

SMART BOOK MANAGEMENT SYSTEM

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ABSTRACT:

This paper describes the smart book management system that uses RFID (Radio Frequency Identification) Technology, which transmits and receives information through radio waves without direct contact. In this system, each bookshelf in the library has a special device called an RFID reader and also every book has a small tag with a unique ID. These tags are attached to the book cover. when a book is near the shelf, the tag receives the signal sent by the reader and the tag sends back its unique ID to the reader. The NodeMCU collects the unique ID information from the reader. NodeMCU is connected to a mobile app through the BLYNK platform. To help the librarian, if a book is placed in the wrong place, the red LED placed on the shelf turns on. Also, a message is sent to the librarian's mobile through Blynk to alert them about the misplacement of books.

Keywords:

RFID Module, Node MCU, BLYNK IOT Platform, Indicating LED's.

1. INTRODUCTION

Wireless communication between objects and readers is made possible by RFID technology, which utilizes tags or transponders to collect and manage data. RFID operates by utilizing electromagnetic fields to identify and track objects equipped with tags. These tags hold information that can be read by an RFID reader. Passive tags do not have an internal power source, but instead collect energy from nearby RFID readers. This energy powers the tags, allowing them to transmit their information. Libraries are important for providing access to lots of information to people, helping them to gain knowledge. RFID (Radio Frequency Identification) technology is widely used in libraries to manage books. Properly organizing books in their designated racks is crucial for maintaining an efficient library. It enables librarians and users to locate and access books easily. With implementation of RFID technology in library bookshelves significantly reduces the chances of misplacement of books. The use of RFID technology helps ensure that books are placed on their respective bookshelves and also helps in returning the books to their designated place when they are misplaced [1]. The use of RFID technology in libraries has revolutionized the way librarians manage and track books.

2. OBJECTIVES

The main goal of this paper is to minimize the occurrence of misplaced books in libraries. This system ensures that every book is placed in its designated rack, and if any book is misplaced, it can be quickly identified and returned to its proper location. To achieve this objective, we plan to design and implement a NodeMCU-based RFID system that can identify misplaced books on the bookshelf. Moreover, this project aims to utilize the Blynk IoT platform to send an alert message to the librarian regarding the misplacement of books on the bookshelf [2].

3. BLOCK DIAGRAM

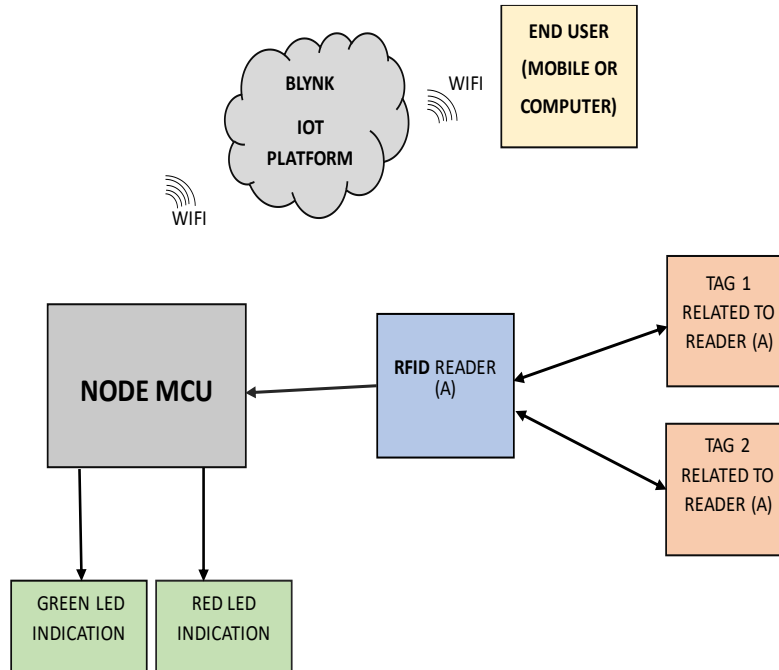


Fig 1: Block diagram of the proposed system

The proposed system consists of an RFID module that consists of a reader and tag. Each rack is connected to an RFID reader each book is assigned a unique RFID Tag which is pasted on the book. The RFID readers are connected to the NODE MCU (a micro controlling unit) this NODE MCU is connected to the mobile application through the BLYNK IOT platform through which the data from the readers is processed and it is passed to the mobile [3]. Node MCU is a microcontroller used to connect devices to the internet or each other, enabling communication and data exchange. LEDs are used for the indication purpose and are connected to Node MCU. When the book is misplaced alert notification will be given through the Blynk platform to the librarians.

4. COMPONENTS USED

To set up a fully functional system, there are several components required they include:

- RC522 Module
- Node MCU
- Mobile or Computer

1.RC522 Module: RC522 Module, which serves as the backbone of the system. This module is responsible for connecting all the various parts and ensuring that they work in sync. This module consists of a reader and a tag. A reader is used to read tag data. The reader consists of an antenna which is used to emit radio waves that are received by the tag and the tag sends back a signal to the reader. This RFID module works on the principle of electromagnetic induction. This technology helps to track the objects to which tags are attached. There are three types of tags depending on the power source [4].

- Active tag
- Passive tag
- Semi-active tag

The RFID reader used in the smart book management system is the RC522 model. This reader operates on a frequency of 13.56 MHz and requires a power supply of 3.3V. The communication protocol used by this reader is SPI. The RFID Tag is a thin label-like device that consists of a chip that has a transceiver and an antenna. It also consists of a memory which is used to store the unique ID. RC522 Reader consists of 8 pins. They are SCK, SDA, MISO, MOSI, IRQ, RST, VCC, and GND [5].



Fig 2: RFID Reader and Tags

2. Node MCU: Node MCU is a powerful microcontroller that provides the necessary processing power to handle all the data and commands that are sent to the system. The Node MCU is an essential component that enables the system to function smoothly and efficiently. It is a type of microcontroller unit used for the communication between the devices. It has a built-in Wi-Fi feature makes it particularly useful for IOT applications. The type of Node MCU used for this project is ESP 32 from the Espressif system. The main use of this microcontroller in this project is to receive data from the reader and send it to the Blynk IOT platform. It is also responsible for controlling the LEDs placed at each rack, which indicate whether a book is placed in the correct rack or not. The NodeMCU is the brain of the system that connects the RFID readers, LEDs, and Blynk platform and ensures smooth communication between them. Node MCU has four types of pins: GPIO pins can be used as both input and output, power supply pins connect to VCC and ground, special purpose pins are used for digital and analog I/O, and external interface pins are used for communication with external devices [6].

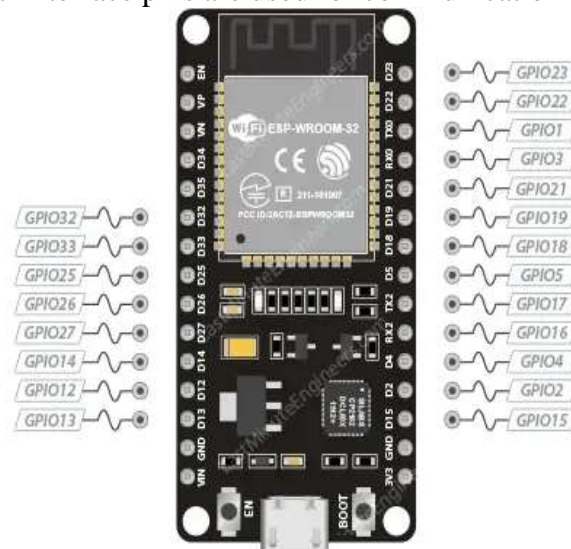


Fig 3: Pin diagram of ESP32

3. Mobile or Computer: a mobile device or a computer is required to interact with the system. To write the code for this system, a computer with Arduino IDE is used. On the other hand, a mobile device is utilized to receive alert messages through the Blynk IoT platform. This allows users to stay informed and up-to-date with the system's status, regardless of their location.

All of these components work together seamlessly to create a comprehensive system that is reliable, efficient, and easy to use.

5. FLOW CHART

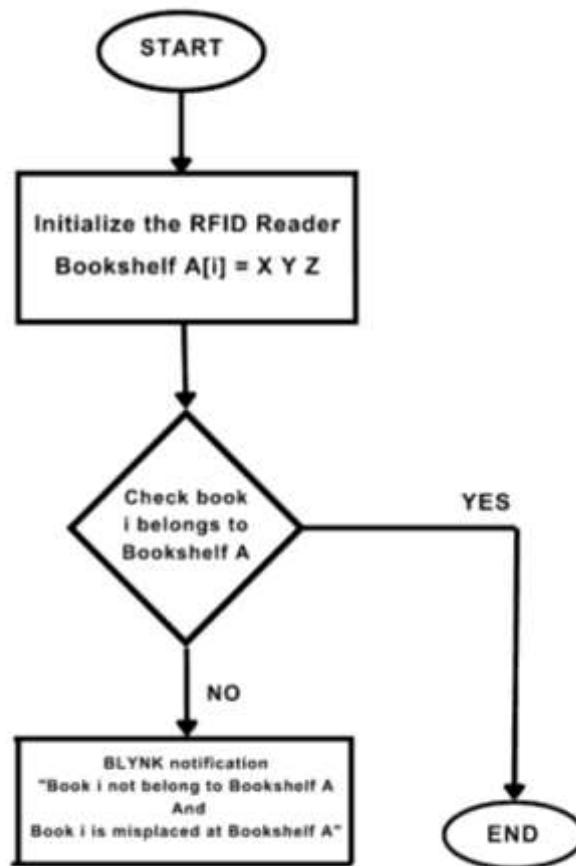


Fig 4: Flow chart of the working system

The RFID reader system has been initialized, marking the beginning of the book management process. Bookshelf 1 contains books X, Y, and Z indicated by i. The system verifies the location of Book i on Bookshelf. If they are correctly placed, there is no Blynk notification. If the placement of the book is incorrect, a Blynk notification will appear indicating the misplacement of the book in the bookshelf.

6. SOFTWARE AND PACKAGES

In order to successfully develop and implement the smart book management system project, there are several necessary software and packages involved. Some of the libraries, packages, and software utilized include:

ARDUINO IDE: The Arduino IDE is a comprehensive software tool that provides developers with a range of features to develop and upload code to their Arduino boards. To utilize specific hardware or functionalities, it is crucial to install relevant packages and libraries. With its text editor, message area, toolbar, and menu bar, the IDE offers a user-friendly interface for writing and editing code, displaying messages, and accessing various features of the application [7].

BLYNK IOT PLATFORM: Blynk is a platform that enables you to manage your hardware from your mobile device. It streamlines the process of creating IoT projects by providing a user-friendly interface, support for a variety of hardware platforms, cloud connectivity, and an extensive set of features and widgets. With Blynk, you can easily create custom dashboards without the need for programming skills. Additionally, Blynk's cloud connectivity lets you access and control your IoT devices from anywhere with an internet connection. [8].

7. HARDWARE SETUP

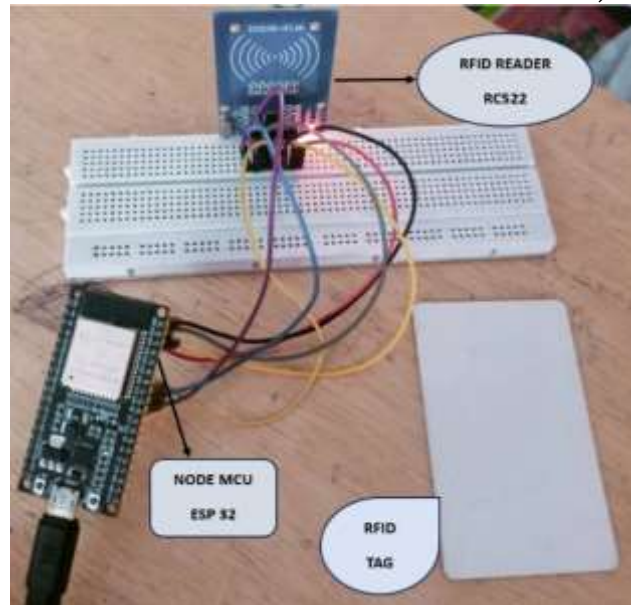


Fig 5: Hardware setup of the working system

The working system consists of a reader, NodeMCU, and tags related to that reader. The pins such as MISO, MOSI, and SCK of the readers are connected to GPIO 19,23 and 18 pins of NodeMCU. The VCC and GND of the reader are given to the VCC and GND pins of NodeMCU. The SS and RST Pins of reader 1 are connected to the 5 and 22 pins of NodeMCU respectively. The red and green LEDs of reader 1 are connected to 12 and 13 pins of NodeMCU.

8. RESULT



Fig 6: Implementation of RFID based book shelving system in library

The implementation of a smart book management system in the library is shown in Fig 6. The system utilizes a bookshelf for machine books, with an RFID reader attached to the machine's rack. Books related to the machine's rack are equipped with tags that correspond to the reader, allowing for easy tracking and management of book inventory. This system helps to ensure that books are properly accounted for and readily available to library patrons [9].

Test Case 1:

Test Case 2:



Fig 7: Book Correctly placed in the Bookshelf



Fig 8: Book Incorrectly placed in the Bookshelf



Fig 9: BLYNK Notification When the book is Misplaced in the bookshelf

The system uses a green LED to indicate that a book has been placed correctly for a particular reader, as demonstrated in Fig 7. Conversely, if a book is not meant for that reader, a red LED will glow to indicate that it has been placed incorrectly, as shown in Fig 8. In case of an incorrect placement, a BLYNK notification, as depicted in Fig 9, will be triggered.

9. CONCLUSION

The implementation of RFID technology in the library helps to identify misplaced books quickly and accurately. Constant monitoring of book placement can be minimized by employing this approach. Using the RFID system helps to reduce the burden on the librarian and allows librarians to quickly identify misplaced books with the help of LED indication. Additionally, the Blynk IoT platform enables librarians to view the misplacement of books on their mobile devices or computers, allowing for faster and more accurate identification of misplaced books. This system ensures that books are always in their designated racks, making it easier for users to locate and access them.

10. FUTURE SCOPE

This paper proposes the use of the MFRC522 RFID module, which is a passive RFID system. This means that the tags can only be read by the scanner when placed at a minimal distance. However, if an ultra-high-frequency scanner is used instead, it can read multiple tags at a longer distance, overcoming this issue. Additionally, RFID technology can serve as an effective anti-theft measure, helping to prevent book theft and unauthorized removal from the library. With the implementation of this system, libraries can ensure the security of their collections while maintaining an organized and efficient environment for their users.

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