Automated Book Management and Tracking System for Libraries Using RFID

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Abstract: Nowadays, libraries contain hundreds of books that need to be handled properly by the librarian alone. So, this becomes a time consuming process and a lot of manual work is required. Also, keeping count of the books becomes tedious. To overcome this issue, we have automated the library management system using RFID technology which will make the handling of a large number of books simple. Not only does this technology help in easing the work at library but also has made tracking of assets, inventory management and material handling easy in other fields. In this project, we have used RFID as a continuous scanner to keep a count of the books. This will keep the librarian updated about the number of books available at the start and end of the day through a database. Another reader is used to scan the user's library card and the book. The books contain RFID tags that are continuously monitored by the reader and if there's been an issuing error the RFID scanner at the entrance sounds an alarm to notify of the unissued book, this is where the security aspect of RFID comes into play. The project revolves around the use of a microcontroller ATMEGA 328p, to control the RFID system. The microcontroller is interfaced with the RFID system, LCD and buzzer. LCD displays the details of the issuing/reissuing of the books (and the details of the user membership). This project is mainly implemented keeping in mind the reduction of the human efforts needed otherwise through a fully automated library guided by the RFID technology to aid in fast transaction.

Index Terms - **RFID, Continuous Scanning, Alarm, Human Efforts.**

I. INTRODUCTION

RFID (Radio Frequency Identification) can be defined as follows: automatic identification method which uses radio-frequency electromagnetic fields to identify objects carrying tags when they come close to a reader. RFID tags generally feature an electronic chip with an antenna in order to pass information onto reader. The assembly is called an inlay and is packaged in various forms to be able to withstand the conditions in which it will operate. This finished product is known as a RFID tag, label or transponder. The information contained within an RFID tag is a unique identifier, once this identifier has been written into the electronic a circuit or chip, it can no longer be modified, only read. This principle is called WORM (Write Once Read Multiple).

There is a tremendous growth in the industry to use RFID technology in 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 system etc.

RFID has been a great help in Library Management in the sense that it has reduced the human efforts needed and made the process of issuing, reissuing and returning the books much easier. Unlike the barcode technology, RFID tags can be scanned without being in the line-of-sight which is why the process is fast.

In this project, a database is present which directly provides the book information and library member's information when the library card is scanned. The RFID tag can contain unique identifying information, such as a book's title or code. The information is read by a RFID reader.

The user first scans the library card at the front desk to verify if he/she is a member of the library, then the user can type the required book's name that needs to be issued. If the book is available, the user will take the book from the shelf and get it scanned in order to have it issued under the user's name. The RFID reader updates this information in the database.

The RFID reader also keeps tabs on how many books there are at the start of the day and at the end so that it is easy to understand which books were issued and which weren't. Also there is a provision which provides easy recognition of misplaced books, as the reader is scanning a particular set of books and updating the database simultaneously, which makes the librarian aware of a misplaced book at a particular shelf.

In addition to all this, using RFID has also helped in securing the library in case of thefts. A RFID scanner at the entrance searches for a tag on a book which the user might have forgotten to issue at the counter and it activates the buzzer to notify the staff of the situation.

RFID technology, in a nutshell, lessens the need of manual operation which otherwise might introduce some delays in the parts of updating the database after every scan or during issuing/reissuing/returning of books.
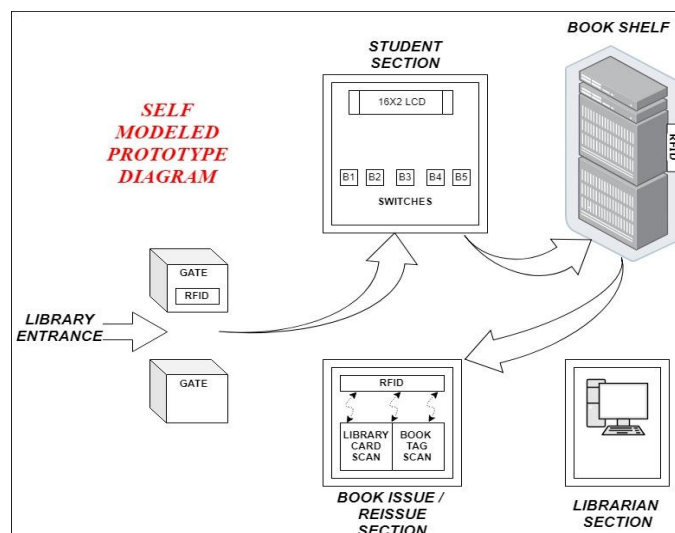
II. DESCRIPTION

Fig. 1: Proposed Library System Process

The above figure 1 shows the proposed model of automated book management and tracking system for libraries. The aim of this proposed idea is to have a track of no of books in libraries at the start of the day and end of the day with no interference of librarian. Also the main objective is to implement a smart library system which is user friendly and reduce the time consumption to issue book or return book. The smart library will consist of proper, efficient and theft controlled operation for a reader which will be fully automated. Library staff whose job is meant to be helping reader, use library resources at the fullest, is always busy handling the books. RFID helps to automate this process and provides them an opportunity to better utilize their time in serving reader with the interference of librarian [1].

The misplacement of books in library is major issue which can be solved by continuous surveillance of books using long distance RFID reader. The RFID tags are placed on every book and on the library card of the user. Attention is given while programming these tags as they consist of unique codes [2]. When a user by mistake places a book on other location other than its allocated location, then there will be immediate update in the database which will be provided by librarian.

There will be an error shown in the database which will be identified by the librarian and he will place the misplaced book on its allocated location. Book can be gained by both the authority and students instead of the traditional way of manually searching the book. This would save a lot of time and enable efficient queue management of books. As actions on these tagged assets are being recorded, data can be usefully exploited as per librarian's need [3-4]. The continuous surveillance of book also help user to know the count of books in and out of library in a day. Also RFID reader continuous surveillance will update the database of book issued by reader with his library card details when the reader scans his library card in front of second low distance RFID reader.

Further if the user does not scan his library card and issues the book, at that time he will come in contact of the thief detection system placed at the exit of the door. At the door there will be other RFID scanner where user needs to scan the book again, if the book is found issued in the database then the user is free to go out of the library. But if the book is found not issued in database the buzzer placed at the door of library will beep continuously and further user will be caught [4].
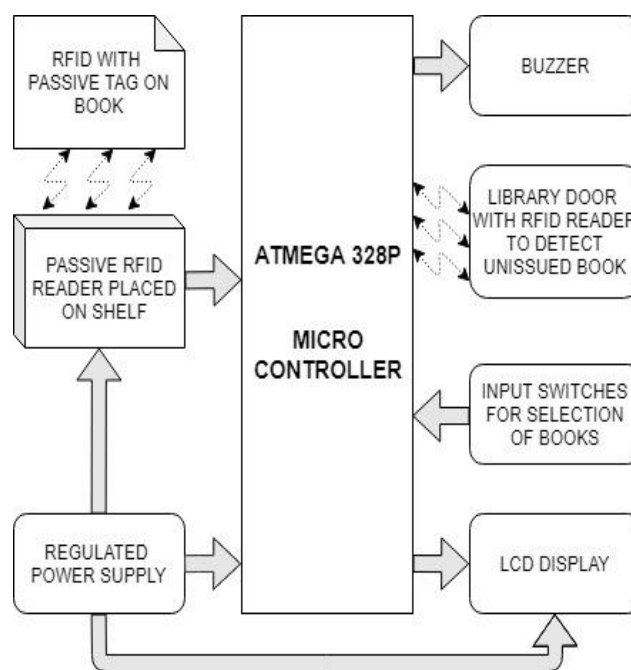
III. METHODOLOGY

Fig. 2: Block Diagram

Working of Block Diagram:

The operations specified in the description are being performed by the micro controller which is interfaced with RFID reader module RC522 also with LCD, books with passive tags, switches and buzzer as shown in figure 2. Also a separate regulated power supply is designed to drive all the components used to complete the operations.

At start the regulated power supply will transfer voltage of 5V to controller and LCD, 7-9V to RFID module.

The controller used here is ATMEGA 328P which is an 8-bit AVR microcontroller driven by only 5V supply. There is a bidirectional communication between the controller and RFID reader.

ATMEGA 328P will consist of database with number of books in library. Also it will contain the database of library card holders used while issuing book for specific user.

The EM-18 RFID reader transmits a radio frequency wave on the tags shown in figure 3. The unique ID embedded inside the tags is recognized by the reader and sent to the microcontroller in order to update the database continuously. It also helps in finding out the misplaced book.

Another RFID module, used at the library entrance, is linked to the microcontroller. If an unissued book goes through the gates, this reader will notify the microcontroller to sound the buzzer indicating theft/negligence.
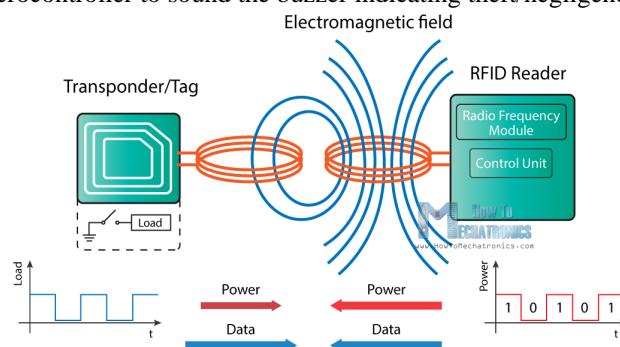

Fig. 3: RFID Reader Working [5]

LCD is used to display the books' location with the help of database. As and when the book and the user's library card is scanned, LCD will display the details of the card holder and the status of the book. The LCD also displays the unissued book's name when the RFID gates detect it [6].

Switches are also integrated with the microcontroller to select the books. Suppose there are five switches then if first switch is pressed then the location of it (ex. Book name, Shelf no 1, position 3) will be displayed on LCD for easiness for user to find book. Similarly such five switches will be used as an option to student to know the location of various books in library.
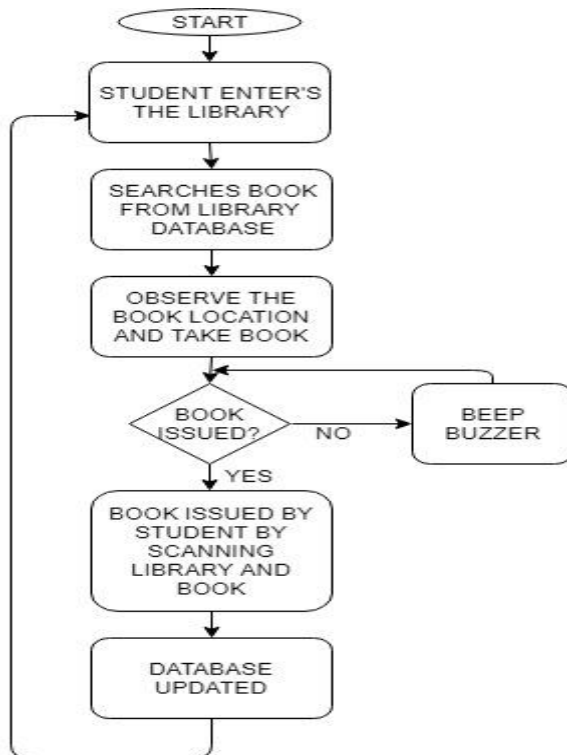
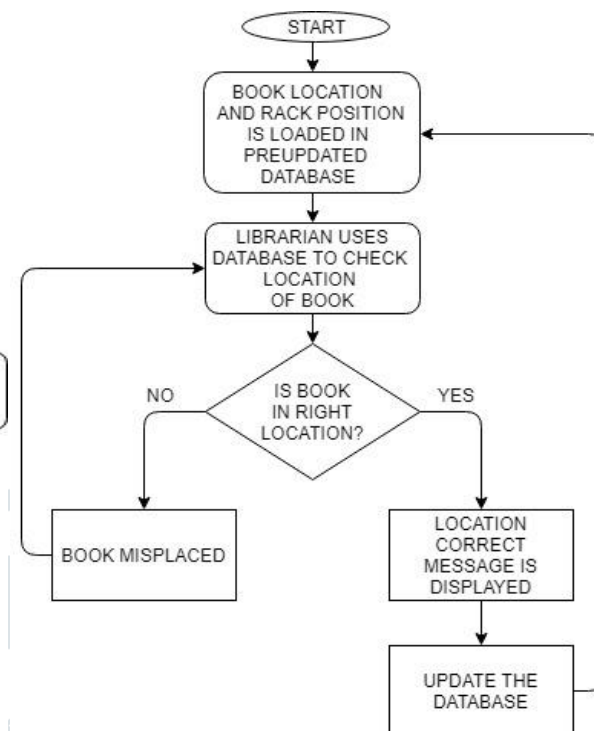## IV. FLOWCHART

Fig. 4: Process of Issuing the Book   Fig. 5: Process of Checking the Location of Misplaced Book
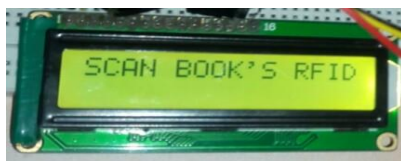
IV. RESULTS AND DISCUSSION

(a) Scanning of library card

(b) Accessing of account

(c) Scanning of book

(d) Issuing of book

Fig. 6: Results

Both figures 6.a and 6.b show the process of scanning library card and getting account accessed. Figures 6.c and 6.d shows the process of scanning book tag and getting it issued. RFID system is an important part of the smart library management system. The idea is integration of the passive RFID technology into a library management system. This integration makes both the library users and staff's task easy, smart, convenient and automated. The proposed system enables the library staff to handle sorting, lending, returning, tagging in easy and convenient manner. In addition, library users can find, borrow, localize and renew the borrowing period of books easily using the proposed system. Furthermore, the RFID reader at the entrance ensures the security of the books which are not issued by the user.

V. CONCLUSION

In this paper we introduced whole new take on RFID systems used in libraries by using RFID in three places. First, RFID sensor is used on the shelf to keep the count of books and also identify any misplacement. Second, RFID is used at the gates to prevent theft of books. And finally, issuing/reissuing/returning of the books is carried under the RFID system. Through this paper we have described all the important components we have utilized in our project and complete working of specified component. Also, the flowchart illustrates the brief operation of process a student and librarian need to go through.

VI. ACKNOWLEDGMENT

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