

Real Time Near Field RFID Based Literature Search in College Library

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Abstract- Now-a-days many user faces a problem of searching exact title of literature of interest through racks in college library. This is primarily due to user is not known to the library infrastructure or literature is widely spread or it is disordered. To overcome this time consuming procedure, automatic literature tracking is developed with help of RFID technique using Near Field Communication (NFC) Tags in real time scenario. This system uses PIC microcontroller which interfaced with GLCD display. The main contribution of this work is that the GLCD can display multi locations of the user i.e. one person can change their location from one point to other point and even then the shortest path to switch to other place will be displayed on the GLCD. Also, the system is handy, portable, reasonably priced and require less time for searching any literature.

Index Terms- Literature Search, NFC, Passive Tags, RFID.

1. INTRODUCTION

The modern technology has increased the standard of living of humans in each field; let it be entertainment, domestic or educational. Everyone craves for better quality in every place and anywhere in field work. This is also seen in educational sectors such as library. Library is a vast place & many times one get confused while searching for various literatures of different departments. Literature includes books, journals, magazines, periodicals, handouts and CDs/DVDs. There have been various searching and tracking systems being developed with the help of different technologies like NFC, ZIGBEE, ARDUINO and Wi-MAX. It would be better if the person knew in which sector the desired literature is placed. This in turn will be easy for him to move directly to that particular section and collect the material instead of going to each sector and searching different racks of articles. This will avoid wastage of time and unnecessary efforts by that person in searching the article. This will also avoid huge crowd mesh at an area.

In present condition there is no such system which would search literatures on the real time basis. So a remedial electronic product is been designed which would try to catch this problem. This can be achieved using RFID technique that get directions and route to get destination by tracing current location. By

displaying the path on a display device with the help of a pointer, the required results can be achieved.

Charlie Walton invented RFID which stands for Radio Frequency Identification. This technology identifies each item by transmitting radio waves. The data is available in tags which is basically a transponder. In RFID system, data can be retrieved by machine readable form which can be used at particular time and place to satisfy particular application.

The paper is organized as follows: Section 1 explains the brief and concise overview of RFID. Relevant papers about different tracking and navigation techniques to search books are studied in Section 2. The proposed architecture of use of RFID for library purpose is discussed in Section 3. Section 4 depicts overall finalized circuit diagram. Finally the paper is concluded in Section 5 that highlights the applications that merit attention in future scope for development.

2. LITERATURE SURVEY

It is observed that some techniques have been developed for book searching in library; few which are directly relevant to the work are highlighted here:

Authors in [1] presented a system for shopping mall where the position of a person can be located using a Wi-Fi router and also a Navigation Software. It uses a Wi-Fi router which is used to make connection at once

with the help of internet. This system is designed to track the various places in the mall itself such as ATMs, Restrooms, etc. It is a real-time Application. The major Drawback of the system is that the accuracy of the system depends on the frequency of Wi-Fi signals or density of routers.

Akhi Choudhari & Sankalp Joshi developed an Android based application to navigate the position of the user in library in paper [2]. In this system GPS is used to show the path to the book. It promotes interaction of Virtual world and Physical World using camera in mobile. This technology introduced the concept of 'Living Library'. It's useful to all the android users. App can be used by many user. The major drawbacks of this system are: - The GPS should be of high accuracy. It's suitable only for small libraries with less number of books. A librarian is essential every time.

S. Vimalraj & S. Sameera proposed library management system using RFID technology [3]. In this system they have used RFID tags for each book and Categorized a batch of students. They have allocated a unique code of 16-digits to a batch of student. Of these 16-digits, 8-digits are common for batch of students while remaining 8-digits Vary from student to student in same batch itself. The passive tags along with RS232 cable and ATMEGA 162 are used to identify the people and books issued and the computation results are displayed on LCD. The Merit of this system is, the user need not check in or check out, which could be time consuming. The drawback of system is that any unauthenticated user can use the ID of authenticated user which may perhaps lead to mishap or theft.

Kehinde Daniel et. al. developed a software for digitization of library in [4], Where in the traditional articles or books are converted into electronic form. This is beneficial when thought of storing or retrieval or manipulate the data. The system is categorized into: Analysis and Design. The basic steps of analysis are: registered user, availability, check the user requirement, borrow data, and return data and Penalty. The Design process is in structured format.

Authors in [5] proposed new algorithm of locating small objects named as LANDMARC algorithm. It improved positioning accuracy effectively, lower the

system cost complexity, and improve the borrowing efficiency of the readers.

A books tracking system based on RFID combined with ZIGBEE is proposed in [6] in order to solve a series of problems, such as readers intentionally keeping library books of their owns, putting the books on the wrong frames, checking large amount of books, etc. The system is innovatively blended with RFID technology which replaced library bar coding. In addition, the virtual routing algorithm is used in the system to realize ID positioning and together with ZIGBEE wireless network technology to transmit the real-time tracking data to PC.

In [7], authors exploited IoT and mobile technologies for easy and efficient library management. The major goal is to reduce the burden of the library user to track a book and to fetch it from its location. Authors used the local positioning system and embedded tags on the book to communicate with each other and with the user's smartphone. With much ease, the user can interact with the library server to check whether the book is available and if available to locate it right to its position.

3. SYSTEM DEVELOPMENT

3.1 Proposed Work

The basic block diagram for the proposed system is shown in Fig. 1. The major system components are:

1. PIC18F Microcontroller
2. RFID Readers and Tag
3. Power Supply

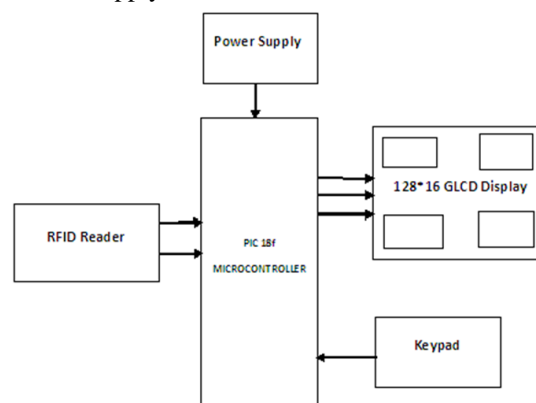


Fig. 3.1 Proposed block Diagram of System

Along with these, keypad and a Graphical Liquid Crystal Display (GLCD) is used. This entire design is an embedded system. The entire system works on 5 V power supply. The input to microcontroller is given by the keypad. The keypad is interfaced with Port B of PIC microcontroller. The keys on the keypad are predefined for a particular set of books. The user with a hand held device will select the rack from which the book is to be issued. The keys on the keypad will be predefined for a particular rack. When the user presses the key, it will connect the column and the row. This will then correspond to the assigned book set. Now once the input is given, the RFID reader will start reading the location of the user and locate the RFID tag with respect to the location of the rack and show the shortest path for the same from the current location of user. The GLCD will then display the path. The next time when the user changes the position, the RFID reader will again read the location of the user and check the input, then it will show the shortest path from that location and the next rack will be located.

3.2 Near Field RFID

Faraday's principle of magnetic induction is the basis of near-field coupling between a reader and tag. Reader will pass A.C. signal through coil, which results formation of magnetic field in nearby region.

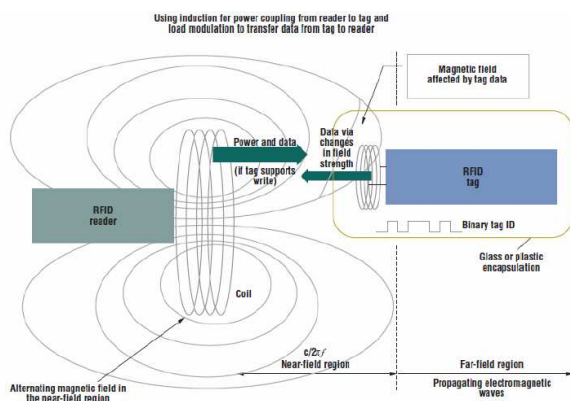
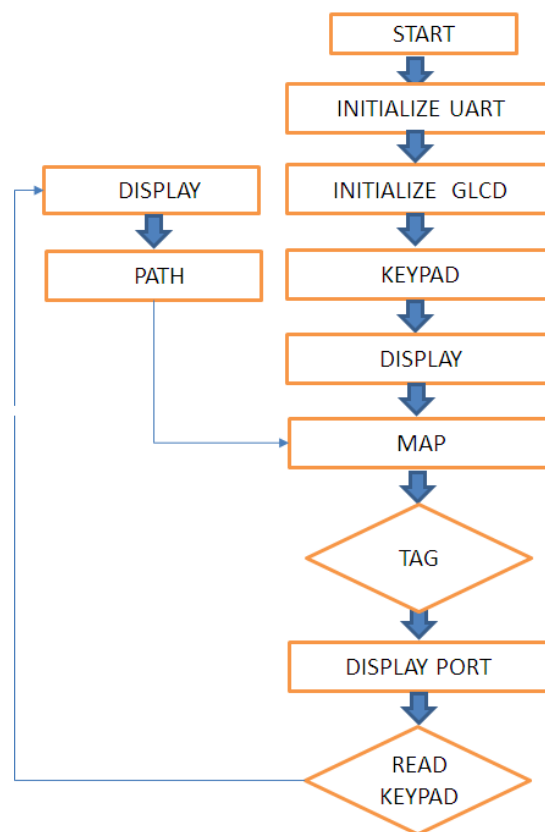


Fig. 3.2 Near Field Communication of RFID Tags [8]

As Shown in Fig. 3.2, if tag with small coil is brought in this region, A.C. voltage will form across it. This voltage is converted to DC voltage and then connected with capacitor. Capacitor will charge and this will acts

as power source to tag chip. Tags draw current that give its own small magnetic field that opposes reader's field. This small incremental current will be detected by coil which is similar to load applied to tag's coil. This is load modulation. Due to load modulation, tag sends data back to the reader. This signal can be recovered by the reader by controlling change in current flows through the reader coil. The number of modulation encoding methods are used that depends on number of ID bits needed, data transfer rate, and additional redundancy bits placed in the code to remove errors resulting from noise in the communication channel. Near-field coupling is the most straightforward approach for implementing a passive RFID system.



3.3 Dataflow

Fig. 3.3 Proposed dataflow of System

Fig. 3.3 shows proposed dataflow of the work. It is briefed as:

1. Start the system.
2. Enter a valid input for book search from the keypad.
3. Antenna of the tag reads from the reader's antenna.

4. Reader will pick up the frequencies and give it to display port.
5. Observe the path on GLCD to reach to the destined location and trace the book.
6. Read the keypad again for location change.
7. Give another input from the keypad to move to another rack.

4. PERFORMANCE ANALYSIS

Uptill the circuit diagram is finalized and shown in Fig. 4.1. This GLCD is interfaced to the PIC microcontroller which processes and finds the position of the customer in mall using RFID reader. In this design the RFID transmit pin is connected to the receiver pin of PIC18. The crystal pin is an 8 MHz which is connected to pin 13 & 14 of the PIC microcontroller. By pressing low, Active reset circuit appears on Pin1. Port A of the PIC microcontroller is being used. Data lines D0-D7 are connected to GLCD. Along with these data lines the control select, read write, enable and reset are also connected to the GLCD. Port B is interfaced with the Keypad. In this design Port A & Port E is not being used.

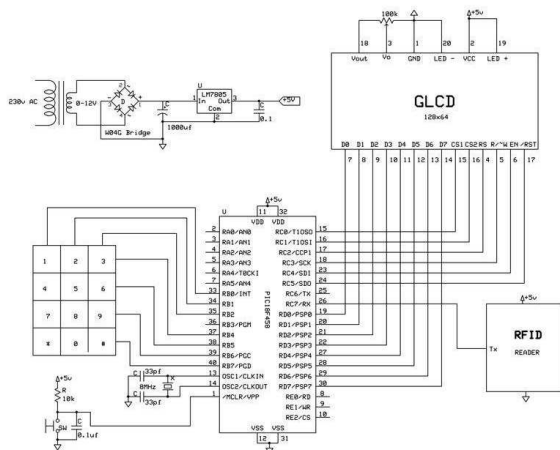


Fig. 4.1 Finalized Interfacing Circuit Diagram

5 V, 1 A linear regulated power supply is designed using IC 7805 voltage regulator. Schematic versus Layout of PCB is developed. As this is our ongoing project, we will design GUI and will display on LCD as shown in Fig. 4.2.

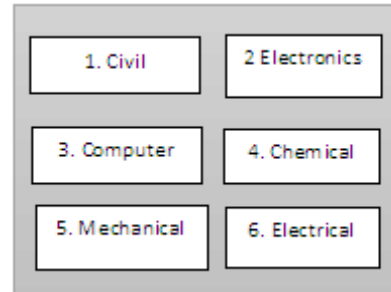


Fig. 4.2 GUI of Rack of Books on GLCD

5. Conclusion

Relevant other techniques to search literature in library have been discussed. How Near Field RFID works is studied in this paper. Real time RFID based literature search system has been developed. The main contribution is that the system is handy, portable, reasonably priced and require less time. It led to less interruption of librarian or any other person in this book search process.

In future, this system can be used Smart Phones by developing its software applications. In this case, there will be a huge scope of introducing new functions and features to this system.

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