

Development of RFID Based Library Management System Using MATLAB

C. Srujana, B. Rama Murthy, K.Tanveer Alam, U. Sunitha, Mahammad D.V, P.Thimmaiah

Abstract - Radio frequency identification (RFID) is a rapidly emerging technology which allows productivity and convenience. No doubt it is an integral part of our day to day life, as we are using in many applications like industrial, shopping malls, traffic and libraries. As so far this technology implemented successfully worldwide. But in India it is still in observation state especially in library management at university and educational institutions due to lack of awareness and cost. To overcome this situation here we made an attempt to implement RFID based library management system in our university. The proposed system is based on high frequency DLP RFID1 Read/Writer having the range of frequency is 13.56 MHz's and it can Read up to 15 Tags simultaneously. The software written in MATLAB and MySQL to improve system performance. The proposed system successfully implemented in our library and it is satisfactory working.

Index Terms — DLP RFID1 Read/Writer, RFID tag, MATLAB, MySQL

I. INTRODUCTION

RFID stands for Radio Frequency Identification. It is an electronic technology whereby digital data encoded in an RFID Tag (or transponder) is retrieved utilizing a reader. In contrast to bar code technology [1], RFID systems do not require line-of-sight access to the tag in order to retrieve the tag's data, and they are well suited to harsh environments. An RFID tag consists of an integrated circuit attached to an antenna. In the case of the tags used with the DLP-RFID1, the antenna is in the form of conductive ink "printed" on a material that allows for connection to the integrated circuit. This type of passive (battery-free) tag is commonly referred to as an "inlay".

The RFID reader is typically a microcontroller-based radio transceiver that powers the tag with a time-varying electromagnetic radio frequency (RF) field. When the RF field passes through the tag's antenna, AC voltage is generated in the antenna and rectified to supply power to the tag [2]. Once powered, the tag can receive commands from the reader.

The information stored in the tag can then be read by the reader and sent back to the host PC for processing. The data in the tag consists of a hard-coded, permanent serial number (or UID) and user memory that can be written to, read from and locked if desired. Once locked, user data can still be read but not changed [3].

The block diagram RFID based library management system using MATLAB is shown in figure-1. The system consists of the following elements, they are:

1. RFID Read/Writer
2. RFID TAG
3. Serial to USB converter
4. Personal computer

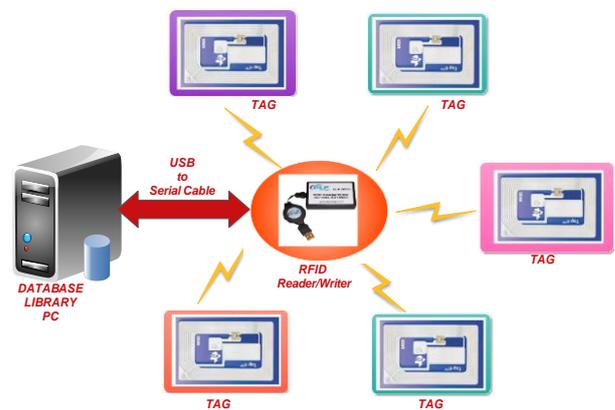


Figure – 1. Basic block diagram RFIDLMS

II. HARDWARE

A. Library PC

The Database library PC is the heart of comprehensive RFID systems. It is the communications gateway among the various components. It receives the information from the readers and exchanges information with the circulation database. The library pc typically includes a transaction database so that reports can be produced which is maintained in the MySql server.

B. Dlp Rfid1reader

Figure-2 shows the DLP RFID1 Read/Writer. It contains a unique, 32-bit, hard-coded serial number that cannot be altered by any means. The serial number can be read via the USB interface and used to identify the reader via the host software. This RFID reader is both reader and writer. It is capable of writing data on to the tag as well as reading the data from the tag when a tagged object enters the read zone. Once the tag information read/write the DLP RFID1 relayed back to the personal computer (PC) via USB to Serial converter. The protocol of the read and tag is ISO15693. The frequency operation is 13.56MHz, reading up to 15 tags [4].



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Figure - 2. DLP RFID1 Read/Writer

C. RFID Tag

Texas Instruments Tag-it HF-I plus transponder inlays consist of 13.56-MHz high-frequency (HF) transponders that are compliant with the ISO/IEC 15693 and ISO/IEC 18000-3 global open standards. These tag contains a user-accessible memory of 2048 bits, organized in 64 blocks. Data can be written into the memory of the tag from the RFID Reader/Writer When the tag is enter to the RFID reader zone read the tag data which is shown in figure-3 [5].



Figure-3. Tag-it HF-I plus transponder (RI-I03 112A-03)

D. Experiments on Position of Tags in Books

Placement of currently deployed high frequency (HF) tags is a critical factor affecting system performance (Figure-4). When tag placement in one item directly overlays another placement and both items are in very close proximity, readability is compromised [6]. The antenna component of each tag interacts and changes the radio frequency, making it difficult for the RFID readers to communicate with the tag. This is analogous to tuning your FM receiver just a little bit away from the channel you are trying to receive, diminishing the quality of the reception. A way to avoid this is the process of staggering tags in like items that are shelved in close proximity.

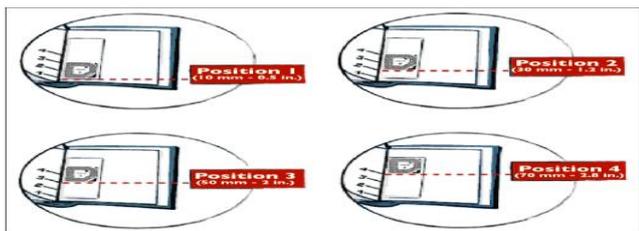


Figure-4. Placement of HF RFID Tags

While RFID tags operate with high reliability and readability on most items, principally books, there are still challenges in regards to some forms of media. Size constraints and presence of metal are core issues to overcome. These constraints apply equally to all applications of RFID.

E. USB to Serial converter

The DLP-USB232R is DLP Design’s smallest USB-to-serial UART interface module, and it utilizes the popular FT232R IC with the FTDI Chip-ID feature from FTDI. In addition to enabling standard USB-to-serial designs, both asynchronous and synchronous bit-bang interface modes are available. The internally-generated clock (6MHz, 12MHz, 24MHz and 48MHz) can be brought out of the module and used to drive a microcontroller or external logic. The DLP-USB232R is available in a lead-free (RoHS compliant), compact 18-pin, 0.1-inch standard DIP footprint. Figure-5 shows DLP-USB232R [7].



Figure-5. DLP-USB232R

III. SOFTWARE DEVELOPMENT

In the present work, the author opted MATLAB for the development of Graphical User Interface for the librarian, and maintained database using MySQL server. MATLAB is an interactive, matrix-oriented programming language that enables one to express one's ideas very concisely and directly, without having to worry about annoying details like memory allocation or type checking. This considerably reduces development time and keeps code short, readable and fully portable. It has excellent built-in support for many data analysis and visualization routines [2]. In addition, there are many useful toolboxes, e.g. database and instrument control. The following figure-6 illustrate the matlab layout [8].

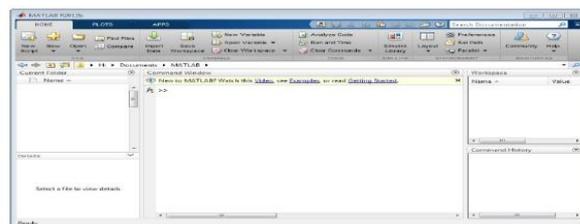


Figure-6 : MATLAB main window layout

The desktop includes these panels:

1. **Current Folder** — Access your files.
2. **Command Window** — Enter commands at the command line, indicated by the prompt (>>).
3. **Workspace** — Explore data that you create or import from files.
4. **Command History** — View or rerun commands that you entered at the command line.

A. Opening a New GUI in the Layout Editor

The MATLAB Graphical User Interface Development Environment(GUIDE), provides a set of tools for creating graphical user interfaces (GUIs), which consists of a Figure window containing menus, buttons,



text, graphics, etc., that a user can manipulate interactively with the mouse and keyboard. Figure-7 shows GUI description panel. There are two main steps in creating a GUI viz. One is designing its layout, and the other is writing call back functions that perform the desired operations when the user selects different features [9].

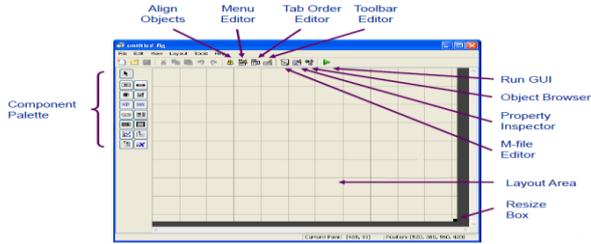


Figure-7 : GUI description panel.

B. MATLAB Database Toolbox

MATLAB Database Toolbox supports communication using ODBC or JDBC driver with compatible database including IBM DB2, IBM Informix, Ingres, Microsoft access, Microsoft Excel, Microsoft SQL Server, MySQL, Oracle, PostgreSQL, Sybase SQL Anywhere and Sybase SQL Server. A JDBC driver is a software component enabling a Java application to communicate with a database. To connect with each databases type JDBC requires drivers. The JDBC driver provides the connection to the database and implements the protocol for transferring the communication between client and database. Figure-8 shows Visual query builder [10].

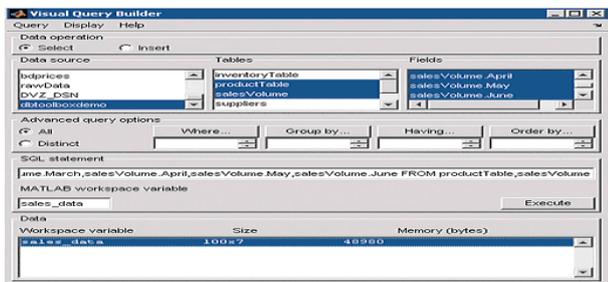


Figure-8. Visual query builder

IV. IMPLIMENTATION OF SYSTEM

The present work was developed in integrating the RFID system and the creation of Graphical User Interface (GUI) at the host PC. The scope of work of the research is to develop an RFID based library management system to assist the librarians for more efficient management of books in the library. GUI for the system was developed using MATLAB. To store the details information of the book to the database. Subsequently all the book information is loaded in the RFID tag. This covers the database related to books and student based on UID.

Fallowing tasks have to be done:

1. Write the book/student information on to the tag
2. Read the book/student information from the tag
3. Add the new books to the library/department
4. Issuing and returning of books
5. Status of the book
6. Database management

The database maintained with MySQL using MATLAB, which is much secured and user friendly.

When books are issued to student, the books are deleted from the department book database and added to the student data base, and also record the issued date and return date of

the book on to student database along with student and book information. In the same way to return the books, books are add to department book database and deleted from student data base along with due date fine.

Searching of books using UID will search the information of Book UID, Book Title, Book Author and Book Publisher. Similarly using Student search Book UID, student UID, student Name. All will process and analyzed using RFID Read/Writer by implementing MATLAB GUI for Library Management System easily and efficiently.

V. RESULT AND DISCUSSION

To double click the RFIDLMS icon start the software programming, appear main window to the project which is shown in figure-9. In this main we have to read the book tag will be read to the DLP RFID1 Read/Writer. After completion of reading the information of book is store to the library database in this will be used to transaction like issuing, retuning of books searching by student and books, status of the book. Also we the books database in subject wise as shown in figure-10.



Figure-9 Reading of book information through RFID Reader

	UID	TITLE	AUTHOR	EDITION	COST(INR)	PUBLISHER
1	E007000014731A91	UNIX Network Programming	W. Richard Stevens	Low price	772	Dorling Kindersley(india)pvvtltd.
2	E007000014731A92	Digital Signal Processing	P.Ramesh Babu	4th edition	11.74	Soltech publications(india)pvvtltd.
3	E007000014731A9F	Fundamentals of Logic Design	Charles H. Roth, Jr.	5th	687	Cengage Learning India Pvt.Ltd.
4	E007000014731A80	VHDL Programming by Example	Douglas L. Perry	4th	467	Tata McGraw-Hill
5	E007000014731AB1	Microprocessors, PC Hardwar...	N.Mathivanan	1st	519	PHI Learning pvvtltd.
6	E007000014731AB2	REAL TIME DIGITAL SIGNAL P...	V.UDAYASHANKARA	1st	566	PHI Learning pvvtltd.
7	E007000014731AB3	Microprocessors and Interfacing	DOUGLAS V HALL	2nd	125	McGraw-Hill education
8	E007000014731AB4	TCPIP Protocol Suite	Behrouz A. Forouzan	4th	979	McGraw-Hill companies
9	E007000014731AB5	CMOS Vlsi Design	NEL H E Weste	3rd	659	Dorling Kindersley(india)Pvt.Ltd.
10	E007000014731AB6	Mastering C	K.R Venugopal	4thedition	854	McGraw-Hill companies

Figure-10. Books list of Electronics and communications based on subject wise.

VI. CONCLUSION

RFID technology is found to be a versatile technology in many real time applications, especially in library management system. This provides an intelligent library management, which creates better service quality with quick and effective benefits to both library management and students. This technology can be applied to a system of volume. Either it may be a small departmental library or vast university library its effects are more obvious and applicable. This RFID technology also provides the facility of self check for the library staff and non-returned books effectively. So, it is expected that this RFID technology will soon replace the presently existing technology method. The proposed system successfully implemented in our library and satisfactory working.



The present work is intended to further, by adding web technology. This web technology can provide additional technology of searching the books present in the library using their computers or mobile devices. For this online services a suitable web based system is under process in our university. For this purpose, the new features available in RFID and internet technologies are to be applied effectively, and planned to develop in this application.

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