

Library Management Using RFID & Bluetooth

Shruti Warriar, Ronald Kotian, Maithri Warriar, Kavita Venna

Abstract— A library is an organized collection of sources of information and similar resources, made accessible to a defined community for reference or borrowing. With the advancement of technology, libraries should also be digitized. People use their smart phones more which is more convenient thus we are making use of Bluetooth technology, hence we will bring the library to the phone. Our mobile phones will consist of the databases of books, CDs, magazines etc. which will make it convenient for us to know about their availability within the library. To reduce human intervention and errors, issue and reissuing of the books will be done with help of RFID technology.

Index Terms— Bluetooth, Radio frequency Identification technology, RFID readers, RFID Tags.

I. INTRODUCTION

In the traditional sense of the word, a library is a collection of books and periodicals. It can refer to an individual's private collection, but more often it is a large collection that is funded and maintained by a city or institution. However, with the collection or invention of media other than books for storing information, many libraries are now also repositories and access points for maps, prints or other artwork, microfilm, microfiche, audio tapes, CDs, LPs, video tapes and DVDs, and provide public facilities to access CD-ROM and subscription databases and the Internet. Thus, modern libraries are increasingly being redefined as places to get unrestricted access to information in many formats and from many sources. As size of the library increases, it becomes more and more tedious to search for a book and issue or return a book. Thus, more and more staff members are required to manage the library. RFID (Radio Frequency Identification) technology & Bluetooth technology is proven to be a promising alternative in relieving the library staff from time-consuming routines. RFID & Bluetooth based systems are going to revolutionize the entire library automation systems. In this project we are going to develop library automation system, which will track the books, whether they are issued or they are in library, so that library user will get the instant information. RFID is an innovative automated library with the support of RFID technology would be a "Book smart Library" and a "self service station" that insists least intervention by library personnel. With the help of Bluetooth & RFID technology it is helpful in taking inventory, finding missing items and identifying misfiled items. Bluetooth is a

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wireless technology standard for exchanging data over a short distance in a very efficient and lucid way. It uses short wavelength radio transmission in the ISM band (from 2400-2480 MHz) from fixed and mobile devices, creating personal area network (PANs) with high levels of security [1].

II. TECHNOLOGIES AND THEIR WORKING

A. BLUETOOTH TECHNOLOGY AND ANDROID

Bluetooth, which is mainly used for data exchange add new features to smartphones. It requires low power which results to long battery life and can be used within the range of 30-ft which is reasonable within a library. This range can be increased using Bluetooth repeaters. Moreover the data transfer rate of the Bluetooth technology is quite acceptable i.e. 3-4 Mbps. So finally due the aforesaid benefits we decided to make use of Bluetooth technology to in library management

We thereby make use of an android app which interfaces the user with the library by giving the user some details of the books that are present within the library. Android is a mobile operating system based on Linux kernel that is developed by Google. With the user based on direct manipulation, android is designed primarily for touchscreen mobile devices such as smartphones and tablet computers. Android is popular with technology companies which require a ready-made, low cost and customizable operating system for high-tech devices. The application is made with the help of the software Basics 4 Android (B4A) as shown in the figure. The main advantages of using Bluetooth tech is that it provides limited area of access which is quite benefit for our system and that it does not interfere with normal signaling of devices.

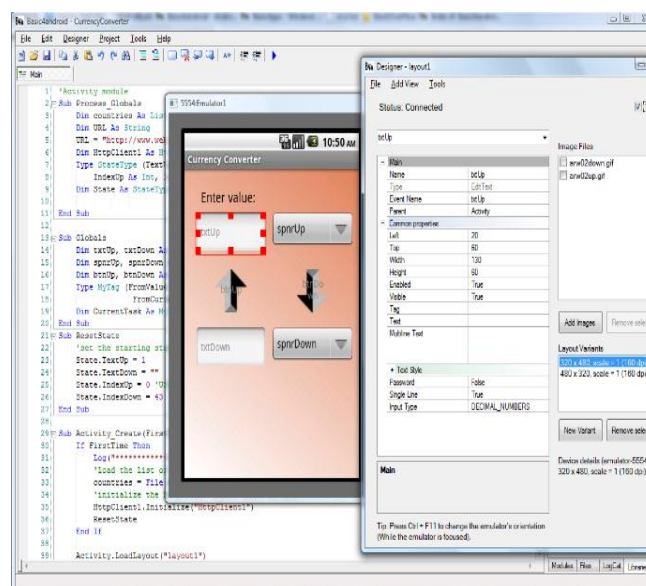


Figure 1 Android Application (Basics 4 Android)

The Bluetooth module used will be as follows:



Figure 2 Bluetooth Module- HC05

HC-05 is a class-2 Bluetooth module with serial port profile, which can configure as either master or slave. A drop-in replacement for wired serial connections, transparent usage. You can use it simply for serial port replacement to establish connection between MCU, PC, phones etc.

B. RFID TECHNOLOGY

RFID system consists of following four components [2]:

- RFID tags
- RFID readers
- Antenna
- Server

RFID Tags: Tags are thin labels which can be fixed inside a book's back cover. RFID tags are made up of carbonic structure which contains a magnetic strip or coil layer inside the tag which helps in sensing the tags. This magnetic layer inside the tag helps in generating the magnetic field. The tag contains a unique serial number like "0600394791 000345" which is used for the authentication of the user. When we bring the tag in front of the reader or in a close Proximity of the reader, the reader antenna senses the tag and checks for the unique serial number of the tag. If the tag is registered in the reader's database then the reader authenticates the tag otherwise the reader shows an error and gives the message that the tag is not registered or the tag is not authenticated. The tag contains the information to be transferred in binary. There are two types of tags- Active and Passive. We use passive tags for the system.

A passive tag is an RFID tag that does not contain a battery; the power is supplied by the reader. When radio waves from the reader are encountered by a passive RFID tag, the coiled antenna with the tag forms a magnetic field. The tag draws power from it, energizing the circuits in the tag. The tag sends the information encoded in the tags memory. These tags are typically much less expensive to manufacture. These tags are smaller in size and are readable over a very long period of time, even after the product to which the tag is attached has been sold

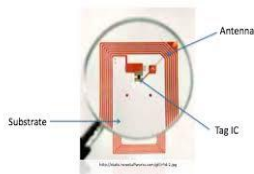
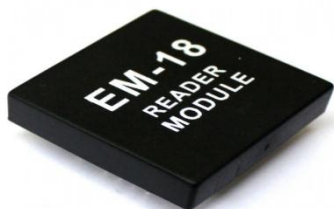


Figure 3 Passive tags



and is no longer been tracked.

RFID Readers: RFID readers are used to interrogate data stored in tags. It contains a radio frequency module, a control unit and an antenna to interrogate electronic tags via radio signals. The antenna inside the reader generates electromagnetic field. When a tag passes through the field, the information stored on the chip in the tag is interpreted by the reader and sent to the server, which, in turn, stores or retrieves information about the book's issue or return [2].

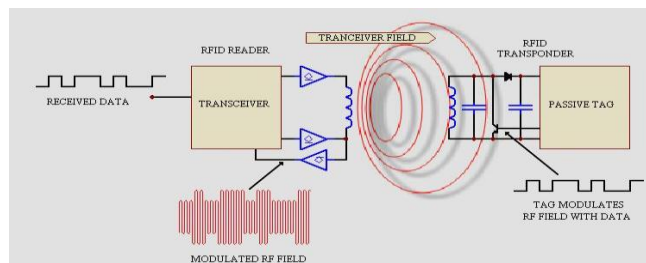


Figure 5 Transceiver- The working of reader and tag

Antenna: The antenna resides inside the reader. It generates electromagnetic field. Whenever a tag comes in close proximity of the electromagnetic field it gets activated and it is able to read and write data to the reader by producing radio signals. Antenna behaves like a communication media between the tag and the reader [1].

Server: Server is a computer that contains a database where information related to book's issue and return are stored and this information can be retrieved when needed. Server connected to the reader via a cable. It receives information from the readers when the tag is brought in close proximity of the reader.

The Objectives of the project in a nutshell is to be able to create a database containing details of all the books and other items in the library. To be able to search for a given book or books by using Bluetooth. To be able to issue or re-issue a book in a more efficient way.

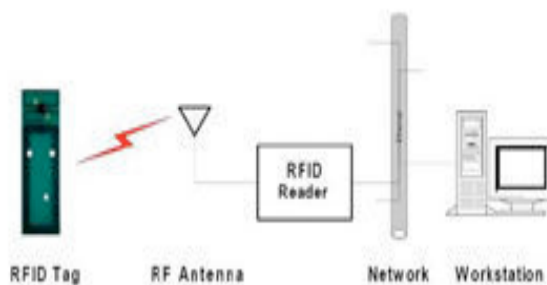


Figure 6 Components of RFID based Library management

III. METHODOLOGY

The process involved is divided into a total of five modules that are described as follows:

A. Module 1 The Initial Setup

Whenever a new book is acquired by the library, an RFID tag is attached into the book with the relevant information like, call number, accession number, book number, etc. The detailed information regarding the book is also captured in the computer database. The computer database also stores all information for individual users (patrons) of the library. Each patron is supplied with registered RFID cards. These cards carry identification data and other associated details like: address, roll no., and telephone no. etc. for each patron. Similarly the database of books will be fed into the application for each mobile user so that he can locate and check the availability of the book in the library [10].

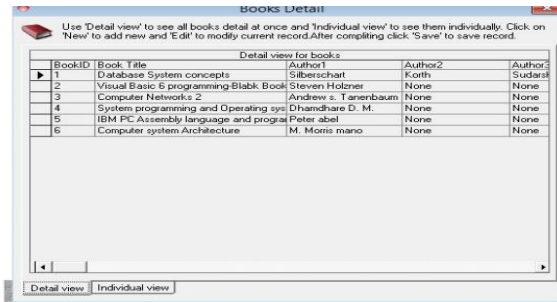


Figure 7 Database of books in admin's system

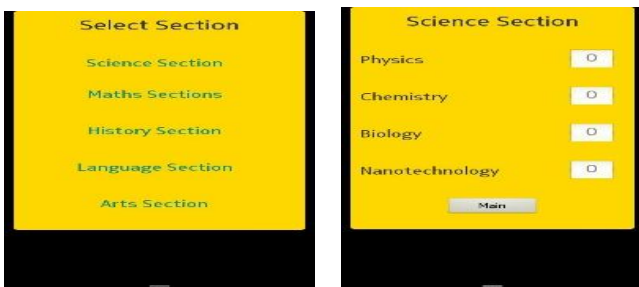


Figure 8 Database of the mobile application

B. Module 2 The Login Process

There is an administrator with special privileges who has a unique master password controlling the GUI of the RFID LMS system. As soon as he powers on the system, the first screen displays the LOGIN dialogue box. The admin then enters the corresponding password [11].



Figure 9 Login page for administrator

C. Module 3 The Issue Process

When a patron needs to get a book issued, he can get it done without any manual intervention. He simply flashes RFID card in front of the RFID reader and it automatically opens

his/her login account page. He then flashes the selected books to be issued, one by one in front of the RFID reader. The computer records all these data against his name. Finally a message is displayed informing the patron that the ISSUE has been successful. The user takes the books for a specified time from the library after which he has to return the books to the library.

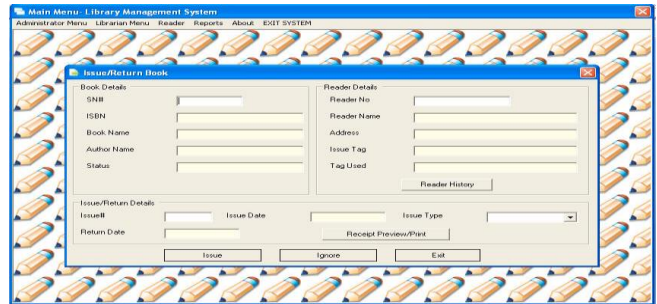


Figure 10 Issue of books



D. Module 4 The Return Process

When a patron wants to return books, he simply places the books again in front of the RFID controller and the books automatically are adjusted for return against the patron's name.

E. Module 5 Fine Calculation

When a patron wants to return books, he simply places the books again in front of the RFID controller and the books automatically are adjusted for return against the patron's

Figure 11 Return of books

name. For this the patron during the time of returning the book, clicks or activates the fine calculation button on the display area or GUI panel. The same returns the fine.

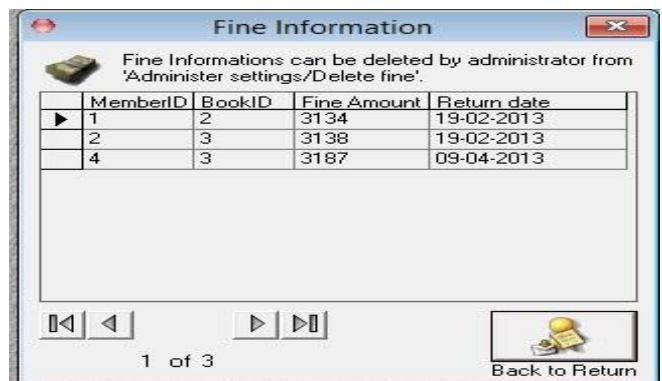


Figure 12 Fine calculation

IV. WORKING AND IMPLEMENTATION.

C. BLOCK DIAGRAM

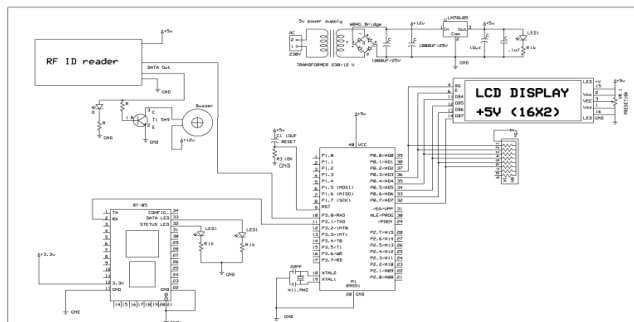


Figure 13 Circuit diagram for library management using Bluetooth & RFID for mobile

This block diagram consists of 3 main parts, the first part is the RFID tag. The second part is the Bluetooth Module which is HC05 and the last part is the microcontroller which is 89S51. The user is interfaced to the Bluetooth module with the help of an android application present within the phone.

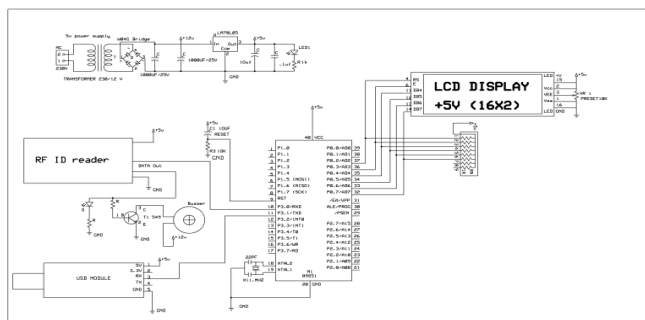


Figure 14 Circuit diagram for library management using Bluetooth & RFID tag for pc module

This block diagram is similar to the previous block diagram except the Bluetooth module is replaced by a USB module which is used to interface the circuit to the computer so that the issuing/reissuing of books can be done and this data will be entered into the computer with the help of the software-Visual Basics.

V. CONCLUSION

Radio Frequency Identification (RFID) and Bluetooth Systems have been in use in libraries for book identification, for self-checkout, for anti-theft control, for inventory control, and for the sorting and conveying of library books. These applications can lead to significant savings in labour costs, enhance customer service, lower book theft and provide a constant record update of new collections of books [9]. It also speeds up book borrowing, returning and monitoring, and thus frees staff

From doing manual work so that they could be used to enhance user-services task. The efficiency of the system depends upon the information to be written in tag. To yield best performance, RFID readers and RFID tags to be used, must be of good quality. We have added Bluetooth technology for the added benefit of the user to not have to search for the availability of the book in the library. Neither do they have to ask the librarian for the same. Hence, the system has become convenient.

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