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Use Of RFID In Library Management System: A Practical Implementation

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Abstract
Radio-frequency identification (RFID) is an automatic identification method, which can store and remotely retrieve data using devices called RFID tags. The technology requires cooperation of RFID reader and RFID tag. The RFID based LMS facilitates the fast issuing, reissuing and returning of books with the help of RFID enabled modules. It directly provides the book information and library member information to the library management system and does not need the manual typing. This technology has slowly begun to replace the traditional barcodes on library items and has advantages as well as disadvantages over existing barcodes. The RFID tag can contain identifying information, such as a book's title or code, without having to be pointed to a separate database. The information is read by an RFID reader, which replaces the standard barcode reader commonly found at a library's circulation desk. For which utmost care has been taken to remove manual book keeping of records, reduce time consumption as line of sight and manual interaction are not needed for RFID-tag reading and improve utilization of resources like manpower, infrastructure etc.

Keywords
RFID tags, RFID readers, Antenna,Server

I. Introduction

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A. The Technology Behind RFID

With RFID, the electromagnetic or electrostatic coupling in the RF (radio frequency) portion of the electromagnetic spectrum is used to transmit signals. An RFID system consists of an antenna and a transceiver, which reads the radio frequency and transfer the information to a processing device (reader) and a transponder, or RF tag, which contains the RF circuitry and information to be transmitted. The antenna provides the means for the integrated circuit to transmit its information to the reader that converts the radio waves reflected back from the RFID tag into digital information that can then be passed on to computers that can analyze the data.

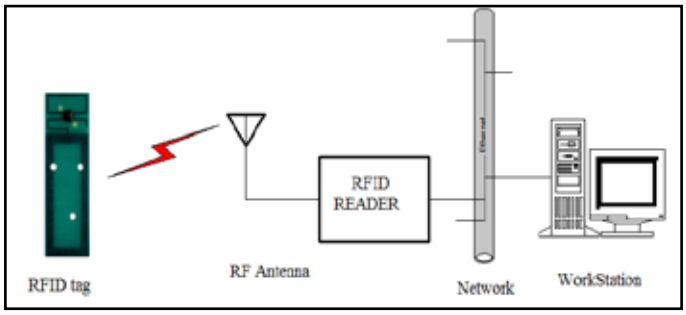

Fig 1: Underlying components and technology

B. Background and Related Work

There is a boom in the industry to use RFID technology in the recent years. Research and development in this field has made this technology to be used in supply chain management, attendance management, library management, automated toll collection etc. There are multiple RFID standards being used in the industry. The existence of these multiple standards helps the users of this technology to choose between various standards and choose the approach which best suits them and then implement it for communication between an interrogator(RFID reader) and the RFID tag. In more specific terms relating RFID to library, RFID in libraries was first developed and was proposed to the world in the late 1990s. RFID technology aimed at increasing the overall workflow in the library to the maximum as possible and to make everything like book issuing to book returning automatic. Singapore was the first country to introduce RFID in libraries and the Rockefeller University in New York was the first academic library in the U.S to make use of this technology. Farmington Community Library was the first public institution to use the RFID technology. Both Rockefellers University and Farmington started using RFID in1999. In Europe, the first public library to use RFID is the Hoogezand-Sappemeer, the Netherlands, in 2001, where borrowers were given options. It was proved in a survey that70% people adapted to the RFID technology quickly. Overall, RFID technology is used in United States the most and then in United Kingdom and then in Japan. But there is an issue that this technology is still costly in today's market for the smaller organizations as compared to the larger organizations.

C. RFID in Library

A library is a collection of information, sources, resources, books, and services, and the structure in which it is housed. Apart from books many libraries are now also repositories and access points for maps, prints, or other documents on various storage media such as microform (microfilm/microfiche), audio tapes, CDs, LPs, cassettes, video tapes, and DVDs. Libraries have materials arranged in a specified order according to a library classification system, so that items may be located quickly and collections may be browsed efficiently. Reference stacks are different which has only reference books and only selected members. Our College Library is a large one having 17,000 books and staffed by both paraprofessionals and professional librarians. The following are the tasks to be performed in the library.

- Circulation: handling user accounts and issuing/returning and shelving of materials.
- Collection, development, order materials, maintain materials' budgets.
- Technical Services work behind the scenes cataloguing and processing new materials and accessioning weeded

materials.

Basic tasks in library management include the planning of acquisitions of materials, arranging the acquired materials according to the library classification, preservation of materials the de accessioning of materials, patron borrowing of materials, and developing and administering library computer systems. Among these, the proposed system will automate the following tasks using RFID technology,

Accessing number of books at a time.

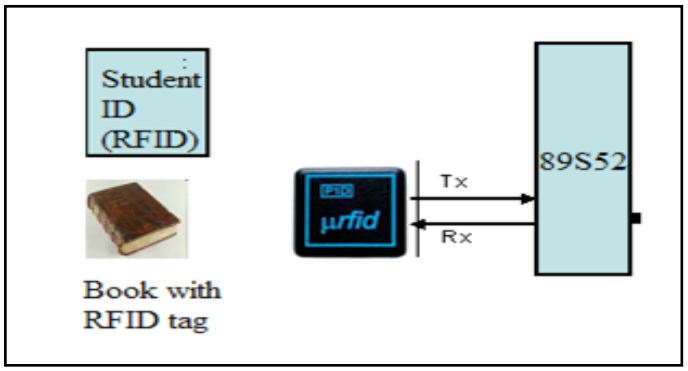

Fig 1.2 : RFID mechanism for LMS

- Searching a particular book to check its presence in the library
- Accounting/Stock verification of the materials

The RFID based LMS facilitates the fast issuing, reissuing and returning of books with the help of RFID enabled modules. It directly provides the book information and library member information to the library management system and does not need the manual typing. It also provides monitoring and searching system. The monitoring module will continuously monitor the movement of books across the gates, so that the books taken out without prior issuing will be traced out easily and will alarm the librarians. The searching module provides the fast searching of books using RFID handheld reader. The physical location of the books can be easily located using this module.

Utmost care has been taken to provide following features to the Library using RFID
technology:

- To remove manual book keeping of records
- Improved utilization of resources like manpower, infrastructure etc.
- Less time consumption as line of sight &manual interaction not needed for reading tag
- To minimize the manual intervention
- To minimize the manual errors

II. Methodology

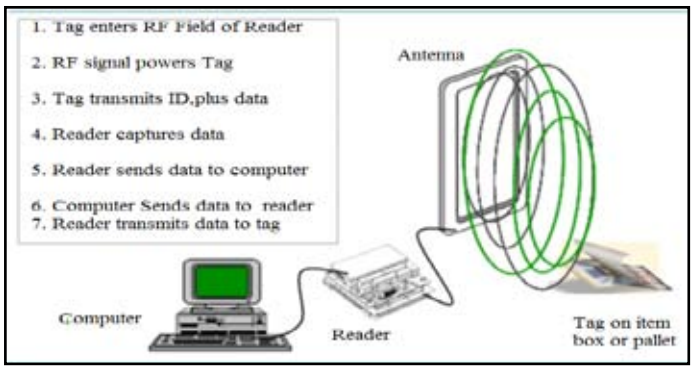

Fig 2.1 :Methodology

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

A. 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.

B. 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 and enables the system for further usage.

C. 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.

D. 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. 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 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.

F. RFID Integration Modules

In order to provide RFID integration with LMS, three modules namely – Transaction Module, Monitoring Module and Searching Module were developed. Their functionalities are described below.

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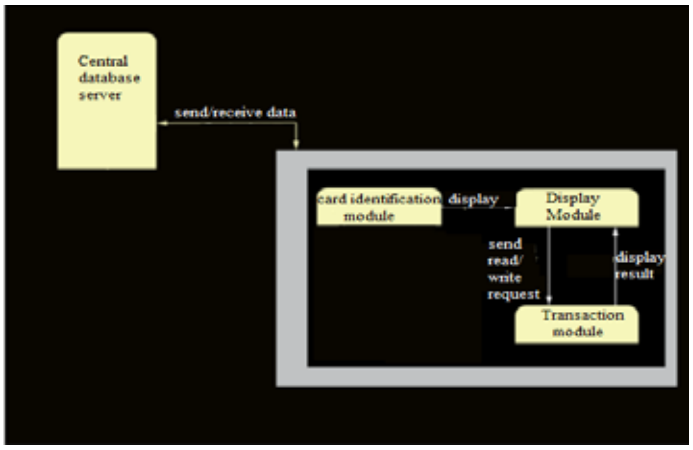

Fig 2.2 : Mechanism to implement RFID

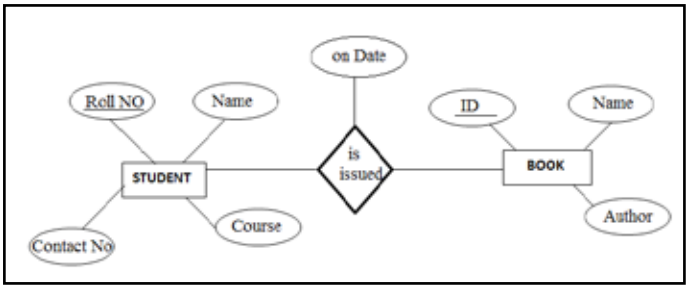

Fig 2.3 : E-R Diagram

III. Experiment Results

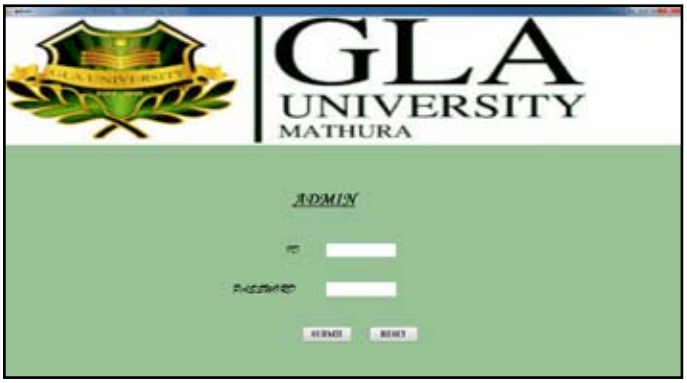

Fig 3.1 : LoginModule

When user enters the correct id and password then he is directed onto the home page. If he enters the wrong id or password then he is asked to enter the details again.

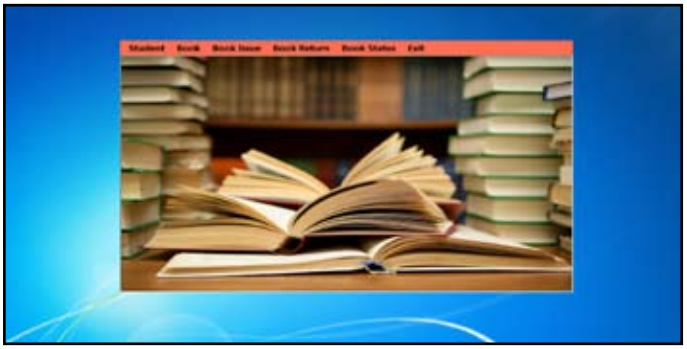
Fig 3.2 : Home Page

The home page contains five modules shown in above fig. if admin selects any of the above five options then a new form will open. If he selects the exit option then the application will be closed.

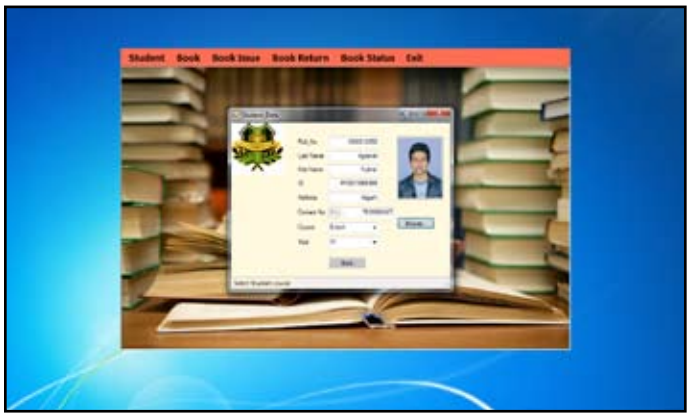
Fig 3.3 : AddStudent

Here we can add a new student by entering the details shown in above fig. If the admin leave any of the field blank then it will show an error corresponding to that field. Students will be added if all the fields are entered correctly.


Fig 3.4 : Add Book

Here we can add a new book by entering the details shown in above fig. If the admin leave any of the field blank then it will show an error corresponding to that field. Books will be added if all the fields are entered correctly.


Fig 3.5 : Issue Book

This is the module for issuing books. First the RFID card of the reader will be placed on the reader. As soon as the card is brought over the reader the details of the student are fetched from the database and are entered in the various fields of student shown above. After this the book containing the RFID tag is brought over the reader. As soon as the book is brought over the reader the details of the book are fetched from the database and are entered in the various fields of book shown above. On clicking the issue button the book is issued to the student.

Fig 3.6 : Return Book

This is the module for returning the books. When the book is brought over the reader the 12 digit code stored in the tag is fetched and the details of the book are fetched from the database corresponding to that code and are entered automatically in the various fields shown above. When the return button is clicked the entry of the book from the issue record of student is deleted if there is no fine on the book otherwise it will show the fine.

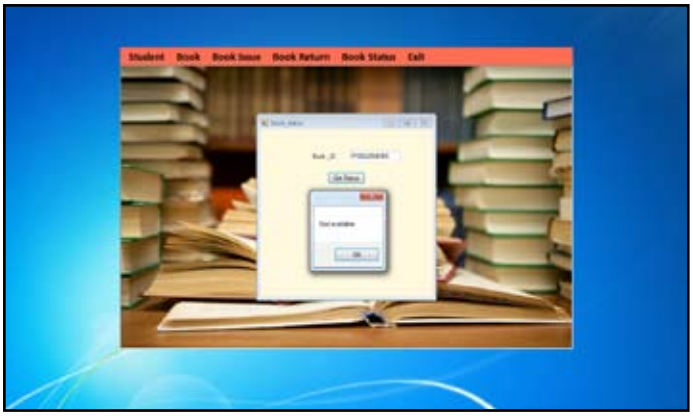

Fig 3.7 : Book Status

This is the module for checking the availability of the books. Here the 12 digit book id is entered to know about the status of book.

	roll_no	L_name	F_name	ID	photo	Addr	mob	course	admyr
1	1006313060	Agrawal	Tushar	HHUU018EE999	0xHHU8HHEJ0001044464...	Mathura	/63UU8342/	Btech	IV
2	1006313003	Mehra	Anjani	FF00020AB740	0xFFD8FFE00010A1614...	Mathura	9720734377	Btech	IV
3	1006313031	Jain	Rishabh	FF0002327BB4	0x89504E470D0A1A0A0...	Agra	7520725876	Btech	IV

Fig 3.8 : Student Data table

This is the database for the book in which rollno is taken as the primary key.

	ID	title	publ	NOP	price	ISBN	DOP
1	FF000121E837	NCER	McGraw Hill	77	225	9780070142763	2014-04-02 00:00:00.000
2	FF0001DC5270	Embedded Systems	McGraw Hill	680	350	9780070667648	2014-04-03 00:00:00.000
3	FF0002054DB5	Mobile Communications	Pearson	492	250	9788131724262	2014-04-03 00:00:00.000
4	FF0008904F28	Distributed System	Pearson	450	450	7852146941235	2014-04-08 00:00:00.000

Fig 3.9 : Book Data table

This is the database for the book in which id is taken as the primary key.

	b_id	b_name	s_id	s_name	photo	roll_no	course	admyr	doi	dor
1	FF0001DC5270	Embedded Systems	FF00018EE999	Tushar	0xFFD8...	1006313050	B.tech	IV	2014-04-30...	2014-05-14...
2	FF0002054DB5	Mobile Communications	FF0002327BB4	Rishabh	0xFFD8...	1006313031	B.tech	IV	2014-04-14...	2014-04-28...
3	FF0008904F28	Distributed System	FF00020AB740	Anjani	0xFFD8...	1006313003	B.tech	IV	2014-04-30...	2014-05-14...

Fig 3.10 : Issued Book table

This is the database which contains the record of the books issued to a student .

IV. Conclusion

Radio Frequency Identification (RFID) 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 labor costs, enhance customer service, lower book theft and provide a constant record update of new collections of books. 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.

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