

Dynamic Book Search Using RFID Technology

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Abstract--- In view of the problems existed in library management; we designed a RFID Intelligent Book Conveyor using Radio Frequency Identification (RFID) technology. This book conveyor is portable equipment with complete functions, friendly interface and convenient operation. It can greatly improve the work efficiency of librarians and the service quality of the library. This project contains one server and multi slave microcontrollers here we are using system (PC) as a server and slave is an LPC2148 microcontroller, each slave microcontroller contains one RFID and each one communicates with master microcontroller.

Keywords--- Radio frequency identification technology, shelf management, RFID tags, active tags, passive tags, black box testing, white box testing, GUI.

INTRODUCTION

Library management system is a planning system for a library that used to track items, orders made, bill paid and patrons who have borrowed. Library management is essential because library housing thousands of books, pamphlets, CDs and others. Library needs a good coordination of information of the entire item above in addition to library management. Shelf management is system that classified all of the books on the shelf in the library. The position of the books on the shelf need to be appropriate or the books will be difficult to be found.



Figure 1: RFID Library Management System

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. This technology has slowly begun to replace the traditional barcodes on library items and has advantages as well as disadvantages over existing barcodes [4]. 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.

COMPONENTS OF RFID SYSTEM

RFID Technology:

Radio Frequency Identification (RFID) is a wireless automatic identification technology that utilizes the Radio Frequency as the medium of communication. With the capability of carrying and retrieving data, RFID offers a wide application in the automatic identification areas. Figure 1 above illustrates the basic RFID system. The system consists of tag, reader and host pc. Reader will

energize the tag to transmit data it carries and an application in the host pc will manipulate the data. Here the library contains multi racks each rack contains slave microcontroller if any person keep any book in the rack the slave microcontroller will detect the book with the help of RFID then it will add the rack address along with book id, now if any person type the book id in the server then system will display the books information by collecting data from slave microcontrollers.

RFID Tag:

The ATA5570 is a contactless R/W Identification IC for applications in the 125KHZ frequency range. A single coil, connected to chip serves as the IC's power supply and bi-directional communication interface. The antenna and chip together form a transponder or tag.

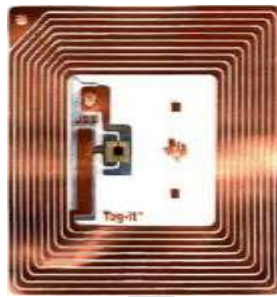


Figure 2: RFID tag

Active and Passive tags:

First basic choice when considering a tag is either passive or semi-passive or active [1]. Passive tags can be read at a distance of up to 4 – 5 m using UHF frequency band, whilst the other types of tags (semi-passive and active) can achieve much greater distance of up to 100m for semi-passive, and several KM for active. This large difference in communication performance can be explained by the following,

(I) Passive tags use the reader field as a source of energy for the chip and for the communication from and to the reader. The available power from the reader field, not only reduce very rapidly with distance but is also controlled by the strict regulations, resulting in a limited communication distance of 4 -5 m when using UHF frequency band (860 MHz – 930 MHz) [3].

(II) Semi-passive (battery assisted back scatter) tags have build in batteries and therefore do not require energy from the reader field to power the chip. This allows them to function with much lower signal power levels, resulting in greater distance of up to 100meters. Distance is limited mainly due to the fact that tag does not have an integrated transmitter, and is still obliged to use the reader field to communicate back to the reader.

(III) Active tags are battery powered devices that have an active transmitter onboard. Unlike passive tags, active tags generate RF energy and apply to the antenna. This autonomy from the reader means that they can communicate at the distance of over several KMs.

GUI Development

Figure below displays the GUI (Flash Terminal).Com Port is referred to the serial communication port on a computer. RFID reader is connected to the host PC through serial port. Therefore, correct com port number must be selected to establish the connection. There are two blocks in the GUI namely, transmit and receive with the help of which we send and receive the information respectively. Transmit block has a field through which we deliver the commands to the slave microcontroller. Consequently, we receive the information back from the slave microcontroller in the receive block.

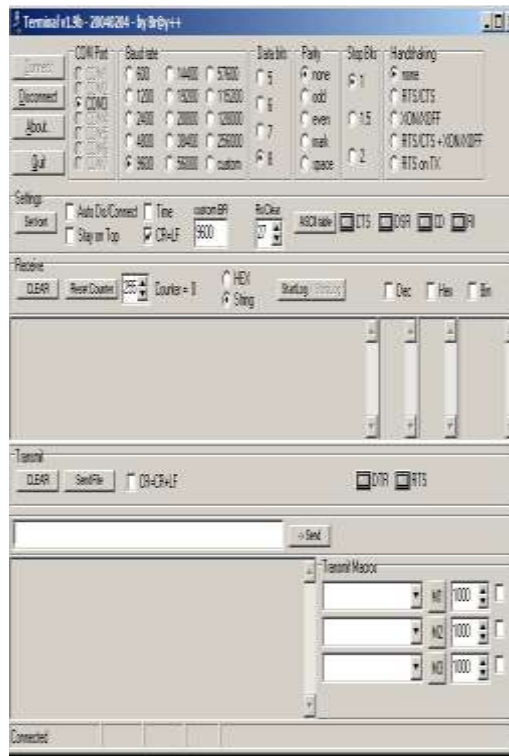


Figure 3: Flash Terminal

SYSTEM IMPLEMENTATION

Implementation is the stage where the theoretical design is turned into a working system. The implementation phase constructs, installs and operates the new system. The intention of the research is to develop a shelf management system. The system will assist the librarian to carry out the shelf management process thus reducing human intervention. The RFID reader will scan each book on the shelf. The data acquired will be sent to the host PC to process the data. There will be a LCD output mechanism to alert the librarian if there is a misplaced book. Database and RFID chip will be used as storage.

A graphical user interface (GUI) is the backbone of the system. Librarian will interact with the system through GUI. RFID tag will be attached to each book on the library. The tag will carry the specific information of the book. A reader will interrogate each book and check which book is misplaced and notice the user to remove the book from the shelf. The aim of the research is to develop a Graphical User Interface (GUI) as an Application Programmable Interface (API) for shelf management system using RFID, to create database that will store crucial information of the books to the RFID tag and to create shelf identification (ID) code [7]. Subsequently in the shelf management process, the software will retrieve the shelf information from the tag to find any misplaced books so that the librarian can position the book back at the right shelf.

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 Flash Terminal. 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.

Following 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

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 GUI for Library Management System easily and efficiently.

TESTING AND ANALYSIS

The testing process focuses on the logical intervals of the software ensuring that all statements have been tested and on functional interval is conducting tests to uncover errors and ensure that defined input will produce actual results that agree with the required results. Program level testing, modules level testing integrated and carried out. There are 2 major types of testing [8]. They are:

White Box testing:

White box sometimes called Glass Box testing is a test case design uses the control structure of the procedural design to drive test case. Using white box testing methods, the following test were made on the system,

- a. all individual paths within a module have been exercised once.
- b. all logical decisions were checked for the truth and falsity of the values.

Black Box testing:

Black box testing focuses on the functional requirements of the software i.e., black box testing enables the software engineering to derive a set of input conditions that will fully exercise all functional requirements for a program.

- a. Interface errors.
- b. Performance in date structure.
- c. Performance errors.
- d. Initializing and termination errors.

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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