Smart Library Management System

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Abstract: **The proposed work Smart Library Management System play a vital role in replacing manual works and errors done by the library staff and students. In the traditional method queues and delays are expected, hence it is a time consuming process. The proposed work is based on RFID and Face Recognition technology, has the ability to recognize and track each and every student and books in the library premise making it the most efficient way which allows fast transaction flow of library activities without much manual intervention. This system will make users to issue and return of books via RFID tags very easy and also calculate the corresponding fine associated with the period of time the absence of the book from the library. This project is a step towards an 'Automated Future'.**

Keywords: **Radio frequency identification, Face recognition, Tags, Automated future.**

1. Introduction

A library management system (LMS) can be considered as an enterprise resource planning (ERP) system for a library. It is formed from a suite of integrated functions to manage a diverse range of processes within a library. Library Management System is an application which refers to library systems which are generally small or medium in size. It is used by librarian to manage the library using a computerized system where he/she can record various transactions like issue of books, return of books, addition of new books, addition of new students etc. With the innovation of new technologies, many life concepts have been changed. However, libraries remain the same in many sides while the main role of libraries has been changed and new references may not need a classical library as it was 50 years ago. In the same time, library services can be improved using RFID and Face Recognition technology to increase user satisfactions. In recent years, there has been arisen in the diversity of implementation based on radio-frequency identification (RFID) systems and has been successfully utilized in several areas such as health care and transportation. RFID and face recognition based library management system will let rapid transaction flow for the library and could prove instant and long- term benefits to library in traceability and security. To solve the problem that it is inconvenient to find references in the traditional library, a kind of reference positioning system using RFID technology is designed to achieve fast search references in the library. Searching and sorting misplaced references are a hard task often carried out by the librarians. The performance of RFID reader motion and tags allows fast transaction flow and easily handling the process like references borrowing from library can be done using RFID technology. Two big issues have been exposed and tried to find the best solution for them, first is the management process of any library, from user management to shelving system and the second one is the data and reference security.

2. Existing Technology

In regular system library staff handle a tedious task involves cataloguing (classifying and indexing materials), acquisitions (ordering, receiving, and invoicing materials), circulation (lending materials to users and receiving them back), serials (tracking journal, magazine and newspaper holdings), in addition library users encounter problems for finding, borrowing, localizing, renewing the borrowed book, queuing which are all time consuming.All the above mentioned tasks are to be done by the library staffs manually and the students have to spend lots of their time in searching required book without knowing the availability of the book and they have to stand in queue for book issue. In such consequence students may theft books from the library in the absence of library staff. In the traditional library management there is no measures taken against the return of books. students used to return their books after their due dates and it a tedious task for the library staff to calculate the fine for the book from their due dates as it requires much time.

3. Block Diagram

The figure shows the implementation of smart library management system using RFID system and Face Recognition technology. The proposed work mainly requires the co-operation of Face detection technology and RFID System. A facial recognition system is a technology capable of identifying or verifying a person from a digital image or a video frame from a video source. This system can uniquely identify a person by analysing patterns based on the person's facial textures and shape by comparing selected facial features from given image with faces within a database. When a student enters the library,

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student face is captured via camera with face recognition technology placed at the doorway. The data is directed to the microcontroller which updates the database. The RFID System comprise of a RFID reader and a tag. The RFID Reader is placed at the entrance/exit of the library and RFID tag is attached to student's ID card and to all the books in the library. When a student with RFID tag comes in the proximity of the RFID reader the tag detects the readers signal through a coil present in it which converts the received RF signal into an electrical signal. Then the tag containing microchip gets powered up and send the unique ID of the student stored in it which is then updated to the database of the respective student.
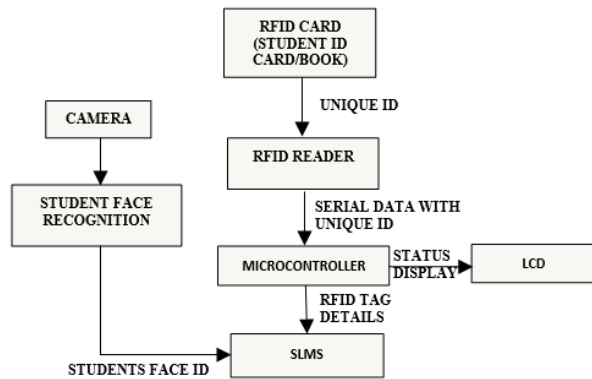

Fig. 1. Block diagram of SLMS

After successful login students are allowed to issue or return the books. If the student is attempting to issue the book in such cases student has to search the book by entering the name of the book and the author of that book and then the student will be knowing the availability of the book and the location of the book from where to retrieve it. After issuing the book the student will be notified by a remainder message which contains name of the book, date of issue, date of return and the details of the book issued to the student is stored in the database along with time and date of student entry. In the same way student can return their books.

4. Components

1) Arduino Uno

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, an influence jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. We can tinker with Arduino UNO without worrying too much about doing something wrong. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is that the first during a series of USB Arduino boards and therefore the reference model for the Arduino platform; for an in-depth list of current, past or outdated boards see the Arduino index of boards.

Fig. 2. Arduino Uno

2) UART

A universal asynchronous receiver-transmitter (UART) is a computer hardware device for asynchronous serial communication in which the data format and transmission speeds are configurable. It sends data bits one by one, from the least significant to the most significant, framed by start and stop bits so that precise timing is handled by the communication channel. The electric signalling levels are handled by a driver circuit external to the UART. Two common signal levels are RS-232, a 12-volt system, and RS-485, a 5-volt system. It is one of the most used device-to-device communication protocols. Embedded systems, microcontrollers, and computers mostly use UART as a form of device-to-device hardware communication protocol. Among the available communication protocols, UART uses only two wires for its transmitting and receiving ends.

Fig. 3. UART

3) RFID Reader

Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. An RFID system consists of a tiny radio transponder, a radio receiver and transmitter. When triggered by an electromagnetic interrogation pulse from a nearby RFID reader device, the tag transmits digital data, usually an identifying inventory number, back to the reader. EM18 is a RFID reader which is used to read RFID tags of frequency 125 kHz. After reading tags, it transmits unique ID serially to the PC or microcontroller using UART communication or Wieg and format on respective pins. EM18 RFID reader reads the data from RFID tags which contains stored ID which is of 12 bytes. EM18 RFID reader doesn't require line-of-sight. Also, it has identification range which is short i.e. in few centimetres.
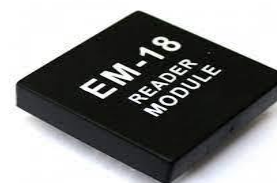

Fig. 4. EM-18 module

4) LCD

A liquid crystal display (LCD) is a thin, flat panel used for electronically displaying information such as text, images, and moving pictures as shown in Fig. 5. Its uses include monitors for computers, televisions, instrument panels, and other devices ranging from aircraft cockpit displays, to every-day consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones. Among its major features are its lightweight construction, its portability, and its ability to be produced in much larger screen sizes than are practical for the construction of cathode ray tube (CRT) display technology. Its low electrical power consumption enables it to be used in battery-powered electronic equipment. It is an electronically-modulated optical device made up of any number of pixels filled with liquid crystals and arrayed in front of a light source (backlight) or reflector to produce images in color or monochrome. The earliest discovery leading to the development of LCD technology, the discovery of liquid crystals, dates from 1888. By 2008, worldwide sales of televisions with LCD screens had surpassed the sale of CRT units. Each pixel of an LCD typically consists of a layer of molecules aligned between two transparent electrodes, and two polarizing filters, the axes of transmission of which are (in most of the cases) perpendicular to each other. With no actual liquid crystal between the polarizing filters, light passing through the first filter would be blocked by the second (crossed) polarizer.
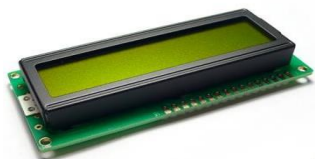

Fig. 5. Liquid Crystal Display

5) RFID Tags

Fig. 6. RFID tag

RFID tags are a type of tracking system that uses smart barcodes in order to identify items. It works by transmitting and receiving information via an antenna and a microchip, also sometimes called an integrated circuit or IC. The microchip on an RFID reader is written with whatever information the user wants. An RFID tag consists of a tiny radio transponder; a radio receiver and transmitter. When triggered by an electromagnetic interrogation pulse from a nearby RFID reader device, the tag transmits digital data, usually an identifying inventory number, back to the reader. This number can be used to track inventory goods. The tags contain electronically stored information. Some tags are powered and read at short ranges by magnetic fields. Others are powered by a local power source such as a battery, or in some cases they don't have a battery but collect energy from the interrogating EM field, and then act as a passive transponder to emit microwaves or UHF radio waves.

5. Results

The proposed work is tested by capturing the face of the student using Face Recognition technology and student details are obtained by using Radio Frequency Identification technology. It inspects the availability of the book and required book is issued to the respective student along with remainder message and the details of the book issued to the student is stored in the database.
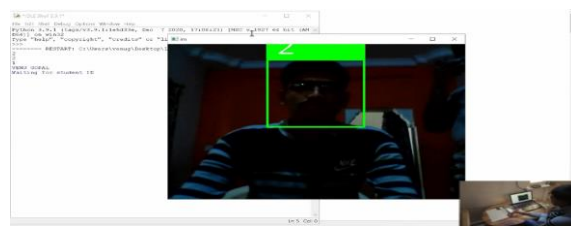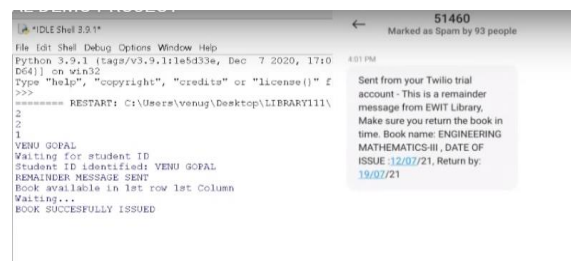

Fig. 7. Student face recognition

Fig. 8. Remainder message for the book issued

6. Conclusion

The smart library management system is implemented successfully with the help of RFID and Face Recognition technology to manage the library efficiently with less human intervention by automating most of the process. The results have proved the efficiency of this methodology is a better substitute than the regular library system and it gives stress free experience to the visitors as well as for the library staffs.

References

[1] Toni Bjornien, Karina Espejo Delzo, Leena Ukkonen, Atef ZElsherbeni, Lauri Sydanheimo, "Long range metal mountable tag antenna for passive UHF RFID Systems", 2011 IEEE International Conference on RFID-Technologies and Applications.

[2] P. Amnuayakanjanasin, S. Aramvith, T.H. Chalidabhongse, "Real-Time Face Identification Using Two Cooperative Active Cameras", 2006 9th International Conference on Control, Automation, Robotics and Vision.

[3] Younis, Mohammed, "A Smart Library Management System based on RFID Technology", 2012 International Journal of Reasoning-based Intelligent Systems, 2012.

[4] D Haval Bagal, Pallavisaindane "Library - A Face Recognition and QR Code Technology based Smart Library System," 2019 International Conference on Communication and Electronics Systems (ICCES).

[5] Shreyak Sawhney, Karan Kacker, Samyak Jain, Shailendra Narayan Singh, Rakesh Garg, "Real-Time Smart Attendance System using Face Recognition Techniques," 2019 9th International Conference on Cloud Computing, Data Science & Engineering (Confluence).

[6] Sharmila, Raman Sharma, Dhananjay Kumar, Vaishali Puranik, Kritika Gautam, "Performance Analysis of Human Face Recognition Techniques," 2019 4th International Conference on Internet of Things: Smart Innovation and Usages (IoT-SIU).