Smart Library Book Management System

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Abstract:-- In recent years, RFID technology has replaced the bar code system or a magnetic strip on the back of credit cards. This paper proposes a smart library book management system that uses Radio frequency waves to transfer data from a tag attached to the book. The incorporation of RFID technology in a library helps reduce human intervention and has been designed to support the librarian as well as the user. Raspberry Pi and RFID reader(s) are attached to each book rack to detect the correct positioning of the books. A MySQL database has been created, that contains information of the books in the library. A web page is also designed to display the location of the misplaced books that helps the librarian.

Keywords:— RFID; bar code; Raspberry Pi; Positioning; database.

I. INTRODUCTION

In olden days, libraries were large and contained numerous texts and were difficult to manage for the librarian and searching for a particular book could be a strenuous task. But the evolution from manually managing the books to the use of Radio Frequency Identification has saved a lot of effort and man hours.

RFID or Radio Frequency Identification is an Automated Data Collection technology that uses radio frequency waves to transfer data between a reader and a movable item to identify and track the item. The operation of RFID is vast and does not require line of sight path or physical contact between reader and the tagged item.

RFID when integrated with backend allows for wide range of applications and is far superior than other automated data technologies like bar codes and OCR.

RFID technology has helped to a great level in indoor positioning systems and has reduced human intervention in lot of everyday applications. Major applications of RFID Technology include Logistics and Supply chain Visibility, Attendance systems, access controls. RFID has been recently banked upon for some rarer applications like race timing, laundry management and Interactive marketing. Library management is a popular application of Radio Frequency Identification. The systems that are currently in use consist of RFID readers placed in the library that see to it that the librarian's database now says that the book has now been borrowed by a particular user and details like the issue date, book details, date to return the book etc. This system has benefitted the Library Managers to a great extent.

The system that has been proposed helps the librarian to manage the misplaced books effectively, by the use of RFID tags in the books and the reader available in the book racks. The developed web page gives the details about the correct positions of the misplaced books.

Section II gives the literature survey related to the proposed work. The motivation and objective of the proposed work is presented in section III. Section IV describes the various components and processes of the smart library book management system. The results of the proposed work are discussed in section V. Section VI presents the conclusion and future scope.

II. RELATED WORK

RFID Technology is one of the best solutions to indoor positioning systems. Earlier barcodes were used for implementation of indoor positioning systems, but the requirement of a line of sight path for Bar code reader systems makes the Radio Frequency Identification more robust. RFID when integrated with Book spine matching, smart cabinets, Internet of Things and many other recent trends in technology, highly efficient and useful systems can be developed.

Anastasis C. Polycarpou[2] from the University of Nicosia Research Foundation, researched upon how using an RFID System based on smart cabinets can make for a good Library. Prototype smart cabinets were built and tested using different types of near-field shelf antennas ensuring confined coverage in the vicinity of the shelf, thus avoiding unwanted identification of books residing at nearby shelves. The shelf antennas were optimized in such a way as to maximize tag readability and minimize electromagnetic pollution in the vicinity of the cabinet.

Kiyotaka Fujisaki[6] from Kyushu University, Japan studied the influence that papers or other RFID tags give to the resonant frequency of an RFID tag is evaluated. A 13.56MHz RFID System is used. The system is affected easily by neighboring environment and the resonant frequency- degrades communication performance.

Shun-Dao Xie[7] from Sun Yat-sen University looked upon how Internet of things can be harnessed for Library Management. Librarians can add, refresh, inventory and find the misplaced items efficiently. Users of the library can search, borrow and return items. The functions of this Internet of Things System for Library Materials Management include user identification, inventorying, adding, refreshing, searching, and self-help, borrowing & returning library materials. An android device with an RFID reader embedded in it is required for this design. The users can make use of an android mobile application.

III. MOTIVATION AND OBJECTIVE

The major motivations behind developing a smart library management system is due to the problems involved, which are mentioned below:

♦ Locating/ searching the misplaced books
♦ Maintaining Security
♦ Waste of man-hour

The main objective of the proposed system is to develop a smart book management system that is robust and efficient, to locate the misplaced books.

IV. DESIGN AND IMPLEMENTATION

This paper proposes a smart system to manage misplaced books in the library and thus help the librarian. It makes sure every rack in the library consists of an RFID reader/Interrogator that is constantly being powered up by a Raspberry Pi. There exists a database that contains the RFID tag values, other book details and position of the books. The RFID tags that are embedded in all the books are being detected by the interrogator. The interrogator sends the tag value to the pi constantly.

Every rack has its own database. When a Reader passes a value to the Raspberry Pi, and if the Raspberry Pi's database does not recognize the book details, a buzzer beeps indicating the book is placed in the wrong rack. A webpage is

created that shows the user the correct location of the misplaced book.

Fig. 1 illustrates the various components involved in the proposed system.

The RFID tags which have a frequency of 125 kHz (uses inductive coupling) are interfaced with the EM18 Reader module. These tags are attached to each book in the library and each time the book is placed in the rack, the unique id code of the tag is sent serially through the Raspberry pi GPIO. Each rack will have a separate reader circuit attached to it to make the detection process easier.
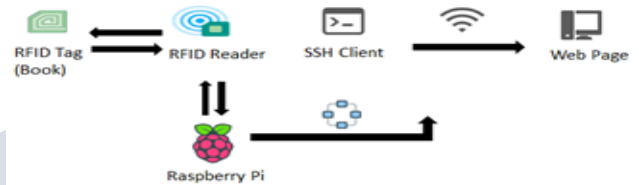

Fig. 1: Smart library management system

A Database containing all the book information and the position of each book in the library is created using MySQL. The unique id obtained from the RFID tag is compared with the book ID stored in the database and the related information of the book is displayed.

A web page is created using the Flask micro-framework Software and HTML. The position of the book is verified using an if-else statement in the python and the web page will display the correct position of the book to the librarian and the users.

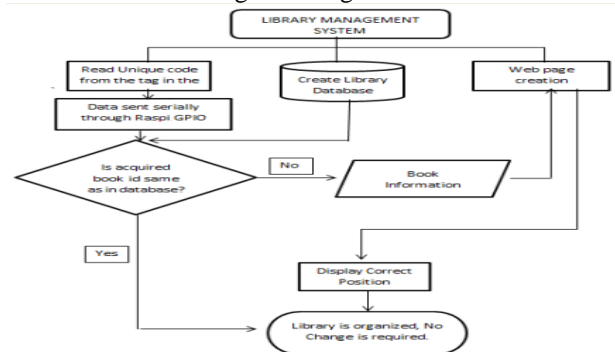The various steps described above are presented in the form of a flow diagram in fig. 2.

Fig. 2: Flow diagram of Library Management System

V. RESULTS AND DISCUSSION

This section presents the results of the proposed work. The RFID reader and associated hardware is attached to the rack. The book is placed on the rack and ID tag value is passed to the Raspberry Pi. The book position is compared to the position existing in the database and the buzzer beeps when the position is incorrect. On logging onto http://127.0.0.1:5000/, the book information and the correct location of the book. Fig. 3 displays the database that has been created using MySQL. Fig. 4 presents the web page which displays the correct position of the book.
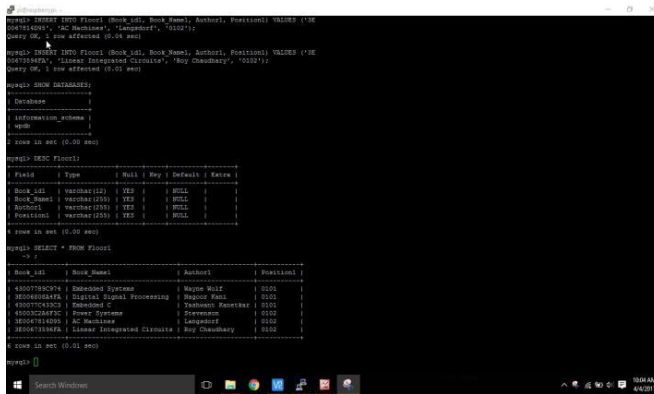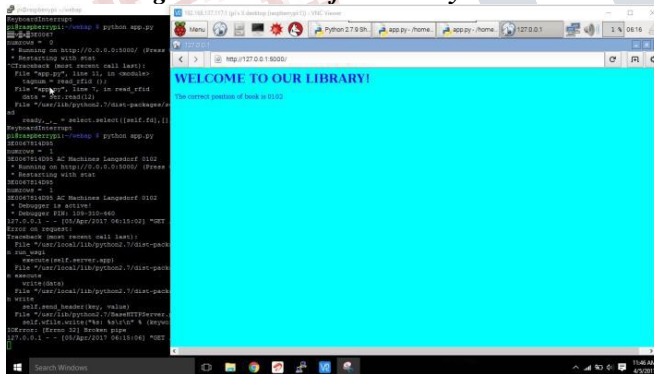

Fig. 3: Database of the library books

Fig. 4: Sample output

VI. CONCLUSION AND FUTURE WORK

In this paper, we looked at how advancements in RFID technology can be used to make a library function efficiently, and provide easy access and save time. It solves the problem of library materials management and provides convenient access to library materials management system using RFID to both users and librarians. The above research is a prototype designed for a single rack though highly scalable. The same prototype can be extended easily to meet the requirements of a larger library.

This system makes use of a RFID reader that can read up to a distance of 10cm. The distance can be improved by using a sophisticated reader.

Replacing the passive tags with the active tags can help in improving the range of detection for the reader and hence make the system more robust.

Future work is to make further study based on this system and implement it into libraries, testing and constantly improving the performance of the system to make it more robust, secure and rich in function.

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