

Development of Automated Library System

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Abstract- The Library is a fast-growing organism. The ancient methods of maintaining it are no longer dynamic and efficient. For expeditious retrieval and dissemination of information and better service for the clientele, the application of modern techniques has become absolutely indispensable. Radio frequency identification (RFID) technology is an innovative automated library system for automatic identification and tracking of library material. Currently, RFID applications range from book tracking and stock management to theft detection and automatic book sorting. RFID technology is a dynamic link between people, objects, and processes, and shortly, it plays a prime role in data collection, identification as well as analysis necessary for specific library operations. An automated library with the support of RFID technology would be a "self-service station" that demands the least intervention by the library personnel. Efforts are being made to introduce self-service "check-in" and "check-out" that avoid long delays in the delivery of library material and also for achieving better efficiency in operations. In this paper, an attempt has been made to describe different components of the RFID system and how we implement RFID tags that are embedded on books as well as user issue cards. These tags are scanned by the RFID readers and the data is sent serially to the microcontroller that undergoes processing. This processed data is stored in a personal computer that displays the whole information and can be retrieved later if necessary. It is found that this automation project will serve as a model for any library.

Keywords- RFID, Node MCU, HTML, Apache Server, XAMPP

1. INTRODUCTION

RFID is an abbreviation of Radio Frequency Identification that uses Radio waves for communication and is rapidly gaining importance to boost the existing systems. The current library systems are based on barcode technology but it's not the best option. The barcode system used in libraries is very

time-consuming and labor-intensive. On the opposite, the RFID system provides a solution to effectively collect, manage and distribute books[1]. In contrast to barcode technology, RFID systems do not require line-of-sight access to the tag to retrieve. The RFID is an automatic identification technique[2] used for the fast transaction of books or journals using RFID tags and readers. The RFID technology helps in the fast issuing, returning, and reissuing of books. The technology helps indirect transaction of information from the tags to the Personal computer of the librarian and in automatic updating of transactions in users account. The RFID tags can be programmed with unique code. This code gets read when passing through the RFID reader. When a tag crosses the reader, the reader recognizes the unique code and updates the account of the user. Modern readers have the capability of reading up to 15 tags at a time[3]. Through this paper, a sincere effort has been made to discuss different components of an RFID system and its advantages and disadvantages in libraries along with some pictures to give an easy understanding of the discussions carried out. In this project, the aim was mainly to develop the website section and integrate the RFID cards with the website. This Hardware-Software Integration through RFID was the novelty of this work which was shown in the project. It was challenging and interesting too.

2. COMPONENTS OF RFID SYSTEM

RFID Tags - RFID tags are a type of tracking system that is electronically programmed with unique information.

- Readers - Sensors to query the tags
- Antenna
- Server - on which the software that interfaces with the integrated library software is loaded.

a. RFID tags

RFID tags are a type of tracking system that uses smart barcodes to identify items. RFID is short for "radio frequency identification," and as such, RFID tags utilize radio frequency technology. This tag is equipped with a programmable chip and an antenna. Each paper-thin tag contains an engraved antenna and a microchip. There are three types of tags: "read-only", "WORM" and read/write". Tags are "read-only" if the identification is encoded at the time of manufacture and not rewritable[4]. "WORM" (Write-Once Read-Many) tags are programmed by the using organization as per their requirements, but without the ability to rewrite them later. There are primarily three basic types- of RFID tags that are familiar to most consumers who use the technology: i) active, ii) passive, and iii) semi-passive.



Figure 1: RFID Tags

b. Readers

Radio frequency identification readers are composed of a radio frequency module, a control unit, and an antenna to interrogate electronic tags via radio frequency (RF) communication. The RC522 is a 13.56MHz RFID module that is based on the MFRC522[6] controller from NXP semiconductors. The module can support I2C, SPI, and UART and normally is shipped with an RFID card and key fob. It is commonly used in attendance systems and other people/object identification applications. When a tag passes through the field, the information stored on the chip of the tag is interpreted by the reader and sent to the server, which in turn, communicates with the integrated library system when the RFID system is interfaced with it. RFID sensors (readers) are installed at library exit gates. These sensors read the information on the tags and communicate that information to a server. The server, after checking the database, turns on an alarm if the book is not properly checked out. Here we can mainly categorize the use of the reader as per its needs in the library.



Figure 2: RFID Reader

c. Server

The software section mainly consists of a Localhost website which is created based on HTML, PHP, CSS & JavaScript. This website helps to execute the Hardware RFID process & smooth flow of library management. This website has two sections namely- Admin Portal & Student Portal for Library admin & students respectively. Admin Portal contains several web pages like- "Add Book", "Delete Book", "Fines", "Student Information" etc. to manage the library. On the other hand Student Portal contains web pages like- "Issue Book", "Return Book", "Books", "Issued Books", "Log In" etc. to issue and return books and for other purposes. In the Backend, the website is connected with a MySQL database to store the information. The whole website is created with the help of software named XAMPP. The inbuilt Apache Server in the software has helped to host the website & the inbuilt database has helped to store the information. Basically, the website is a link between RFID and the database[5]. Each student and admin must have to create a profile in the respective portal to access it. The website is made for managing the whole process easier.



Figure 3: Apache Server

2. PROCESS FLOW

i. Door-Side RFID

- At first, when someone touches the RFID card at the reader the RFID will sense the card.
- The unique no on the card will encode in binary and through the inbuilt antenna, it will send to the Arduino UNO.
- Then the Arduino[7] will match the number with its database.
- If the number matched, Arduino, find that the user as an authorized user gives a green signal by the LED and the servo motor will rotate and the gate will open.
- Otherwise, it will give a signal by the RED LED that the user is unauthorized and the servomotor[8] will not rotate and the gate will remain closed.

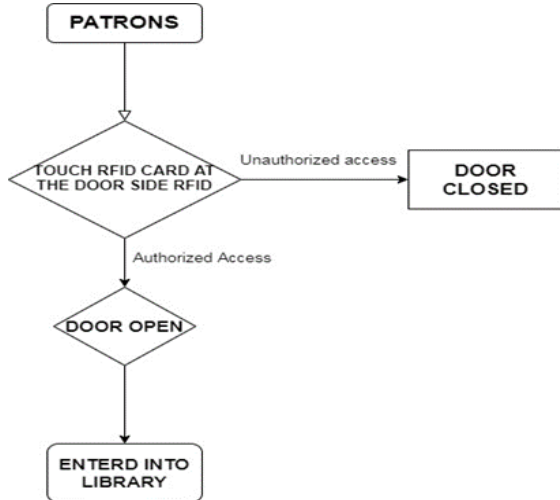


Figure 4: Flow Chart of Door-side RFID Process

ii. Library RFID

- In the Library RFID, we have used the ESP8266 WiFi module and RC522 as RFID Reader.
- As the Server, we are using Apache server to connect the Localhost and PHPMyAdmin as the Mysql database.
- Basically, we have used XAMPP[9] software which has an inbuilt apache server and database. For the Hardware Section, we have used two ESP8266[10]; the first one to identify the person and the other is for books.
- Each RFID card has a unique number which we are using as the Library card number of students and books RFID tags for books. We used RC522 as an RFID reader.

- For the Hardware Section, we have used two ESP8266; the first one to identify the person and the other is for books.
- Each RFID card has a unique number which we are using as the Library card number of students and books RFID tags for books.
- The data acquired by the RFID will store in the PHPMyAdmin localhost MySQL database section.
- Book RFID will store the book-related information and Card RFID will store the person-related information.
- The tables are interconnected with each other through Foreign Keys.
- The whole database will be controlled by the Apache server.

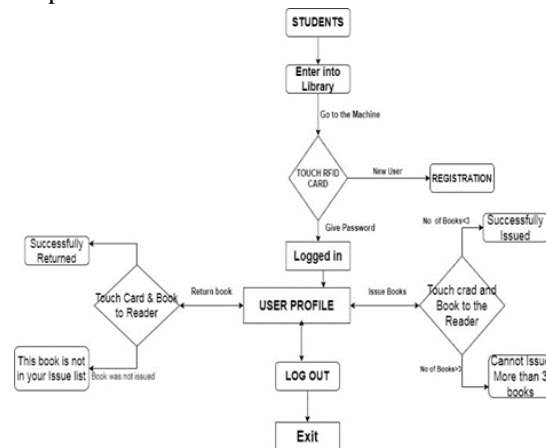


Figure 5: Flow Chart of Library RFID Process

3. OUTPUT

The whole process of managing the library through RFID is described below-

- Students come towards the library door and touch their RFID card (which will be their library cards) at the door RFID.
- If he/she is an authorized user, a green LED will blink & doors will open. Otherwise, Red LED will blink and doors will remain closed.
- Entering into the library he/she can search book from the pc. If the book is available it will show the Book name & ID, otherwise, it will give a message that no book is found.
- To issue or return the book they have to log in to their profile with their RFID card. If he/she is a new user, he/she has to sign up and register with their details. There is also another option to change their password.

- Entering into their profile students can edit their info, check their fines(if they have).
- To issue a book they have to collect the book from the shelf, open the issue window, touch the book to the RFID. This will fetch the book details and then they have to touch their RFID card to the Card ID reader. After clicking the ‘ISSUE’ button the book will be issued in their name. An autogenerated email will be sent to the user's email id containing detailed information about the issued book.
- One student can issue a maximum of 3 books against their names.
- If they need any book urgently and for more than 15 days, they can make a request to the admin. If the admin approves, the book will be issued.
- The return process is the same as the issue process.
- Besides this, there are other features available on the website. Students can edit their personal info, check the lists of books available in the library, check their fines, check the lists of issued books and their return dates, etc.
- Students need to log out from their profile after completion.

4. CONCLUSION

There are few options available on our website for security purposes. If any student forgets their password they can update it. Besides this one student can issue or return a book only through his/her profile. We are also thinking about adding some more features to make it more useful and efficient. We are also thinking about making a mobile application through which students can check available books, library status, etc. from home. RFID technology is not only emerging but also more effective, convenient, and cost-efficient technology in library security. This technology has slowly begun to replace the traditional bar-code on library items. If the price which is the only constraint is reduced, the usage of RFID in various sections will increase at a huge rate.

5. REFERENCE

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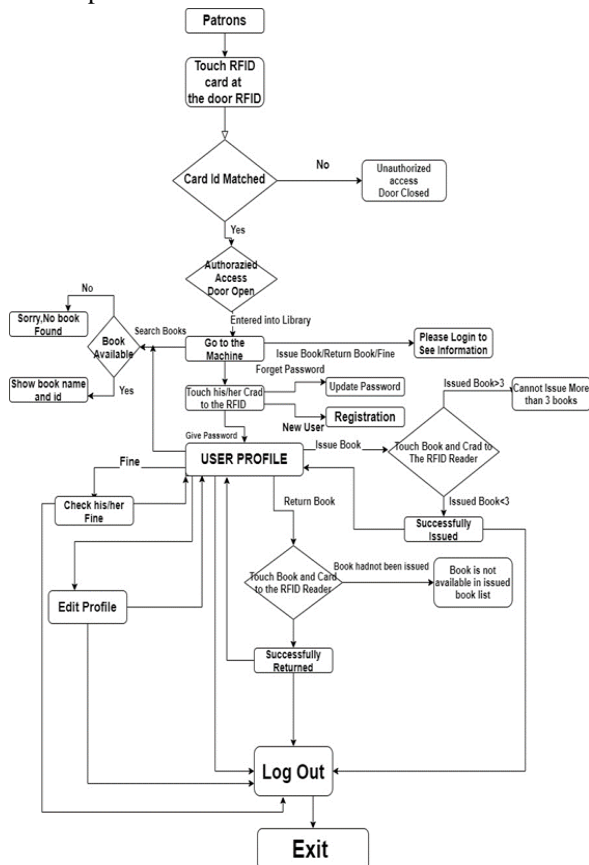


Figure 6: Flow Chart of the Process