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S.I.A.C. – Smart Identity and Access Card

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ABSTRACT

Radio frequency identification (RFID) is a rapidly emerging technology which allows productivity and convenience. Radio Frequency Identification (RFID) is a new generation of Auto Identification and Data collection technology which helps to automate business processes and allows identification of large number of tagged objects like books, using radio waves. This paper proposes RFID Based Library Management System coupled with Attendance Management System. Managing records of books along with recording and monitoring of class attendance is an area of administration that requires significant amounts of time and effort in a school/university environment. RFID is a technology that allows for a tag affixed on identity card of student to communicate wirelessly with a reader that would allow fast transaction flow and will make it easy to handle the issue and return of books from the library without much intervention of manual book keeping which benefits by adding properties of traceability and security, the system can also automatically capture student's attendance by flashing their student card at the RFID reader and save time, effort and cost of paper based records.

I. INTRODUCTION

A smart card will be a simple plastic card empowered with one of the cutting-edge technologies of current scenario, the RFID. The card will function as a medium to perform several daily routine works in the campus area for a student irrespective of them being in a college, university or a school! A RFID or Radio Frequency Identification is a radio-wave frequency based electro- magnetic coil. It charges as soon as radio-waves are incident on it. RFIDs charge in two ways. First is a passive way that does not require any batteries or constant power supply.

The second is an active way where a constant power source is required for the RFID reader. In this project, as a matter of fact, the card may be in an individual's pocket, we use the passive medium as it would be extremely difficult to provide a power source everywhere.

We are going to create a smart card which will act as a tool for a student, coming out of one of the most under-rated things that an institute provide to their students— the ID card or the Identity Card. We named it the S.I.A.C. – Smart Identity and Access Card. It will be used by a student to punch in their attendance without coming in contact with any kind of attendance sheets, thus effectively reducing their touch to the publicly shareable thing. Moreover, the books that a student would like to follow from the library will be punched in straight away over the student's special ID, thus effectively removing the usage of a scanner- kind-of-joystick that the librarians share, or somewhere removing the register entry that the librarians share. Next, we aim to add functionality for the staff as well, where they can simply tug in the card of an individual and retrieve all kinds of educational history, including the those of attendance, for that individual, limited to the institute they are currently present in. This effectively removes the usage and maintenance of registers thus reducing the contact of touch between the staff members.

As a matter of fact, according to several research studies, the virus can remain infective on surfaces like glass, plastic, and others.

Thus, the aim is to avoid touching of these kinds of surfaces by the students.

Moreover, it was reported, that nearly 3% case drop would have occurred in the world if the surfaces were maintained to be clean. This would have dropped the number of deaths the world has suffered.

II. LITERATURE REVIEW

Radio frequency identification (RFID) refers to the use of radio frequency wave to identify and track the tag implanted into an object or a living thing.[1]

RFID is used to collect information automatically by radio frequency data communication between a mobile object and an RFID reader to identify and track them. They are most commonly referred to as reader and tag respectively in [8]. A radio-frequency identification system comprises hardware, known as interrogators or readers and tags also known as labels as well as RFID software or RFID middleware. RFID tags are of two major types, which include Active Tag and Passive tags.[2]

In recent years, RFID is one of the automatic identification technologies. There is a wide research and development in this area trying to take maximum advantage of this technology, and in coming years many new applications and research areas will continue to appear. RFID system has been successfully applied to different areas as diverse as transportation, healthcare, agriculture, and hospitality industry to name a few. RFID also brings about some concerns, mainly the security and privacy of those who work with or use tags in their everyday life which is proposed in [3].

For instance, the U.S. based retailer corporation Walmart, in aiming to reduce its logistics costs, has applied RFID systems to all its stores and its suppliers; it is estimated that Walmart can save 5% of its inventory costs and 7% of its inventory management costs each year, which in total amounts to 8.4 billion U.S. dollars. In addition to the logistics management industry, the RFID technology is also effectively used in Taipei Metro EasyCard, vehicle repairs, libraries, medical and healthcare industries, restaurants, hotels, etc.[10]

RFID is used to uniquely identify tagged objects or people. RFID systems have been widely used in many application areas such as inventory control, product tracking through manufacturing and assembly, parking lot access and control, Bank Locker Security System, Automatic Toll Collection System (ATCS), Library Management system (LMS), Attendance Management System etc. as discussed in [4,5,6].

Radio frequency identification (RFID) is a rapidly emerging technology which allows productivity and convenience. Radio Frequency Identification (RFID) is a new generation of Auto Identification and Data collection technology which helps to automate business processes and allows identification of large number of tagged objects like books, using radio waves. This paper proposes RFID Based Library Management System that would allow fast transaction flow and will make it easy to handle the issue and return of books from the library without much intervention of manual book keeping which benefits by adding properties of traceability and security. The proposed system is based on RFID readers and passive RFID tags that are able to electronically store information that can be read with the help of the RFID reader. This system would be able to issue and return books via RFID tags and also calculates the corresponding fine associated with the time period of the absence of the book from the library database.[7]

Applicability of Radio Frequency Identification (RFID) system which is a new generation of Auto Identification and Data collection technology in a future Smart Library Management System is presented in this paper. It helps to automate business processes and allows identification of large number of tagged objects like books, using radio waves. In existing system barcode and token card system were used. Barcodes have no read/write capabilities; they do not contain any added information such as expiry date etc. and it needs line of sight, less security and it also can easily damage. By using token card system, they are very labour intensive and work process for the librarians was more. By considering the above demerits in the existing systems, the proposed Smart RFID system, which is a wireless non-contact system that uses radio frequency to transfer data from a tag attached to an object, for the purpose of automatic identification and tracking. RFID doesn't need the line of sight, it removes manual book keeping of records, improved utilization of resources like manpower, infrastructure etc.[9]

III. COMPONENTS

A. Hardware Components

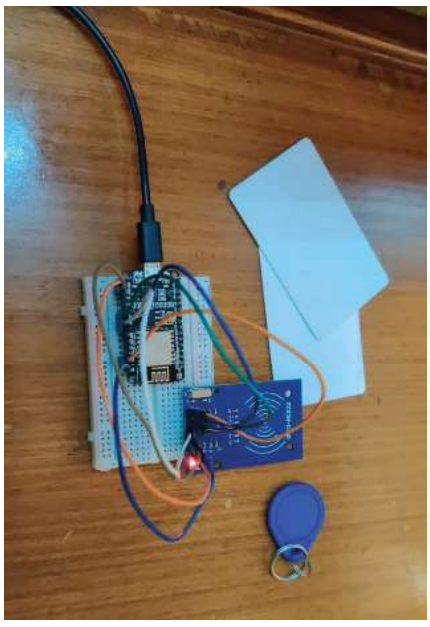

Fig. 1: Hardware

1. **RFID Tag:** The RFID tag is a part of the combination of RFID system as a whole. RFID tag or the Radio Frequency Identification tag is a kind of tags attached to some object (here, the card). The system consists of a tiny

radio transponder, and particularly a transmitter when it is a tag (the sender). Usually, the sleeves are made of a foil like material consisting of a combination of copper and aluminium, and then covered with some sort of strong material.

The tag, here, implies the antenna or the sender in the system.

2. **RFID Reader:** The RFID reader is the other part of the combination system of the RFID system. The reader is also said to be the brain of the RFID system and is necessary for any system to function. They are also called interrogators, and are the devices that receive the signal from the RFID tag. They receive the radio waves in order to communicate to the incoming signal from the transponder. The reader in case of a passive tag, as used in this project, can read up to a distance of 12 meters if the tags are far-range ultra-high frequency tags. On the other hand, the active tags can achieve a range of 100 meters or more depending upon the kid of tag used.
3. **Node MCU:** The NodeMCU ESP8266 development board comes with the ESP-12E module containing ESP8266 chip having Tensilica Xtensa 32-bit LX106 RISC microprocessor. This microprocessor supports RTOS and operates at 80MHz to 160 MHz adjustable clock frequency. NodeMCU has 128 KB RAM and 4MB of Flash memory to store data and programs. Its high processing power with in-built Wi-Fi / Bluetooth and Deep Sleep Operating features make it ideal for IoT projects.

   NodeMCU can be powered using Micro USB jack and VIN pin (External Supply Pin). It supports UART, SPI, and I2C interface.

   The NodeMCU Development Board can be easily programmed with Arduino IDE since it is easy to use. Programming NodeMCU with the Arduino IDE will hardly take 5-10 minutes. All you need is the Arduino IDE, a USB cable and the NodeMCU board itself.

B. Software Components

1. **Database:** The database that we are going to lay back will comprise of three different tables each for a given module. The ER diagrams of each are shared in the description of each module itself, with their usual semantics.
2. **Web Application:** The web application is simply a set of web pages that act as a common platform to all the features our smart identity and access card feature. The platform is built on php and is used in its minimal form. It provides additional features like registering a student against a new card ID, maintain an admin to regulate all the stuff and more.

IV. PROPOSED SYSTEM

We are going to develop a Smart Identity and Access Card that make use of latest cutting-edge technology the Internet of Things, often abbreviated as IoT. The card will use the technology of RFID or the radio waves in order to provide a useful tool to a student for their campus lives. To develop the system itself, we plant an RFID reader and a microcontroller on the breadboard connected via the jumper wires.

In order to make things permanent and free of glitches, we solder the RFID reader. This system will act at the site where the smart card will be used. The card itself will consist of a RFID tag or a coil that charges up when electro-magnetic waves are incident on it, thus releasing signals, that are thence read by the RFID reader. Behind all this stuff, there will be a web application where the updates or changes are made.

Moreover, it will serve as a medium of intermediary for the two hardware sub-systems to coordinate and output something useful. We make use of C-like language to code for the board in the Arduino IDE. Also, we make use of php to code for the web application. In order to represent it as a model for big enterprise, we make use of a free Xampp (preferred if the host machine is Windows) or a Lampp (preferred if the host machine is Linux) server, where we host our web application and also provide the underlying database. The student will simply tug-in the card at a site of use, say in the college library. This will activate the electro-magnetic coil and it will start emitting signals. Those signals are then read by the reader present on-site. The system than updates the web application as per the request by the user.

V. EXPERIMENT PROCEDURE

Module 1: The Attendance System

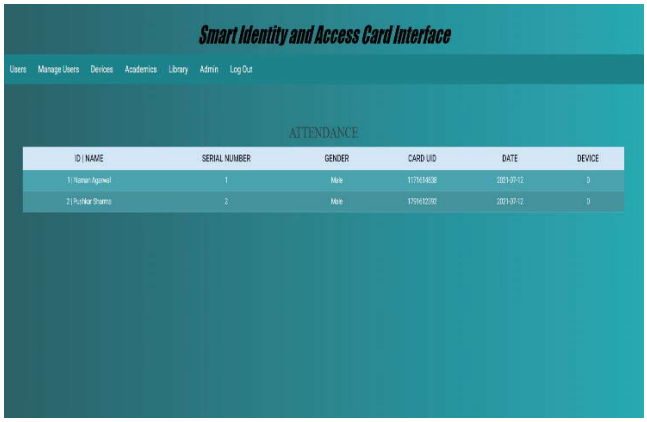

Fig. 2: Attendance

RFID Based Attendance System is a modern attendance system. It can be useful in different places like schools, colleges, and universities to register the attendance of the students.

When a student attends a class, the RFID reader in this particular class room will read the student's information, which is stored in the RFID chip that is installed on the student's ID and then mark the attendance of that particular student. The attendance record is stored on a local server. The updates are than reflected in the database present on the local machine itself. The updates can then be viewed only by the lecturer.

A simple algorithmic approach to the module is as follows:

- Step 1: Bring the card near the reader.
- Step 2: The reader reads the card value and the microcontroller updates its local storage to it.
- Step 3: The system than sends the read value over the internet to our database where it is updated.
- Step 4: The steps 1 to 3 are repeated until all the available student gets himself/herself registered for the current lecture.
- Step 5: The database in interaction with the host web application displays the result of change only to the authorized user.
- Step 6: The authorized user can than get the complete list of students currently tagged-in with the card.
- Step 7: The list is than discarded but the updates have been permanently written to the database.

The database for the attendance system module is represented using the following ER diagram:

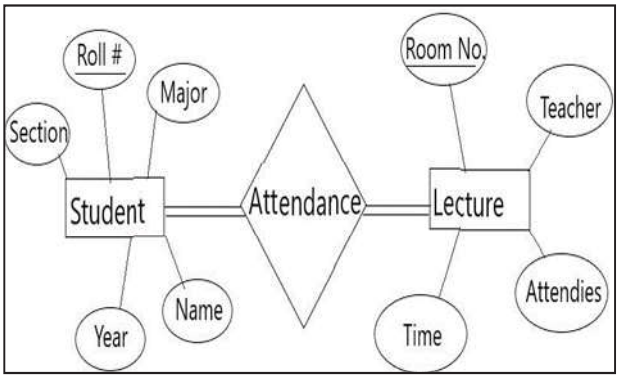

Fig. 3: Attendance E-R Diagram

Module 2: The Library Management System

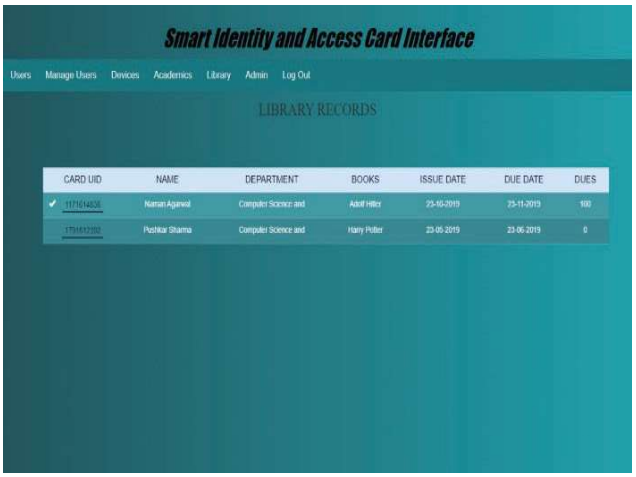

Fig. 4: Library Record

Any student that issues a book will be done by students with help of the Card. Even the books here will be empowered by RFID tags. The first scan will tug in the student information, while the consequent scans will result in book updating onto the student's Card. Students can now easily navigate using their Card to know the current book dues and/or operating fine on issued books. This will replace the current library computer system with a simple RFID reader attached to a more interactive touch screen that will run the smart campus card the student's Card. Students can now easily navigate using their Card to know the current book dues and/or operating fine on issued books. This will replace the current library computer system with a simple RFID reader attached to a more interactive touch screen that will run the smart campus card application to access information. An algorithmic approach for this module is as follows:

- Step 1: With every book in the library, attach a RFID tag.
- Step 2: The reader for the book and the user issuing the book is integrated at the counter.
- Step 3: Whenever a user requests for the book, the book is simply passed under the scanner. This step is repeated until all the required books are updated.
- Step 4: Now tug-in the user's card. This will automatically map the previously scanned books with the name of the user on our web application.
- Step 5: The user can than simply tug-in the card at any nearby library scanner and get to know the books details, or simply go to the web application or the same.

The database for the Library Management system module is represented using the following ER diagram:

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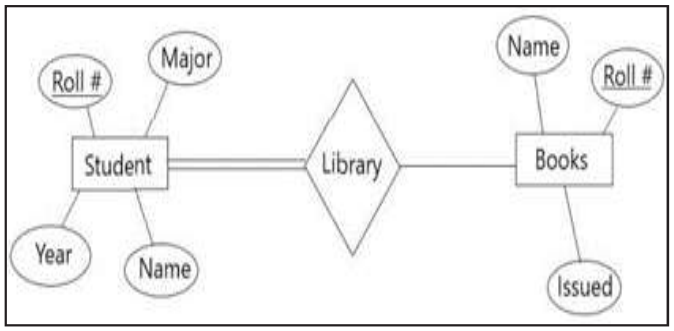

Fig. 5: Library Record E-R Diagram

Module 3: The Academic Record System

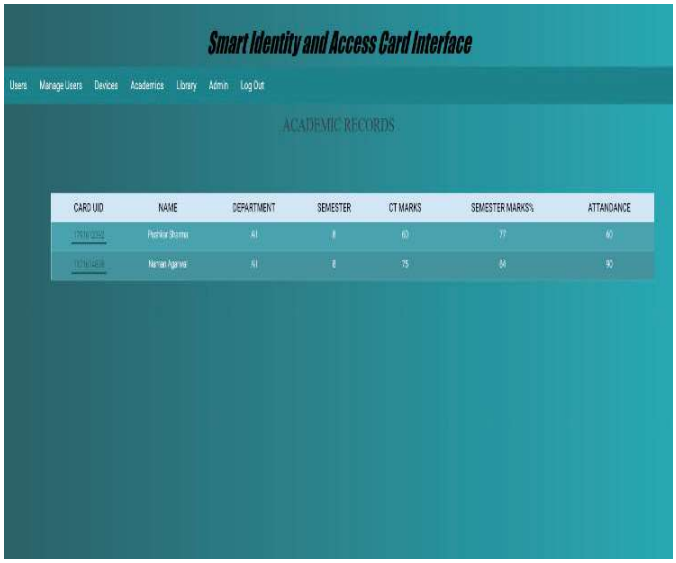

Fig. 6: Academic Record

Any faculty or higher staff members eligible to access a student's academic information will be empowered here. They just need to scan the corresponding student's RFID base S.I.A.C. This will generate a request to the database server and information of the student will be available over the web app. The information comprises of:

1. Student's Class Test Marks.
2. Student's Attendance record. The database for the Academic

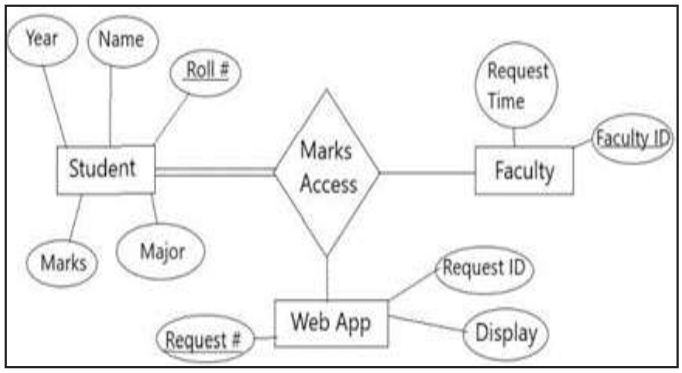

Fig. 7: Academic Record E-R Diagram

Advantages

1. In some universities around the world, students' attendance is done manually by the instructors during every lecture. This action might create inconveniences, like the instructor might forget to take attendance or by mistake he/she might mark the wrong student absent in case of having many students with similar names. Not only is this process time consuming, it also leads to stacks of files and folders that need to be stored and maintained. This is tackled by the Module 1: The Attendance System.
2. Another problem related to records, for a student, is of books issued and fines to a student's name, sometimes students forget books issued to them or date for re-issue of books and the fine keeps piling up. This issue is resolved via the Module 2: The Library Management System.
3. Similarly, record of student's academic score is also maintained by teachers manually, each subject's record is stored separately which is to be compiled for each student at the end of academic term.

VI. CONCLUSION

The paper concludes by providing a systematic and technologically advanced alternative to pursuing the orthodox attendance and library system. Moreover, the system should be error-free and marking of goods like books against an individual is hassle-free. The student can now immediately know the dues etc. against him/her and can rectify any kinds of misleads. The system also ensures that if a faculty member wishes to know about a certain individual in terms of their academic records, the faculty need not follow to other members like those of counsellor. Instead, a complete comprehensive way is available for the faculty in this regard.

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