RFID Based Library Management System

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Abstract: **Libraries are very important aspects for humans. They are essential in acquiring and retaining the knowledge of a person. But the earlier library system has caused many problems. This project helps to identify the large number of tagged books using radio waves. The database shows the availability of the book in the library so that the student can search in the database and if available, they can collect book from the library. It helps to handle the issue, renewal and return process via RFID tags easily. Student will get notified about the due date of book using GSM. If the student failed to return the book after the due date corresponding fine will be generated based on the time period. RFID EAS system is used for theft detection at the library.**

Keywords: **Arduino, Database management, Library management system, RFID, RFID reader, RFID tag, RFID technology, tracking.**

1. Introduction

Every educational institute has the library and an existing library management system uses manual system and bar-code technology for accessing the book. But with largely increasing the number of books in the library it causes human error, consumes more time and become less efficient. It is important to digitalize the existing library and the problem of barcode technology. The drawback of the above-mentioned technology can be overcome by using RFID technology. There is a rapid development in this technology which has been used in various application. RFID system helps inefficient collection, management and distribution of books. It will track the books and makes issue/return of the book process easier. Database is created to store the information of the books available in the library, so that the user can access it for collecting the books. It helps to authenticate the registered user to avoid accessing from unauthorized user. GSM module is used to provide alert message for the registered user during return process. It is implemented with theft detection system to identify the theft action that take place in the library. RFID has three parts- a scanning antenna i.e., RFID reader, a transceiver and a transponder i.e., the RFID tag which is programmed with information and it is located on the objects to be identified. The RFID technique uses electromagnetic coupling for data exchange between the reader/writer and the tag. When RFID tag passes near the area of scanning antenna, it detects the signal from antenna and the chip get activated and transmits the information. The proposed system is more efficient and provide more easy option for the registered user.

2. Literature Survey

The paper [1] explains about book tracing and theft detection using RFID technology. This system mainly helps to automate the process without the intervention of human and to overcome the disadvantage of bar code technology.

The paper [2] proposed a study on implementation of smart library system using IOT. The main aim is to solve the difficulty in tracking down the details of library transactions due to slow system, loss of data about the books and difficulty in updating the information on regular basis by using RFID and IOT technologies. This system will manage and control all the information of the library and provides benefits for staffs and students. This system is more efficient and utilizes less time.

The paper [3] focused to reduce manual work and to track the position of the book using IR sensor installed in each rack. IR sensor continuously senses the availability of the book in the rack and stores the information in the cloud. It helps the user for easy access of book.

The paper [4] introduced a library access system smartphone application using android. The main aim is to provide easy option for accessing their library account through the android device. It provides the option for the user to check the availability of books in the library and saves the time. Database is created to store the information.

The paper [5] explains the role of QR code in reaching mobile users of academic libraries for the effectiveness and potential to deliver library services to a new generation of students. It can hold more information than bar coding. If there is any damage to the code, it is likely to render it unreadable.

The paper [6] emphasized on various bar code techniques and checks whether the large data encoding into same dimension is possible or not. It allows secure data transmission by encoding data into bar codes. Paper makes a study about the existing bar-coding technique.

The paper [7] explains an overview of the current states and trends in RFID technology. It focuses on the challenges that the organization face in deploying this technology. It compiles

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complete automatic records of customer service. It focuses to solve the technical and security issue.

3. Methodologies

The objectives of the proposed system are as follows:
1. To authenticate the registered user
2. To provide automated locating
3. To maintain the correct database
4. To provide alert system

Methodology for objective 1:

- First the user has to register in a particular authorized center.
- Then user can be provided with the user identity card (RFID).
- The user has to carry out the identification process to access the library.
- Tags are used to store the information of the object to be tracked and can be accessed via radio signal of RFID reader.
- The tags used in this system are passive tags. RFID card is scanned, if it is valid then user can access the books from that particular library or else.
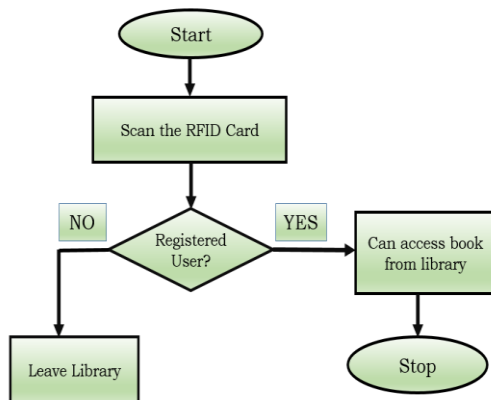

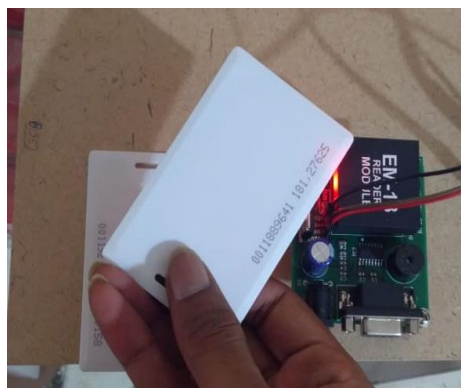Fig. 1. Flow chart for objective 1

Fig. 2. Snapshot of objective 1

Methodology for objective 2:
- Tagging is the important process in this RFID system.

It stores the data of a book to which RFID tags are attached and rewrite without any help of contact and line of sight.
- All the books present in a library is embedded with RFID tags.
- The user cards and RFID readers are used to read these tags.
- Once the user borrows the book then the book is scanned and that scanned information is uploaded to the database.
- After that the issue/push button is pressed.

Book issue process:
- After authentication is done, further process is enabled.
- Student searches the availability of required books from Library Database.
- If available, student takes book.
- Student shows RFID tag to RFID reader.
- Reader reads and updates the database.
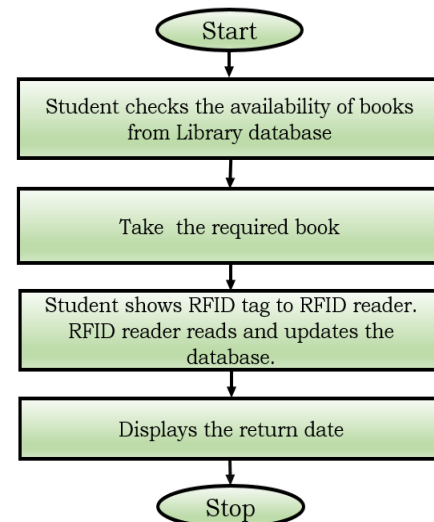- Displays the return date and student leaves library with book.

Fig. 3. Flow Chart for book issue process

Book return process:
- Student enters the library with book to be returned.
- Student displays the RFID tag to the RFID reader and places a book inside the tray.
- After a book is placed inside the tray, "Book Returned" message is displayed on the LCD and also database is updated.
- Student exits from the library after returning of books.

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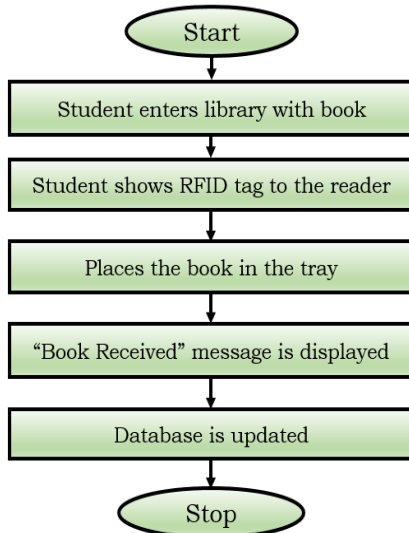114

Fig. 4. Flow chart for book return process

Methodology for objective 3:

- Data stored in a tag provides an identification, storage location, loan status and history of a particular books.
- RFID tags are designed in such a manner that they can be placed on the library media, including books, CDs, DVDs and tapes.
- The librarian has to classify the books into groups and paste RFID tags on them. These tags help in tracking the books within the range of the RFID reader.
- The librarian has to login to the mat-lab software and update the information of availability of books, their location, issue and return of books information and the fine generated if the book returned after due date.
- The GSM module is a highly flexible plug and it supports features like SMS, Data, GPRS. The details of due date of books can be sent to the user using GSM modem.
- These are the information which are uploaded to the database and can be monitored by the librarian.
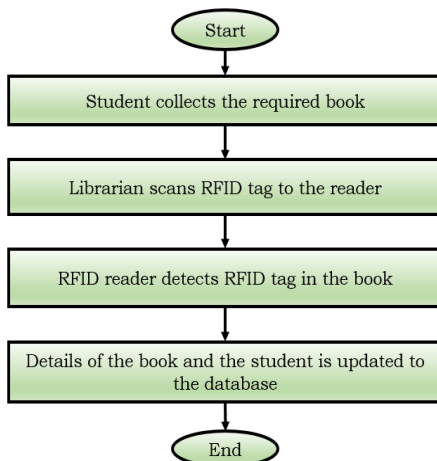

Fig. 5. Flow chart for objective 3

Methodology for objective 4:

- In order to prevent the theft inside the library, alerting function is provided in this system.
- If student tries to take away the book without registering it in the library, then the alarm gets activated.
- RFID EAS Gate is used for anti-theft in the Library RFID Management System.
- It tracks items of about 1 meter. When an un-borrowed item passes through them, then ittriggers the alarm system.
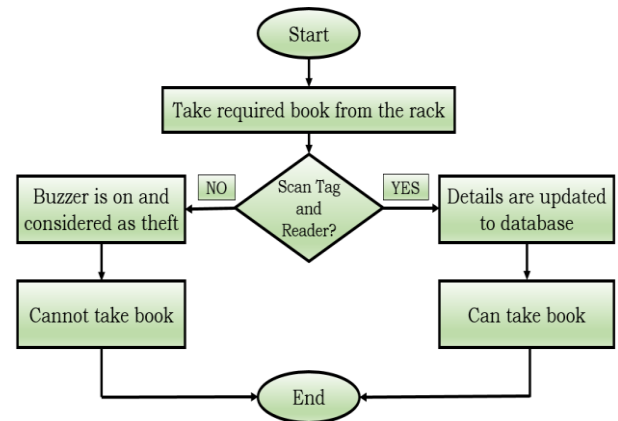- Buzzer makes sound and lights on the gate will glow as student passes with the un-borrowed library material.

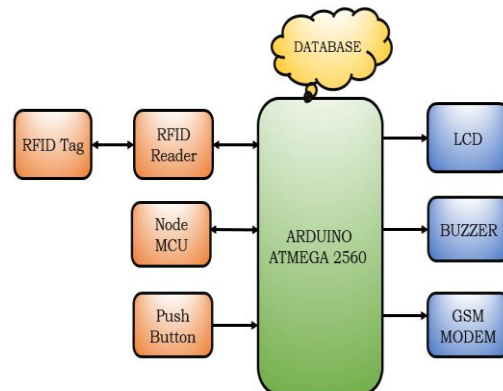Fig. 6. Flow chart for objective 4

4. System Design

Fig. 7. Block diagram of the system design

As shown in the figure, it consists of RFID Reader to scan RFID Rag and push button is used to indicate the issue of books. Buzzer is on, when there is any book theft in the library. Information regarding student, issue/return of books and due date is updated to the database.

The working principle of this system mainly includes:

1) Tagging

In this system, tag is the most important link. It stores

information about the book to which it is attached. It provides identification of book and also its location in library. The librarian's role is simply to classify the books and paste the RFID tags on them.

2) Issue/return process

The student approaches to borrow the book or return it to the counter. First the students have to identify themselves using the RFID cards they are given. RFID reader to read card to make an entry in the database. The worker gathers the book and reads the card during book return. If the book is returned late, the user receives good.

3) Updating to a database

The librarian must update the information about the availability of books, their location, issue and return of books and also about the fine if the book is returned late.

4) Anti-theft detection

The EAS Anti-theft program is used to detect EAS-equipped RFID tags. Detection of theft is an integral function of chip within the tag. Triggers the alarm system i.e., buzzer when they are passed through an un-borrowed book.

5. Advantages

- *Time saving:* Since more than one tag can be read at a time, RFID technology in library can reduce circulation time and issue/return time is also reduced.

- *Accurate data management:* The system contains accurate data of the issue/return dates and hence the data related to fine collection becomes automatic and accurate.

- *Improved security:* Any unauthorized exit of the documents can be detected easily, so it reduces theft and security in the library is improved.

- *Better shelf management:* It is made easy and quick by tracing the documents automatically

- Improved customer service: Lesser time is required for issue/return at the counter, so it can provide better customer service.

- *Labor saving:* This system makes library functions automatic, making the task of the librarian easy.

6. Conclusion

The proposed system is very efficient in terms of technology and easy to use, consumes less time and automate the library and reduce the workload of the librarian. RFID in the library speeds up the process of book borrowing, tracking, books searching thus frees workers to perform further customer support tasks. RFID readers and RFID tags to be used have to be of high quality to provide the best results. The main benefit of this project is that all the activities including problem, renewal and return of books are digitized and all these actions are modified in the database automatically. The efficient utilization of the technology also depends on the information that is to be written in tag. Such applications will result in substantial labor cost savings, improve customer service, lower book theft and provide a continuous update of new book collections.

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