be low. Normally, the goods act as a parasitic capacitance for the RFID tag and In [3] if other RFID Tags are near the target RFID tag, the resonant frequency of target tag is changed. For example, the situation that two pieces of tags are adjacent occurs when thin books are stood on the book shelf. This influence is large compared with the influence of other goods such as a book. In order to show this difference clearly, using the method shown in Fig. 9, the relation between the resonant frequency and the distance between two pieces of tags is evaluated. Figure 10 shows the results of this evaluation. It is clearly shown that as the distance between two pieces of tags becomes narrow, the resonant frequency decreases greatly. On the other hand, the combination between the tags is small if the distance of two tags is separated more than 7 cm. From [2] the common problem of mis-placed & mis-shelved searching of the books & materials can be very easily reduced and also there is no need of arranging the books in the order that any book can be placed anywhere inside the library and the same can be located.

the change of the resonant frequency of RFID tag is low [3]. Similarly when renewing is required the user himself/herself can use the reader and renew it. The user



need not wait or stand in queue for the Librarian to come and help. As that of borrowing, a form is created and database containing the details relevant to the form is created[2].

- Create an easy tounderstand user friendly environment.
- Attractive user interfaces to navigate through the system for the users.

### III. SYSTEM MODEL

The proposed system is based on the RFID technology where RFID tags are embedded on the books and on the user cards and RFID readers are used to read these tags for proper, efficient and theft controlled operation of libraries. Most of the drawbacks associated with the bar-code technology can be overcome using the proposed system. GSM technology is used in the proposed system in order to alert the user with the books taken, due date for return and the fine to be paid if not returned on time. The RFID tags are placed on every book and on the ID card of the user. Attention is given while programming the stages as they consist of unique codes.

The below flowchart showing the working of the project. The whole system is divided in to two sections

1. Library section
2. Rack section

The objective of this project is to develop a system that can handle & manage the activities involved in a library in an efficient & reliable way. Less managing personnel & easy searching availability are major goals in this project

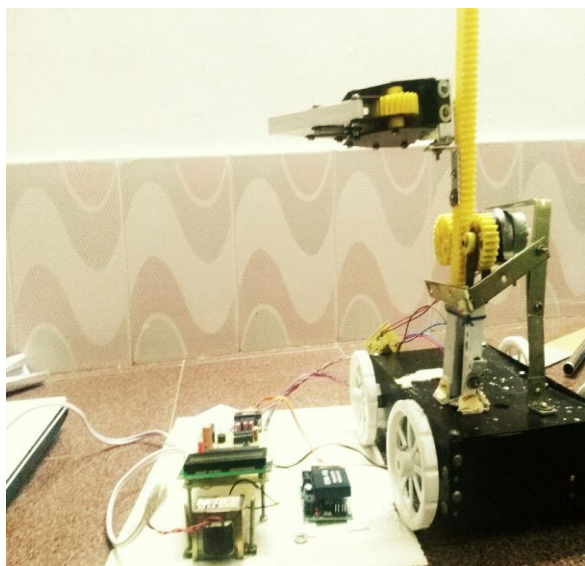
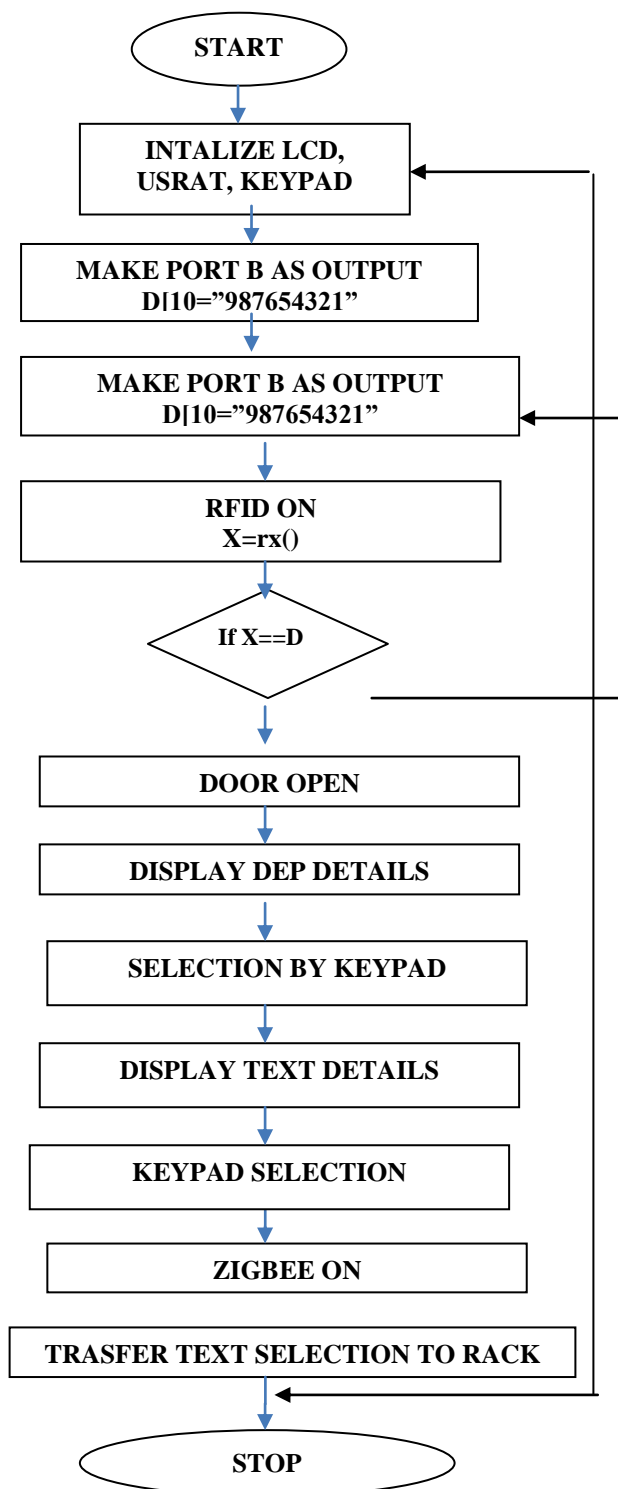


Fig.physical connection

#### Objectives

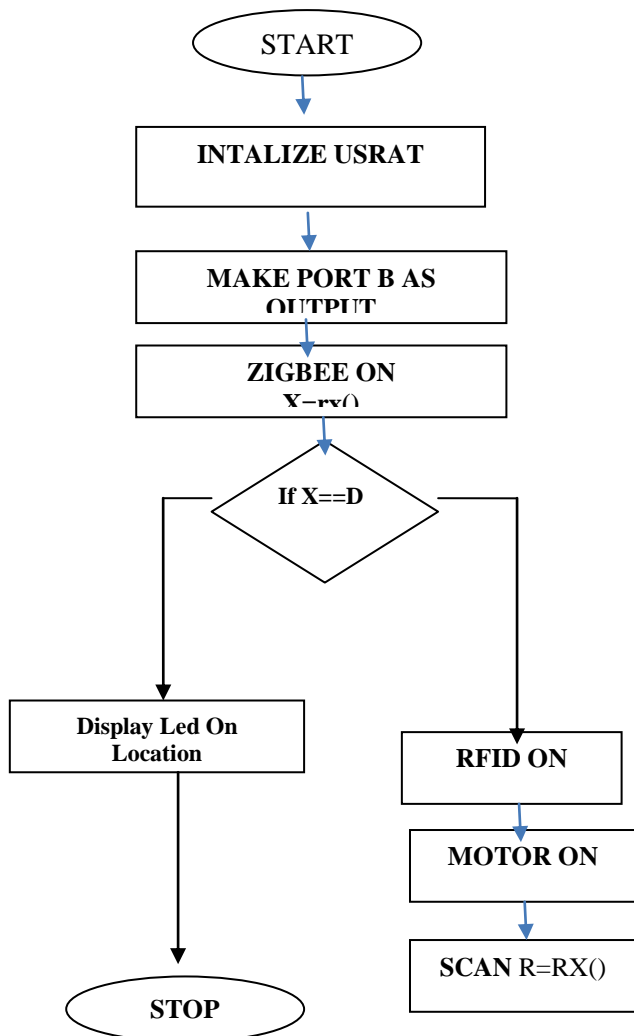
- Develop a system that can replace the manual library managing system.
- Develop a database which stores user details & book details.
- Give reliable search facility for the users.
- Administrator, librarian & users should have separate logins.

### FLOW CHART OF LIBRARY





**FLOW CHART OF RACK**



**LIBRARY SECTION**

- Initializing all interfaces like LCD,KEYPAD,UART etc.
- Information about each user(students)will be stored in the system.
- The registered students can only enter in to the library by checking their RFID tag.
- If the tag is matched, door will open and the students can select books through keypad ,it will display on the screen

**RACK SECTION**

- After entering the tag no required book, system will find its position in the Rack.
- If the value is missed, scanning will occur automatically.
- After scanning, the system identifies the position of required book & Led will be switched ON.
- Even in case of misplacement of book, the particular position will be identified by the system.

**The hardware requirement of this project includes**

- ATMega32
- LCD Module
- Keypad
- MAX 232
- Power supply
- DC motor
- Motor driver
- PC
- ZIGBEE
- GPRS

The software used is AVR Studio 5. It is a Windows based Integrated development environment from the Atmel Technology incorporated AVR microcontroller families. The various features of this software are

- Capability to work in C programming Environment
- Creates source code using the built in editor.
- Compile and link source code using various tools.
- A compiler, linker and library come with AVR Studio.

An efficient computerized **Library Management System** will enhance the effectiveness of the library. A good library management system should enable librarian to manage library resources in a more effective way to save time and effort. **Library Management System** Encourage learning and teacher-student joint effort by enhancing college library's productivity and access to educational resources. our product helps advancement in both the library and classroom.

The library management system centralizes the whole distribution process of ordering books, issuing of books & replacement of books. It generates real time report and user friendly to students & staff members. Now days the systems developed on open source so we can access these system's easily from anywhere & anytime and easy to navigate. These Systems helps to librarian to manage a library in easy way & it avoids all types of human mistakes. Students can easily login & access books, according to their requirement. Today in many schools and colleges, librarians using library management system for managing issuing & returning the books. Collecting Fine and payments due from students, we can generate Reports for Record-Keeping.

- Patrons find what they are looking for quickly & easily.
- Reminders for due dates allows patrons to submit borrowed materials in time& also automatic renewal of books.
- RFID enabled patron cards allows for easy patron identification.
- Low cost.
- Reduced time that spending for finding the misplaced / mis shelved books.





- Details of books are correctly maintained and thus reduces manual work.

#### IV. EXPERIMENTAL RESULTS

The process of borrowing, returning and other details with regards to the student and book, the sequence done at administration desk is carried out in this implementation process. There are three categories based classifications that include Student Details, Book Details and Date Details. Under Student Details records of the student's name, Course, year, Department with their respective EPC ID's is stored into database. Similarly for the book details also each book is given a unique ID that is related to the details of the book like the name, Author's name, edition, etc. In date details the issue date, return date, renewal period availability of the book conditions are included.

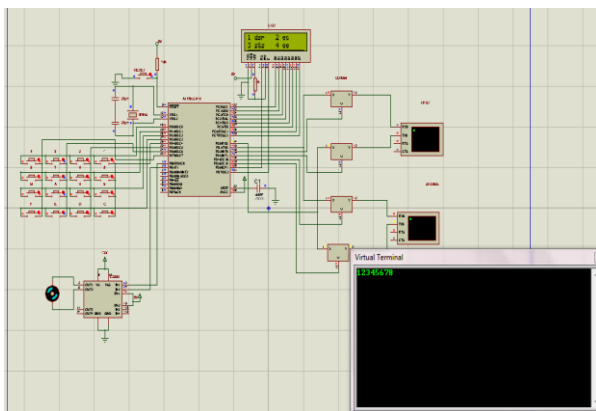


Fig 1: PROTEUS window for LIBRARY section

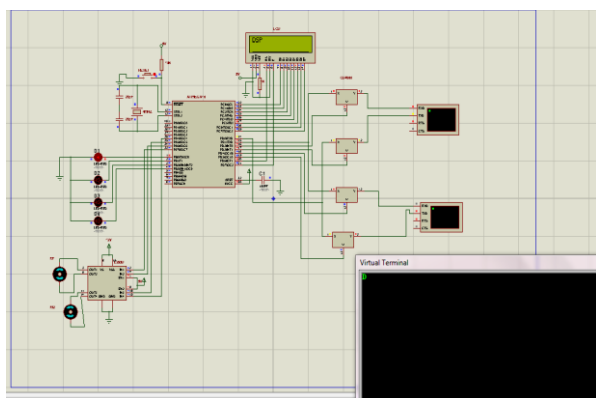


Fig2: PROTEUS window for rack section

#### V. CONCLUSION

The intelligent book search and management system which is based on RFID and GPRS technology breaks through the traditional fixed terminal query mode .It solves the problem of existing bar code technology has at present that it can't provide the location of books precisely and cant show the concise rout guide picture. This smart

book system has solved the problems that finding books waste too much time and energy caused by books misplaced or unclear instructions on the book shelves .Moreover it improve the speed for readers to find the books. Problems & issues faced in the library environment like locating the misplaced or mis shelved book or materials, reducing the manual work & ease access of the books are done and a solution is developed that could overcome these problems with the better enhanced work.

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