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Microcontroller Based Book Management System Using Near Field Communication and Fingerprint with Server Technology

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Abstract*: This research work is about the concept of automation of library racks while taking books from the rack. It reduces the misalignment of books in a rack. Using fingerprint sensors in an each racks to scan the 2D fingerprint image of the students and it compare with the already existing fingerprints, that are stored in a fingerprint board. The fingerprint sensor (R307) uses Minutiae based matching algorithm for comparing the two 2D images. Fingerprint of the student is matched with the database means, Dc motor will activate with the relay card for opening a door. If the fingerprint of the student is not matched means then the door doesn't open. Door takes 4 sec to open and it take a 10 sec of interval to take a book from a rack. After that door will automatically closed. Using a Near Field Communication sensor, it has a tag and that tag is placed in a each book with different ID. After the door closed, NFC will activate and it scan the exits book and using Arduino Uno it update to a server with the student id, book name and date of book taken. Student wants to return a book, then directly goes to the respective rack and place the book in a rack using their fingerprint and it will automatically update to the server for returned a book with date.

Keywords: Arduino Uno, Fingerprint Sensor, NFC Sensor, Relay Card, DC Motor, Used In Libraries.

I. INTRODUCTION

The project discusses about the problem of waiting for returning a book in a library. Using NFC sensor we can directly place the books in a rack. Initials the students finger prints are stored in a finger print develop board using store button. Then the students can access the library using their fingerprint. If the student wants to take a book from the library, he/she directly goes to the rack and places their finger on a glass surface or a prism that is illuminated by a led diode. When the ridges of fingerprints touch the surface, the light is absorbed, while between these crests a total reflection occurs. The resulting light and dark areas are recorded in an image sensor.

Then it compares with the previous image and opens the door when there are same pattern of image exit in a memory else the door will not be open.

Hence the door opened, student can take the book from the rack at that time NFC scan the book which goes out from the rack, after the 30 sec the door automatically closed and then the student ID and book id from the NFC send to the server using Internet of Things (IOT)

In a server page the student data and book data are stored. Students wants to return a book, he/she directly go the rack and open the door using fingerprint and then place the book in a rack. After that, student id and entered book id will send to the server, it updates the book id and student data in a server page.

II. SYSTEM CONFIGURATION

Arduino Uno Microcontroller: The Arduino Uno microcontroller is the powerful microcontroller and it is easy to programmable which is based on ATmega328P microcontroller. It has be programmed by boot loader pins. The communication between them is using original STK500 protocol and it doesn't use USB to serial, it consists of Atmega16U2 used for USB to serial converter. In this paper we used ATmega328P microcontroller which is built with flash memory technology, so that data is nor erased the power is switched off.ATmega328Phas 1KB EEPROM data memory and 2KB SRAM. Its clock speed is 16 MHZ.

Near Field Communication: It is a short range wireless communication used with the frequency of 13.56 MHz and it covers a very low range of less than 10cm. It is used in a book racks for communicate with the NFC tags, which is activated by wireless power transmission and then that tag produce an electromagnetic flux which have a unique id. With that id Arduino performs the operation of updating to the server.

Fingerprint Sensor: Fingerprint scanners are security systems of biometrics. They are used to unlock doors and in other security applications. The fingerprint sensor uses Minutiae based matching algorithm. The comparison is only 1:1 ratio. The searching process exceeds up to 1:N.Supply voltage up to 4.2 – 6.0V. if the finger print of the student is matched with the database means then the door of the rack will be open else it doesn't open.

DC Motor: It is a electrical machine that is used for convert direct energy into mechanical energy.

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Its speed can be controlled by variable power supply and it is called universal motor. Coil of wire that generates an electromagnetic field. Direction of the coil is depends on the current flow in the coil.

Relay: Relay cards act as a switch and which control the Dc motor to rotate forward and reverse with 12v power supply.

III. RESEARCH METHODOLOGY

a) Hardware Design: Using a Fingerprint sensor and Near Field communication sensor for monitoring the students and books in library. It update to the server any changes occurs in a library rack, so we can easily identify the problems who made them. The below fig shows the hardware description of microcontroller based NFC server technology.

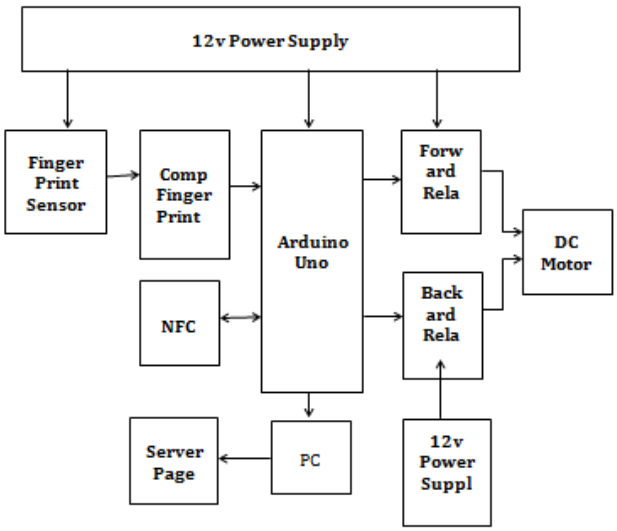

Fig.1 Block diagram of hardware description

b) Hardware Implementation: In a library, racks play a major role. It is used for arrange a book with respect to their subjects. We are using hardware in rack for the automation process. Arduino takes major part in this project, because it controls both fingerprint and NFC scanner. Initially fingerprint sensor is a first process to scan a 2D image from the students and it compare with the previous fingerprint pattern and current fingerprint patter. If both the patterns are similar means fingerprint board gives an output as Id of the student that is stored in a fingerprint board.

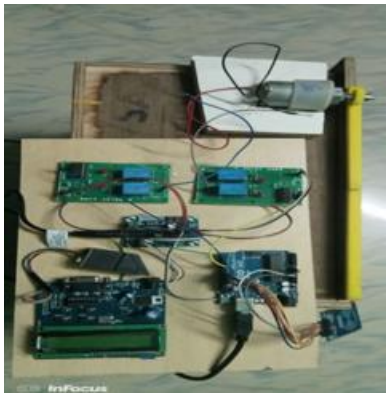

Fig.2 Hardware Implemented

Arduino Uno processes the ID and then it gives a signal to relay for ON and OFF the switch. Relay gives 12v to the DC motor to run forward direction for opening a door silent. After the door opens, student can able to take book from the rack. The door will automatically closed after 10 sec And the NFC sensor read the book data and gives to the Arduino. It combines both student id and book id and sent to the server. Server displays the student and book data in a server page as shown in figure 2.

IV. RESULTS AND DISCUSSION

a) Hardware Result: The implementation of hardware output is stored in server page. This page will help to view the student details like student ID, book ID, date of taken and date of return of book and which is useful to monitor student details that are not returned the book at a particular time period.

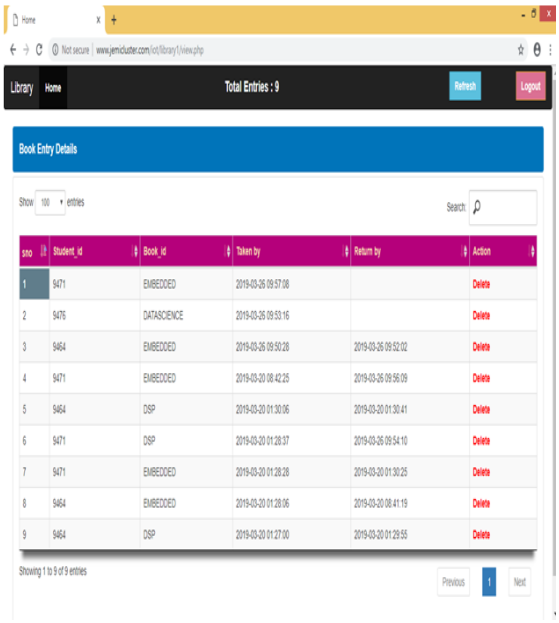

Fig.3 Server Page Output

The server page can be accessed by anyone at anytime those who are all members in a library. One of the main advantage in our project is the user able to search the books easily, which are available or not in a library as shown fig.3 server page output.

Searching Result

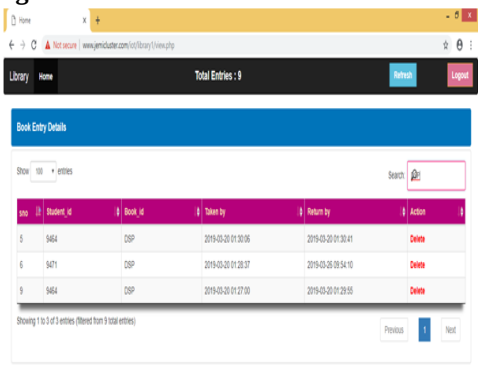

Fig.4 Searching of particular book in server page

In this page, we searched a DSP book the display will show the details of book who are all taken that book. It helps to know the availability of DSP books in library.

b) Software Result: Using NetBeans, we will able to see the hardware output in bottom of the page. The output is combination of both Student ID and book ID.

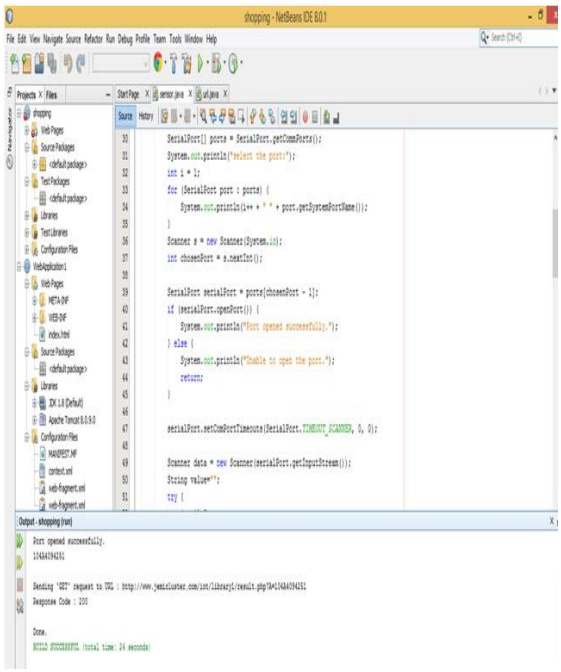

Fig.5 NetBeans Output Page

After the completion of program we click right button and then clicks the run file. It starts to connect the hardware using USB A/B type respectively. Then the output page will show the open port successfully. Finally the hardware process will proceed.

V. CONCLUSION

Now a days, Librarians are using different technologies in libraries for reduce the work and they have started using RFID to give more effective and efficient circulation services as well as for security of library collections. But it does not provide more effective security of book arrangement and it takes much time to return a book. So we use NFC, It is more effective, convenient and cost efficient technology in library security. This technology has replaced to the traditional bar-code on library items. But the cost factor, non availability of standards and user privacy is the major barriers in adoption of NFC technology by more libraries. As far as the cost constraints are concerned, once the libraries implement such a technology, its benefits can be realized in terms of less work and students independently use library, as it will speed up the return and entry process. In our project we can add a feature that sends a mail to student for intimation, when he/she didn't return a book within a given particular of time period.

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