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INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY
IOT ENABLED REAL TIME LIBRARY MANAGEMENT SYSTEM.

Liya George[*1], Parvathy Jagadeesh[2], Tency Sara George[3] & Indu Reena Varughese[4]
[*1,2,3&4]Dept. of Electronics and Communication, Amal Jyothi College of Engineering, Kanjirappally, Kerala, India

ABSTRACT

The library plays a critical role in our society, it is an important component of any educational institution. An effective real time library management system provides the right information, to the right person, in right manner at the right time. Security, searching for books, locating the book and its cost effectiveness are the major considerations regarding library management system. Authentication of users plays a vital role while considering the security of library system. Users are able to login to their respective portals using face recognition. Fetched books can be issued using the RFID scanning technology. RFID tags which are attached to the books helps in issuing and returning purposes and that can be done much effectively and easily. Apart from the existing systems this real time library management system does not require the assistance of a librarian. Thus simplifies the entire library procedure and provide comprehensive set of features for greater efficiency.

KEYWORDS: Face Recognition, Book tracking, RFID tags, NFC, ZIGBEE, Wi-MAX, ARDUNIO.

1. INTRODUCTION

Human standard of living has been increased ever since technology started its rapid growth. Whatever bethe field, everyone craves for better quality and better facilities. Library is one among them and is a vast place which contains wide variety of books. There have been various searching and tracking systems being developed with the help of different technologies like NFC, ZIGBEE, ARDUINO and Wi-MAX.The majorconcerns regarding any library management system is its security. As institutions keep strict policies regarding usage of their facilities, authentication of library users play a major role.

Unique way of authentication can be achieved through biometrics. Searching of books and locating the books are other major areas of concern. It will be easy for a user to move directly to the required section and collect the literatures instead of searching them on all racks. Thus it would avoid wastage of time and unnecessary efforts. Evaluating the present scenario, there is no system provides a real time search for literatures. This can be resolved using the Radio Frequency Identification technique that directs the user to the corresponding rack required for the user by tracking the location. Though NFC technology is being used for the library management system it lacks eligibility for a vast use like library [5]. NFC is designed for very low range communication such as less than 10cm, where RFID traditionally has ability to communicate over few meters. Authentication of the users are done with the help of biometrics. Face recognition is the least intrusive technology hence it is used for the authentication purposes. With the help of a Pi camera users get captured. Faces of people are compared with the faces in the database. The users are allowed to login to their profile only if the faces got matched.

This technique develops and implements a system that will enable easy and effective management of library services. IoT enabled library management systems overstep security to become tracking systems that combine security with more efficient tracking of materials throughout the library, including easier and faster charge and discharge, inventorying, and material handling.

2. LITERATURE SURVEY

Many researchers have developed book searching systems which are studied here:

Paper [1] proposes Radio Frequency Identification, which allows faster transaction of books and provides issue and return of books with greater efficiency. The system consists of RFID readers and passive tags. Tags are able

to store the information electronically that can be read using the RFID readers. Since RFID speeds up the entire transaction process like book searching, issuing it saves the time of users and staff to great extent. For the best results, RFID readers and RFID tags should be used must be of good quality.

Face recognition technology [2] is the least intrusive and the fastest biometric technology. It works with the most obvious individual identifier, the human face. In most cases, people are totally unaware of the process. Instead of requiring people to place their hand on a reader or position their eye in front of a scanner, face recognition systems take pictures of people's faces as they enter a defined area without any contact of the subject. A face recognition technology is used to automatically identify a person through a digital image. It is mainly used in security system. The proposed system has a database which consist of predefined information regarding the users. The image taken during recognition process are compared with that present in the database. Library Automation [3] refers to the implementation of computer software that allows previously done manual tasks to be completed with the help of a computer system. This paper describes the various techniques which is used to perform library management in colleges, importance of library management, future trends of library management, software used for library management, advantages, applications and the current trends which are being followed for the implementation of this concept. We should pay more attention to the research issues for confidentiality, authenticity, and integrity of data in the IoT, with the development of advanced network techniques, distributed multi-agent control and cloud computing. Once the signal of IoT is stolen or interrupted, it will directly affect the security of the entire information of IoT. With the wide spreading of IoT, it will provide more extensive wealth of information, the risk of exposure of such information will increase.

3. SYSTEM DESIGN

a) Concept

Location of demanded book can be identified using the searching option provided in the system. The issue and re-issue can be done using RFID technique [4]. The RFID tag attached to the book can be scanned using RFID reader. This will save a lot of time and efficient queue management. These actions are being recorded so we can use it in necessary situations. This technology works on small and thin tags, which allows it to be placed inside of each book. The tag consists of an antenna and a tiny chip which stores small amount of data to identify each item. The information contained on microchips in the tags affixed to library materials is read using radio signals. RFID tag's listen for a radio query from the reader and respond by transmitting their unique ID code.

The issue and reissue using RFID technology can be done by the user after authentication using face recognition. Pi-cam is used in face recognition process for authentication. The library door opening and closing are provided to ensure the security and prevent the unauthorized access to Library.

b) Components

System consist of following components:
- Raspberry pi:

It is the basic component required to run entire system. **The Raspberry Pi is surely the most powerful device,** which can be used as a personal computer. Not only as a computer, but it is actually a power pack hardware. Here we use Raspberry pi 3 model in fig 1, which is quad tone 64-bit CPU, Bluetooth, and Wi-Fi. It is the 3rd generation pi. It was the first member of the pi family which comes with 256MB RAM.

Fig 1: Raspberry pi 3

- Quad Core 1.2GHz Broadcom BCM2837 64bit CPU
- 1GB RAM
- BCM43438 wireless LAN and Bluetooth Low Energy (BLE) on board
- 100 Base Ethernet
- 40-pin extended GPIO
- 4 USB 2 ports
- 4 Pole stereo output and composite video port
- Full size HDMI
- CSI camera port for connecting a Raspberry Pi camera
- DSI display port for connecting a Raspberry Pi touchscreen display
- Micro SD port for loading your operating system and storing data
- Upgraded switched Micro USB power source up to 2.5A

- RFID reader:

It communicates with the tags through an RF channel toidentify information. Depending on the type of tag, this communication may be a simple or maybe complex. RFID readers in fig 2 are used to store data in tags. It contains a radio frequency module, a control unit and an antenna to interrogate electronic tags via radio signals.
The antenna inside the reader generates electromagnetic field. When a tag passes through the field, the information stored on the chip in the tag is interpreted by the reader and sent to the server, which, in turn, stores or retrieves information about the book's issue or return.

- RFID Tag:

Tags are thin labels which can be fixed inside a book. RFID tags are made up of carbonic structure which contains a magnetic strip or coil layer inside the tag which helps in sensing the tags. This magnetic layer inside the tag helps in generating the magnetic field. In the figure shown, the tag contains a unique serial number like "0600394791 000345" which is used for the authentication of the user.When the tag shown in fig 2 is brought in front of the reader or in a close proximity of the reader, the reader antenna senses the tag and checks for the unique serial number of the tag.

If the tag is registered in the reader's database, then the reader authenticates the tag otherwise the reader shows an error and gives the message that the tag is not registered or the tag is not authenticated

Fig 2: RFID Tag and Reader

- Pi camera:

The **Raspberry Pi Camera Board v2** is a high quality 8 megapixel Sony IMX219 image sensor custom designed add-on board for Raspberry Pi, featuring a fixed focus lens. It's capable of 3280 x 2464-pixel static images, and also supports 1080p30, 720p60, and 640x480p90 video.

It is attached to the Pi by way of oneof the small sockets on the board's upper surface and uses the dedicated CSi interface, designed especially for interfacing to cameras. Pi cam in fig 3, used to face recognition for security purpose.

Fig 3: Pi cam

- Servo motor:

Servo motor shown in fig 4, works on (pulse width modulation) PWM principle.The job of the servo motor controller (or commonly referred to as the motion controller) is to close theloop on the system by constantly looking at the encoder signal and applying a torque to the motor in order to control it. The simplest form of this is to hold a specific position.

If a disturbance causes the motor to move off of a position - the encoder detects this change in position - creating an error signal. This error signal is then translated into a commanded current by the controller in order to drive the motor back to the original position. It's angle of rotation is controlled by duration of pulse applied to its control pin.Basically servo motor is made up of DC motor which is controlled by a variable resisters and gears.

Fig 4: Micro servo motor

In library management system motor used for door opening and closing.

4. OPERATING PRINCIPLE

The user can enter in to the library in a usual manner. After entering in to the library there is a facility to search for the location of required book. There will be a cloud facility available which contains the meta information like title of the book and author. The user can search for the book and fetch it from the corresponding rack. The issuing process is done using face recognition technology. The data base is also get updated during the issuing process occur. The re-issuing process is also done using the same face recognition technique. When the face recognition system identifies the user, the user can automatically login to their own profile. Then the user can choose the corresponding options according to their need (issue, re- issue, reserve etc.). Since the issuing and returning process is done through face recognition, the whole process will be more secured than all other existing system. (Fig 5)

The proposed system comprises of the following modules.
- Authentication

The main issue with many of the automated library systems is security. One aspect of security is authenticating the library user. Authentication is more important for our proposed smart library system Hence; we propose a strong authentication mechanism which authenticates through face recognition through a biometric reader.

Locating the Book RFID Tag is embedded in each of the library books. Once save the book's information, it updates details about the book in the library's database. The database has separate tables for each of the Rack. Thus, when a book is placed in a particular rack, the information gets updated in the concerned table. When the user queries for a book, the database identifies the rack as each rack has a separate table.

- Issue and Return

After the book is found, it is issued after checking for the eligibility of the user to borrow books. Each user has a separate profile and all the information regarding the users' transactions are maintained in the library database. Once the book is issued, it can be taken out of the library. RFID scanners are present at the entrance and exit of the library. If an unissued book is taken out an alarm is raised. The return of the books is similar to the return procedure in the previous systems except that the user drops the book in the return box which has a RFID reader and thus the book is automatically removed from his list of borrowed books and there is no need of a librarian to monitor the return of the books. The fines and dues are automatically calculated and the payment can be paid from there. In system modeling, system is divided into 2 parts. first part is user section. when user is entering into the library after the searching of the book
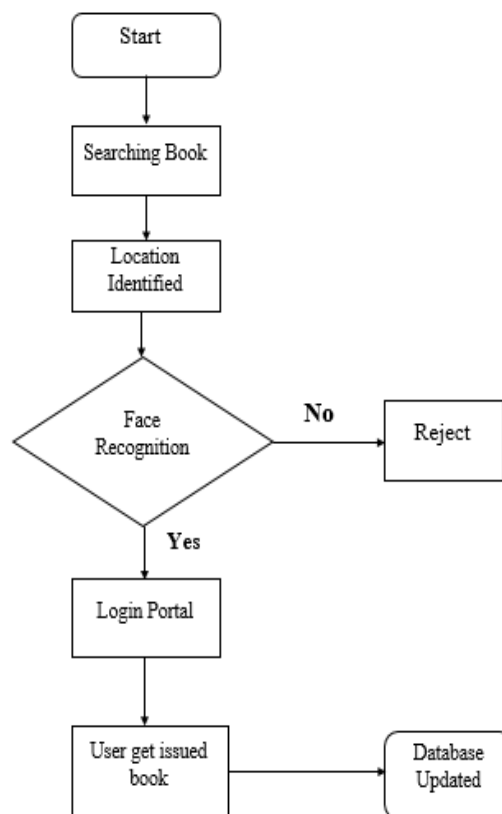

Fig 5: Block diagram operating principle

In user section, user need to login their portal by face recognition. When face of user don't matched with the details enter in the cloud, user will fail to login their portal. User can issue or return the book using their portal

when face get matched. Issue or return is done by using barcode reader. After ending all the process, the system gives a receipt and that receipt should have scanned at the exit door for the user to make an exit.

In admin Section admin should control the processes taken in library. If the user forgot the password or username, admin should send an email to the user. Admin should also control the details of the book, return and issue details, author details, user permission and also report on user including fine etc. Admin should manage all the modules present in the library

5. METHODOLOGY
The process involved is divided into some phases that are described as follows

- Phase 1- The Initial Setup

Whenever a new book is acquired by the library, an RFID tag is attached into the book with the relevant information like accession number, book number, etc.
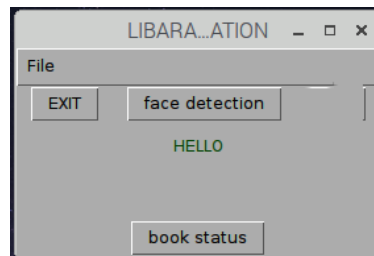
Fig 6: Initial setup

The detailed information regarding the book is also captured in the computer database. The computer database also stores all information about individual users of the library. Each user can identify the position of the book using book status window.

- Phase 2 - The Login Process

The first screen displays the login dialogue box shown in fig 7. The user enters their portal using face recognition. Face recognized by the snaptaken by the Picam compares with available data in the database. If the pictures are similar, user can enter into their respective login.
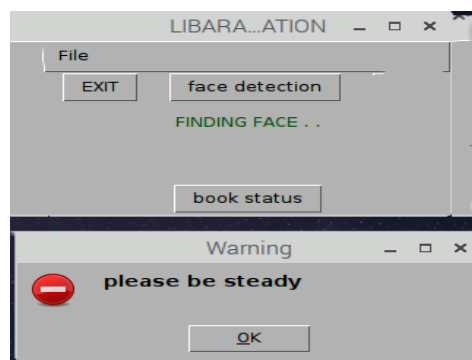

Fig 7:Login process

If the picture does not match with information available in the database, the process will be rejected. Login to the respective portal is required for accessing various library services like issuing, returning and reservation by the user.

- Phase 3 -The Issue Process and Return process

After user enter into the portal, shows the details of book in left side of portal. It is shown in fig 8. when user can select the needed book, click on given options. After that attached RFID tag inside the book are scanned by RFID reader. RFID reader should read the unique ID of the tag. It becomes issued in our profile and also automatically updates in our profile. When a user needs to get a book issued, he can get it done without any manual intervention The same technique is also applied for the returning purposes. (fig 9). Face recognition and RFID scanning are the main process involved in issuing purposes. Reservation and the due dates can be fixed as per the requirements.

After fetching the books user will only be able to get out of the library premises after issuing process. There is an icon provided in the portal which allows the user to move out of the gate.
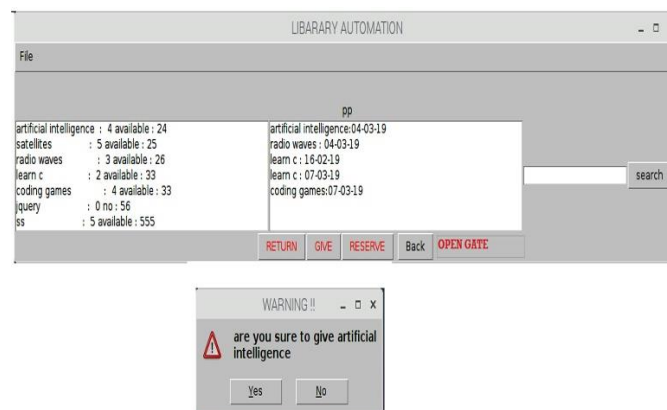
Fig 8: **Issue process**

. Only after clicking the icon user can go out of the library without any interventions.
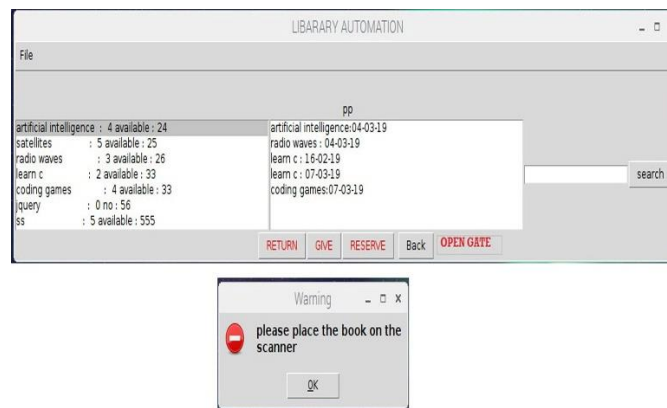

Fig 9: Return process

If user didn't issue the book, the door of the library will not be opened and an alarm indication is also provided.

6. CONCLUSION

IoT enabled real time library management is uttered by many in the industry to be the frontrunner technology for automatic identification and data gathering. It is quite clear from the above discussion that an IoT enabled real time library management system is a comprehensive system that addresses both the security and materials tracking needs of a library. IoT enabled real time library management in the library is not a threat if best practices and guidelines followed religiously, that it speeds up book borrowing and inventories and frees staff to do more user-service tasks. The technology saves money and quickly gives a return on investment. It is

important to educate library staff and library users about IoT technology before implementing relatedprograms and systems.

7. ACKNOWLEDGMENT

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