LIBRARY DEVELOPMENT (DROP BOX) USING RFID BASED ON EMBEDDED PLATFORM

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Abstract: Libraries are the source of knowledge and sense, but with the growing education branches and new researches, millions of the books are being added to libraries. Manual sorting and placement of these books in shelves is a time consuming and cumbersome process for humans. This often results in incorrect placement of books on shelves.The idea about advanced radio frequency identification (RFID) technology in library automation. The use of RFID technology is a major feature to create a move towards self service operations and other aspects of improving efficiency in library. The disadvantages of current library computerization and the need for new design principles that take advantage of technology such as RFID. The aim of this paper is to find out whether RFID render any significant profits to library management and how these profits reflect to customer approval. In this paper we are using the RFID technology for detecting the books and people based on unique Tag number and Microcontroller will process the data and sends it personal computer side data base in which the data base will be maintained about the person.

Keywords: RFID, RFID reader, drop box.

I. INTRODUCTION

Radio-Frequency Identification (RFID) devices have an important presence in our daily life and they will become appearing in the near future. Passive RFID is flaying to replace bar codes in library applications. The bar-code system used in libraries is very time consuming and labour intensive. In the opposite, the RFID system provides a solution to effectively collect, manage, and distribute books. Radio Frequency identification (RFID) allows an item, (i.e. library book) to be traced and interconnected with by using radio waves. In a library environment, RFID technology it provides a means of assigning an ID to and item and reading that ID to perform circulation transactions.

RFID is an electronic technology whereby digital data encoded in an RFID tag is retrieved utilizing a reader. In contrast to bar code technology, RFID systems do not need line-of-sight contact to the tag in order to retrieve the tag's data. The first step is to decide on which kind of RFID reader and tag is used for library automation. The importance of reader are what kind of tag it reads operating frequency, ability of near reading, writing inside the tag , connection type with computer The reader has two main functions: the first is to transmit a carrier signal, and the next is to receive a response from any tags in proximity of the reader. A tag wants to receive the carrier signal, transform it in some way corresponding to the data on the card, and retransmit the changed response back to the reader. Secondly tags which are located in book are binding with the specific Id. In modern passive RFID devices; the tag consists of a small integrated circuit and an antenna. The profit of passive RFID is that it requires no internal power source; the circuit on the tag is actually powered by the carrier signal. Thus, the carrier

signal communicated from the reader must be considerably large so that the response can be read even from the card.

Proteus (PROcessor for TExt Easy to USe) is a fully functional, procedural programming language created in 1998 by Simone Zanella. Proteus incorporates many functions derived from several other languages: C, BASIC, Assembly, Clipper/dBase; it is especially versatile in dealing with strings, having hundreds of dedicated functions; this makes it one of the richest languages for text manipulation.

Proteus contains everything you need to develop; test and virtually prototype your embedded system designs based around the Microchip Technologies™ PIC18 series of microcontrollers. The unique nature of schematic based microcontroller simulation with Proteus facilitates rapid, flexible and parallel development of both the system hardware and the system firmware. This design synergy allows engineers to evolve their projects more quickly, empowering them with the flexibility to make hardware or firmware changes at will and reducing the time to market. Proteus VSM models will fundamentally work with the exact same HEX file as you would program the physical device with, binary files (i.e. Intel or Motorola Hex files) produced birany assembler or compiler.

II.   MEANING OF RFID TECHNOLOGY

The concept of RFID technology was developed in 1948 but it has had to wait fifty years before it has been able to deliver on its original promise. The advent of tiny integrated circuits allowed solution designers to add intelligence to the movement of goods thought the supply chain and when a chip and an aerial were attached to a sticky label the RFID "Tag" was born .RFID in the reading of physical tags on single products, cases, pallets, or reusable containers which emit radio signals to be picked up by reader devices. These devices and software also must be supported by sophisticated software architecture that enables the collection and distribution of locations based information in real time.

"RFID": RFID means Radio Frequency Identification, i.e. technologies that usage radio waves to automatically identify individual items.

"Tag": Tag means a microchip that is attached an antenna and is able to transmit identification information, i.e., capable of receiving data from, or transmitting data to, a reader. show Fig. 1.

"Reader": Reader means a device, capable of reading data from a tag or transmitting data to RFID tag.

"RFID Subject" or "Individual": RFID Subject means a consumer, customer or any other such individual that comes in contact with a product that has attached to it, or contains ,an RFID tag.

"RFID User": RFID user means an RFID operator, such as a store, warehouse, hospital, library and the like, who employs RFID technology, including RFID reader and tags.

"Premises": Premises means a store, a warehouse, a hospital, a library, or any other such equivalent space that encompass the tags and the readers that communicate with RFID tags.

"Content": Content means the freely given specific and informed indications of a RFID subjects wish to have his /her personal information processed by the means of RFID technologies.

Definition:According to World English Dictionary

"RFID is a technology that uses tiny computer chips to track items such as consumer commodities at a distance."

Fig. 1. RFID tag.

III. OBJECTIVES OF RFID TECHNOLOGY

- To find out impact of RFID technology on libraries.
- To find out profits of RFID for libraries.
- To find out merits and demerits of RFID for libraries.
- To find out title role of librarians for adopted RFID in libraries.

IV. RFID TECHNOLOGY FOR LIBRARIES

- RFID is the latest technology to be used in library theft detection system .Unlike EM(Electro-Mechanical) and RF(Radio Frequency) system, which have been used in libraries for decades ,RFID based systems move beyond security to become tracking systems that combine security with more efficient tracking of materials throughout the library, including easier and quicker charge and discharge, inventory ,and materials handling .
- RFID is a combination of radio-frequency based technology and microchip technology .The information contained on microchips in the tags affixed to library materials is read using radio-frequency technology regardless of item orientation alignment and distance from the item is not a critical factor except in the case of extra –wide exit gates.
- The objectives used in RFID systems can replace both EM or RF theft detection targets and barcodes.

V. RFID TECHNOLOGY USES IN LIBRARIES

The first library suppliers started to market RFID systems in the mid 1990's .So, RFID technology was implemented in libraries in the late 1990s for varied library operationsacross the globe. It is important to note that Singapore was certainly on of the first to introduce RFID in libraries and Rockefeller University in New York may have been the first academic library in the United States to utilize this technology, whereas Farmington Community library in Michigan may have been the first public institution, both which began using RFID in 1999.The RFID using countries are USA, UK and Japan. In 1990 s, Indian libraries also started using RFID and mostly the academic libraries attached to IITs IISc, Universities are now widely using RFID technology.

VI. LIBRARY RFID TECHNOLOGY MANAGEMENT SYSTEM

Using RFID in libraries saves library staff's time by automatizing their tasks. An establishment that uses RFID library management saves a book reader, precious time that he would have been spent, waiting for his turn in a queue for borrowing or returning a book. Taking care of books and making them available to the book readers are important tasks. Most of the library staff's time is used up in recording information of incoming and outgoing books. Borrowing and returning of books can be fully automated with the help of self-check- in/out systems. This system involves installation of special software. A

person using this system to borrow books is existing with options on a computer screen. The person has to detect himself with a code, which is first a personal identification number, or any form of single identity code. Books selected by the somebody are identified by the system's RFID reader. And, the investigation bit in the book's tag is deactivated by the system. When a book is returned, the check-in/out system activates the surveillance bit.

VII. APPLICATION IN LIBRARY RFID

I. The Patron self-check-out station

It is basically a computer with a touch screen and a RFID reader, with special software for personal identification, book and other media handling and circulation. After identifying the patron with a library ID card, a barcode card, or his/her personal ID number (PIN), the patron is asked to choose the next action (check-out of one or several books). After choosing check-out , the patron puts the book(s) in front of the screen on the RFID reader and the display will show the book title and its ID number (other optional information can be shown if desired) which have been checked out.

II. Anti-theft Detection

RFID EAS Gates is the anti-theft part of the Library RFID Management System using the same RFID tags embedded in the library items. Each lane is capable to track items of about 1 meter and would trigger the alarm system when an un borrowed item passed through them. The alarm will sound and collared lights on the gate will flash as patron passes through with the un-borrowed library material.

III. Counter Station

Counter Station is a staff assisted station on services such as loan, return, tagging, sorting and etc. It is full with arming module, tagging module and sorting module. Arming module allows EAS (Electronic Article Surveillance) bit inside the tag of the library material to be set/reset so as to trigger/not trigger the alarm of the EAS gate.

IV. RFID Transponder or Tagging

It is the most important link in any RFID system. It has the capability to store information relating to the specific item to which they are attached, rewrite again without any requirement for contact or line of sight. Data within a tag may deliver identification for an item, evidence of ownership, original storage location, loan status and history. FID tags have been specifically designed to be affixed into library media, books, CDs, DVDs and tapes.

V. Book Drops

The Book Drops can be located anywhere, within or outside the library. Probable remote locations outside the library include train stations, shopping centres, colleges, schools, etc. This offers unprecedented flexibility and convenience of returning library items at any time of the day, even when the library is closed.

VI. Shelf Management

This solution makes locating and identifying items on the shelves an easy task for librarians. It comprises mostly of a portable scanner and a base station.

Fig. 2. Book Drop box and Application in library RFID technology management system

VIII.   COMPONENTS OF LIBRARY RFID TECHNOLOGY SYSTEM

RFID based library system may possibly have the following components:

- Antenna.
- Staff and Conversion Station.
- Self-Check –in /Check-out station.
- RFID Label Printer.
- Hand held Reader.
- External Book Return.
- library software is loaded.
- Readers or Sensors to query the tags.
- RFID tags that are electronically with unique information.
- Application software.
- Exit sensors.
- Patron cards.
- Portable scanner.
- Book drop Kiosk.
- Active or write one read many (WORM) Tags.
- Passive or Read write Tags.
- Reader or coupler.

IX.   MERITS OF RFID TECHNOLOGY IN LIBRARIES

The major merits of RFID application in libraries can be summarized as:

- Capability to manage the expenses over a number of years.
- Staff can exploit their profession skills as applied to clerical skills.
- Miss-shelved reports.
- More than single item can be checked out or checked in at the same time.
- Long tag life.
- Fast Circulation.
- Easy self-charging /discharging.
- Fast inventorying.
- Greater reliability.
- Automatic material handling.
- Economy.
- Automated issue/return.
- Easy stock verification.
- Automated sorting of books on return.
- Improve the security function in library.
- Immediate update of the databases is possible.

X.   DEMERITS OF RFID TECHNOLOGY IN LIBRARIES

The disadvantages of RFID application in libraries can be summarized as:

- Frequency block
- High cost
- Lack of standard
- Accessibility to compromise
- Removal of exposed tags.

- User privacy concerns.
- Exit gate sensor (Reader) problems.
- Reader collision.
- Tag collision.
- Interoperability.
- Absence of proper principles and protocols, it need to be unique and inter-operable.

XI. BENEFITS OF LIBRARY RFID TECHNOLOGY SYSTEM

Time saving ,fast accessing of books and eliminating manual errors are the main benefits of the RFID in library. Although RFID can be used in library anti-theft system ,this does not meant that it is a highly secure technology .The library saves some time in processing new items because it only has to affix one technology to the item .It may also save some money due to the integration of circulation and security with single vendor and into a single system .RFID improve library workflow ,reducing non-value added work processes, improves staff productivity ,Assist traceability of book allocation, Ability to locate specific items, Faster inventory process, More than one items can be checked out or checked in at the same time ,Improve customer service, Higher staff job satisfaction, Satisfaction with correct and reliable shelving order, Financial reduces costs of replacing stock reliable knowledge of stack location.

XII. RFID Vs. Barcode

RFID technology is more sophisticated than the bar code. This is because of the following facts:

- It will be embedded and read with no requirement for line of sight
- Tags can be reprogrammed easily
- Capable of working in suitable and exacting environments
- Prepared to carry 96 bits of information compare with 16 bits for bar code
- Fraud controlling increases
- Cloning become non existence
- Improves antitheft protection
- Better efficiency
- Cost saving

Simultaneous multi-tag reading

- High speed data capture
- Possibility of having a unique ID
- Portable database
- Profit enhancement
- Better supply chain and record management
- Reducing counterfeiting
- Tracking work-in progress
- Reducing administrative errors
- Reducing rework

XIII. Principle of Operation

A radio-frequency identification system combines inexpensive, programmable tags with a electronic radio detector. When the tag comes to within a few feet of the detector, the detector reads data carried in the tag via radio waves. A detector can work in a system with any number of tags, from a handful to millions. RFID equipment has myriad uses including inventory tracking, secure building access and retail-theft control. RFID methods utilize radio waves to achieve this. At a simple level, RFID systems consist of three components: an RFID tag or smart label, an RFID reader, and an antenna. RFID tags

have an integrated circuit and an antenna, which are used to transmit data to the RFID reader (also called an interrogator). The reader then changes the radio waves to a more usable form of data. Info collected from the tags is then transferred through a communications interface to a host computer system, where the data can be stored in a database and analysed later. A RFID reader is a network connected device (fixed or mobile) with an antenna that sends power as well as data and commands to the tags. The RFID reader acts like an access point for RFID tagged items so that the tags' data can be made available to several applications.
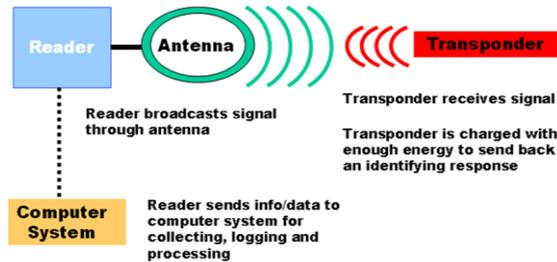

Fig. .3 Basic principle of an RFID system.

XIV.   System Architecture

The basic architecture of an RFID system consists of a tag that includes an antenna and a chip, a reader equipped with antenna and a transceiver, and a workstation to host the Middleware and database. System architecture comprises of
i. Hardware Architecture,   ii. Software Architecture

I.   Hardware Architecture

Main part of hardware architecture is microcontroller. All data received by PC are thought the microcontroller. All books have RFID tag which is read by RFID reader and send RFID code to microcontroller and then PC database. All books check-in/out database are save in PC.
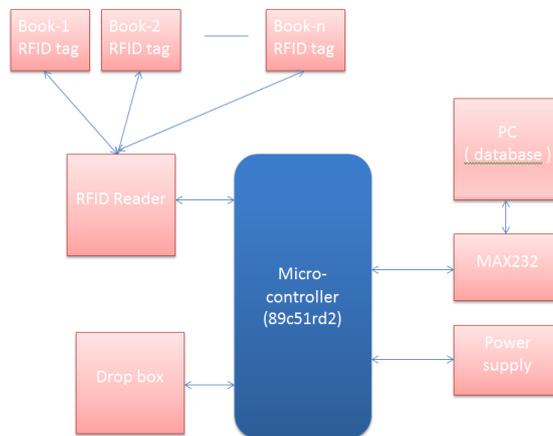

Fig. 4. Hardware Architecture Block Diagram

II.   Software Architecture

Whenever we start our system then RFID reader is set in standby mode. RFID reader sensed the books RFID tag and gat information form tag and send to the PC database.
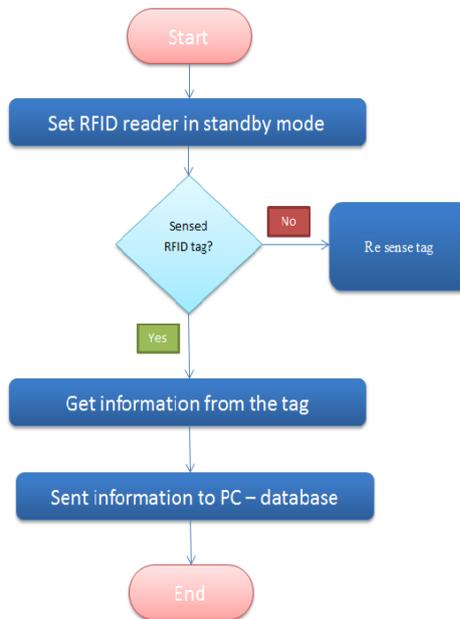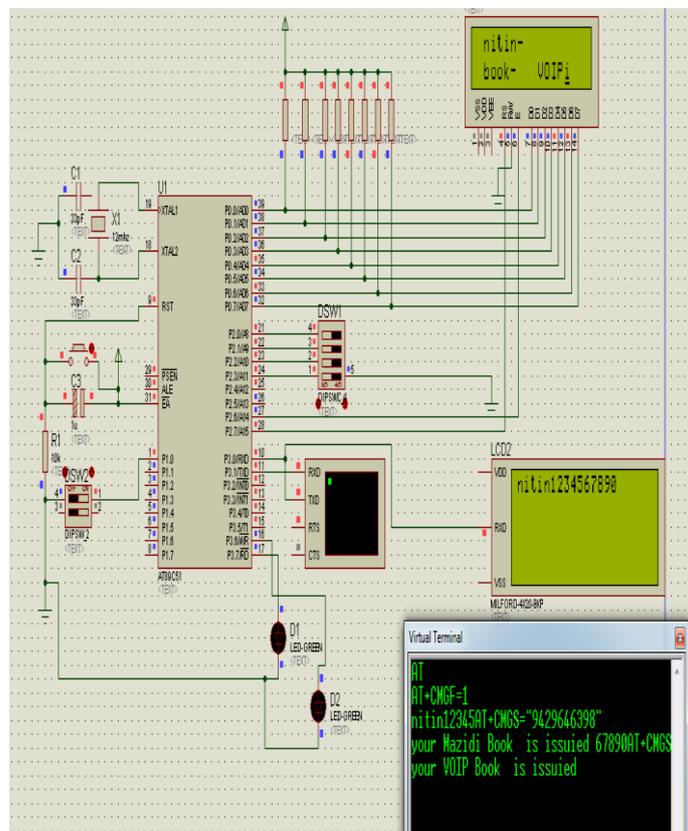
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Fig. 5 software Architecture Block Diagram

Simulation result

VIII. Conclusion

The RFID Based library management System could automatically detect the identities of the books and will perform the check-in/check-out recording. The system could automatically make a log of all the timings and as well as details of the books. These will be the major achievements met in the project, among other objectives also achieved which include report generation part on daily and monthly basis and establish remote database connection. Reading books in motion can be done accurately using RFID. A system developed with a log in windows enables security and the overall cost of implementing the system may seem high but after a year of running the system, very high benefits will be realized. The whole system is very convenient and saves much on time.

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