

An RFID and Fingerprint Automated Attendance System

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Abstract: *Managing attendance is a very important record-keeping activity in any institution. The lapses recorded in traditional methods of recording and managing attendance has therefore necessitated the development of an automated system for this task. The integration of Radio Frequency Identification (RFID) with fingerprint biometric technology was used to enhance the security level and integrity of the records. The system does not only speed up the process of taking attendance but reduces error and allows for faster verification of student attendance, all with minimal human interaction.*

Keywords: *RFID, Fingerprint, Arduino Uno, Automation*

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I. Introduction

In many institutions, attendance is a very important criterion, which is used for various purposes. These purposes include record keeping, assessment of students, and promotion of optimal and consistent attendance in class. In most institutions, minimum percentage of class attendance is required in a course before students are allowed to sit for an exam. However, this policy has not been strictly adhered to due to the various challenges posed by the manual and present method of taking attendance. The existing conventional attendance system requires students to manually sign the attendance sheet every time they attend a lecture, test or exam. As simple as it seems, such system lacks automation, where a number of problems may arise. These includes the time unnecessarily consumed by the students to find and sign their name on the attendance sheet, impersonation, and misplacement of attendance sheet. Thus, there is a need for a system that would eliminate all of these problems.

An RFID is a wireless technology which uses electromagnetic waves for communication between RFID reader and RFID tag. Automated attendance systems using wall mounted RFID swipe card systems have been used in the past but it wasn't able to eliminate the problem of impersonation. Even though it solves the issue of manual taking of attendance.

To eliminate the issue of impersonation above, there is the need of developing an RFID and fingerprint biometric automatic attendance management system. It facilitates access to the attendance of a particular student in a particular class. This system will also help in generating reports and evaluating the attendance eligibility of a student. By using RFID technology, it is easier and faster to detect students handling at that time and reduce assets losses. In this system the fingerprint recognition is also adopted to enable the process of identifying of students more reliably and securely for facilities management. RFID and fingerprint based attendance management system was developed to provide a faster, more secure, and more convenient method of user verification than passwords and tokens can provide for a reliable personal identification.

The aim of this research is to design and implement a new approach by providing an application and automated system for monitoring student attendance by using both RFID and fingerprint biometric technology.

II. Literature Survey

2.1 RFID BASED ATTENDANCE SYSTEM

According to Arulogun *et al* (2013), student attendance system has been in use for the past years and will continue because of its importance to institutions of learning. Each student is given a card which serves as an identification card and attendance card. The student swipe the card across a reader which reads the tag on the card and compares with the information stored in the database and if it matches, it takes the attendance and updates the database. During the time of their work it was found that the reading of the tag was not as fast as desired and this is as a result of low frequency reader used and the system was selecting some of the cards due to lack of synergy between the card and the entire system. The system is aimed at monitoring the attendance of students controlled by arduino uno board using only RFID reader and these system lacks the capability to fully authenticate the students identity due to fraudulent activities accompanied by the use of only RFID reader to monitor attendance of student hence recommend the use of fingerprint biometric to enhanced its full capability since no two individuals have the same fingerprint. Therefore there is unique identity associated with fingerprint of an individual.

Similarly, an RFID based systematic student attendance management system was proposed by Hanisah (2010). It tracks a student using RFID. The proposed system embedded integrated Radio Frequency circuits in student identity cards for the purpose of automated tracking. The system developed also provides real time access to attendance reports via the internet. The use of embedded chips on identity card ensures that each student is authenticated and marked for attendance securely and genuinely. The system is therefore not suitable for implementation in remote areas where there is limited access to internet. Also, the cost of internet service is high, thus increasing the cost of implementation. Radio Frequency interference can also considerably affect the accuracy of attendance saved by the developed solution.

Sumita *et al* (2013) & Priyanka *et al* (2017), design an RFID technology based attendance management system which comprises of RFID tags, RFID reader, middleware and a backend database. RFID tags are uniquely and universally identified by an identification sequence, governed by the rubrics of EPCglobal Tag Data Standard2. A tag can either be passively activated by an RFID reader or it can actively transmit RF signals to the reader. The RFID reader, through its antenna, reads the information stored on these tags when it's in its vicinity. The reader, whose effective range is based on its operational frequency, is designed to operate at a certain frequency. The operational frequency of the reader ranges from 125 KHz – 2.4 GHz. The middleware encompasses all those components that are responsible for the transmission of performance of the system. The backend database stores individual tag identifiers to uniquely identify the roles of each tag. The database stores record entries pertaining to individual tags and its role in the system application. The RFID system is interdependent on its core components to achieve maximum efficiency and optimum performance of the application. Due to its high degree of flexibility, the system can be easily adopted for an array of applications ranging from small scale inventory cabinets to multifarious and highly agile supply chain management systems. Although, the cost of incorporating this technology has restricted its outreach, the technology promises to have untapped potential germane information from the reader to the backend management systems. The middleware can include hardware components like cables and connectivity ports and software components like filters that monitor network. The primary aim of the research is to uniquely identify individual students based on their unique tag identifiers. The research should shower light on the scalability and efficiency of the system. A systematic and serialized approach is required to solve this conundrum. The key characteristics of the application include automated attendance, generation of report of attendees for a particular course, error free tag identifier detection, easy scalability to incorporate more records, integrity and security in data storage.

This paper concentrates on the principal purpose to overcome the human errors while recording student attendance and the creation of a data centric student attendance database system with an improved overall efficiency. The application graphical user interface (GUI) is designed using Visual Basic 6.03 and Microsoft Access is used as the database provider. The Atmel4 AT89S52 is the heart of the system, which is a low-power high performance CMOS 8 bit microcomputer with 8K bytes of downloadable flash programmable and erasable read only memory.

2.2 BIOMETRIC ATTENDANCE SYSTEM

Emmanuel *et al* (2013) developed an automatic attendance system using fingerprint verification technique. This work did not only focus on attendance management, but also on the specification of accuracy of the minutiae during enrolment and verification process. A high degree of accuracy in the enrolment and verification process was reported by the author, however, the attendance management software is a desktop application; hence it can only be used on standalone PCs where the application is installed.

Rufai *et al* (2012) developed a biometric model for examination screening and attendance monitoring system. The model was developed to ensure that impersonation does not take place during examinations. The authors reported that the use of biometric devices helped to reduce impersonation since one student cannot misuse, forged or steal another student's biometric identity.

Karthik *et al* (2013) developed A Foolproof Biometric Attendance Management System which upon taking attendance automatically sends messages to the head of department and the student's parents or guardian. However, the system is also capable of calculating the average attendance of each student in percentage.

Gunjan *et al* (2013) fingerprint identification is the oldest method that has been successfully used in various applications. Each one of the ten fingerprints is different from one another and from those of every other person. Even identical twins have unique fingerprints. That makes them ideal for personal identification. A fingerprint is made of a series of ridges and furrows on the surface of the finger. The uniqueness of a fingerprint is determined by the pattern of ridges and furrows as well as the minutiae points. Minutiae points are local ridge characteristics that occur when a ridge splits apart or a ridge ends. For attendance, the student places his/ her finger over the fingerprint device and the student's matriculation number is sent to the database as having attended that particular lecture. At the end of the semester or year, reports are generated to enlist the name of students that are eligible for exams and number of times the student attended lecture.

III. Design Procedure

The design consists of three stages:

- ✓ Enrolment
- ✓ Attendance taking
- ✓ Print attendance

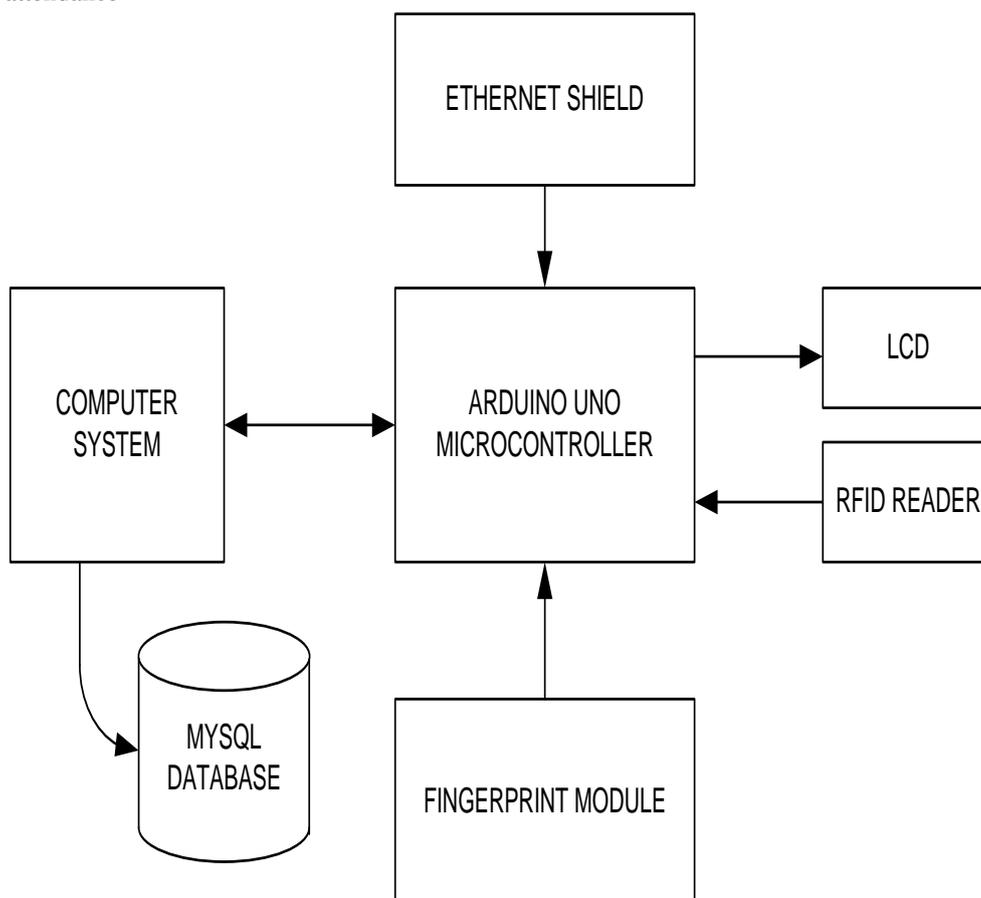


Fig. 3.1 The Block Diagram

The block diagram above in fig.3.1 below illustrates the composition of the design. The database contains all the information of the student as stored in a MySQL database during the enrolment stage. MySQL database is a web based database designed using komodo edit. During attendance taking, the information of the students is collected over a XAMPP server and the database is updated. XAMPP is a free and open source cross-platform web server solution stack package. The information can be previewed from the website or the XAMP server interface of which the PC is the host.

The microcontroller coordinate all the process involved in the collection of information and its interaction with the database through the aid of a program written and compiled into it. The ethernet shield is mounted on the microcontroller board which aid the communication between the board and the database. It helps in filtering and fetching of data in order to update the attendance of each registered student. The information of each student is inputted using the PC's keyboard. After the enrolment and attendance taking, the printing of the attendance is done over the website. The Liquid Crystal Display (LCD), displays the stages involved in the registration as well as the attendance taking. Accessing the system is done through the fingerprint module and the RFID reader. In the process of taking the attendance the system prompt the student to place his or her thumb on the fingerprint sensor when it has been confirmed to be the right thumb it then grant access for the swiping of the card, it then reads the RFID tags on the card to confirm if it is legit, during this stage it compare the tag with the information stored in the database and if there is a match, the attendance is taken otherwise it rejects it. These operations are controlled with the aid of a written program on the Arduino IDE and the result is printed in tabular form. Flowcharts depicting the enrolment stage, attendance taking stages are shown in fig. 3.2 and fig. 3.3.

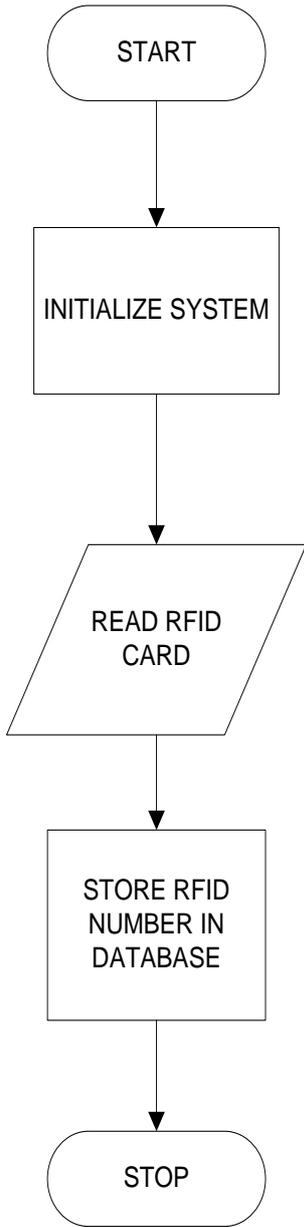


Fig.3.2(a) RFID Enrolment Stage

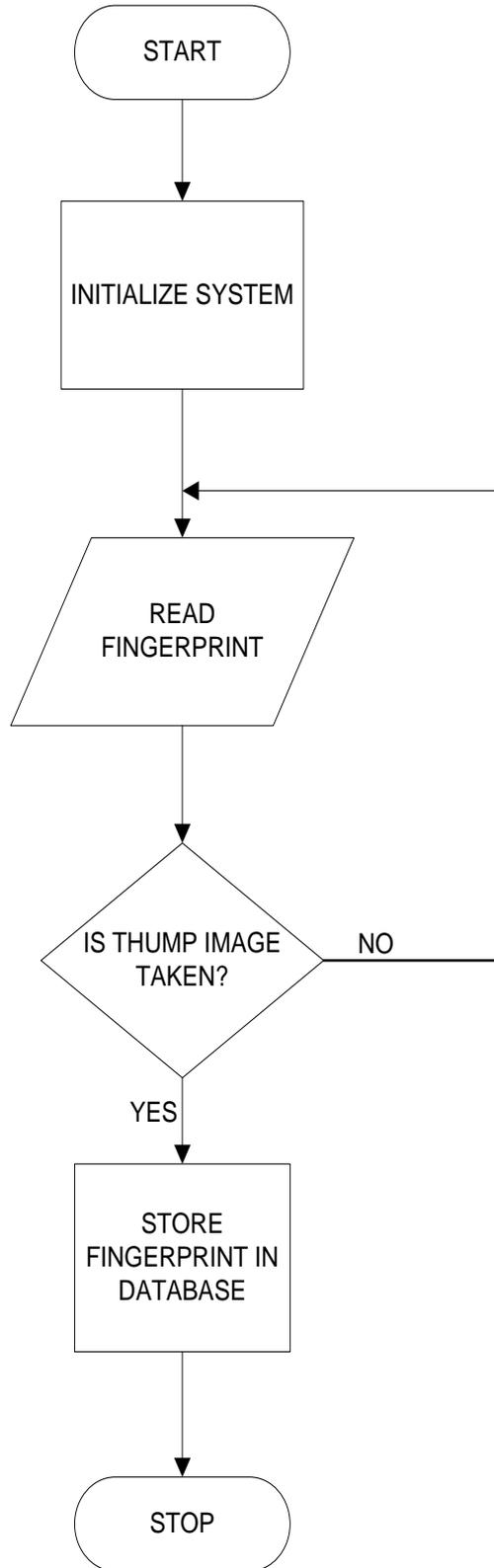


Fig.3.2(b) Fingerprint Enrolment Stage

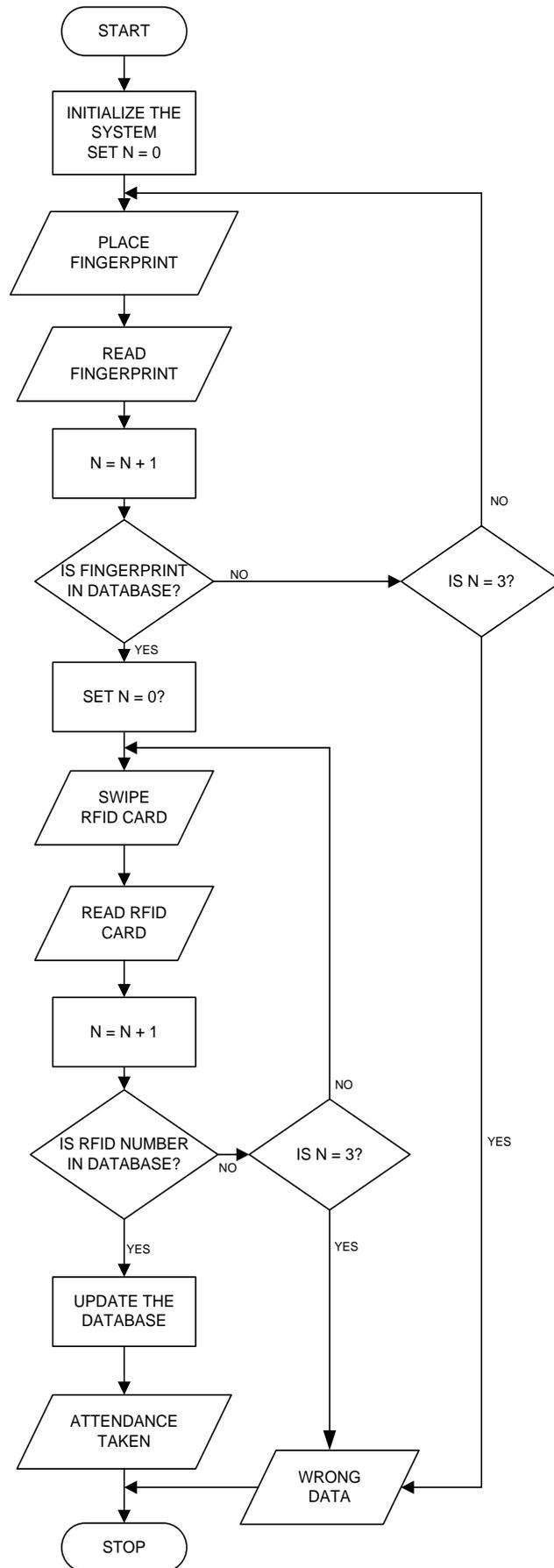


Fig. 3.3 Attendance taking stage

IV. Simulation Results

The circuit diagram was implemented and simulated on Proteus VSM. Fig. 4.1, fig.4.2, fig.4.3, fig.4.4 show a stage by stage workability of the system.

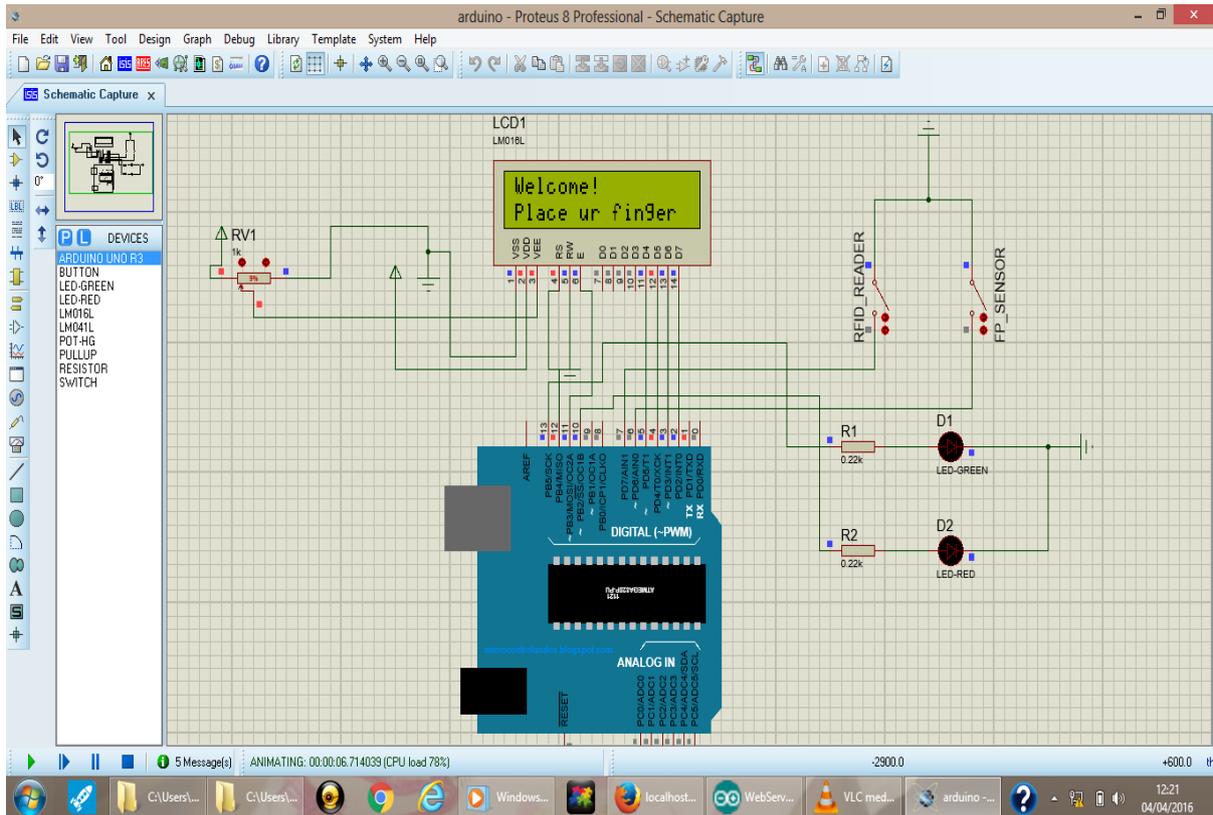


Fig. 4.1 Simulation prompting student to place finger

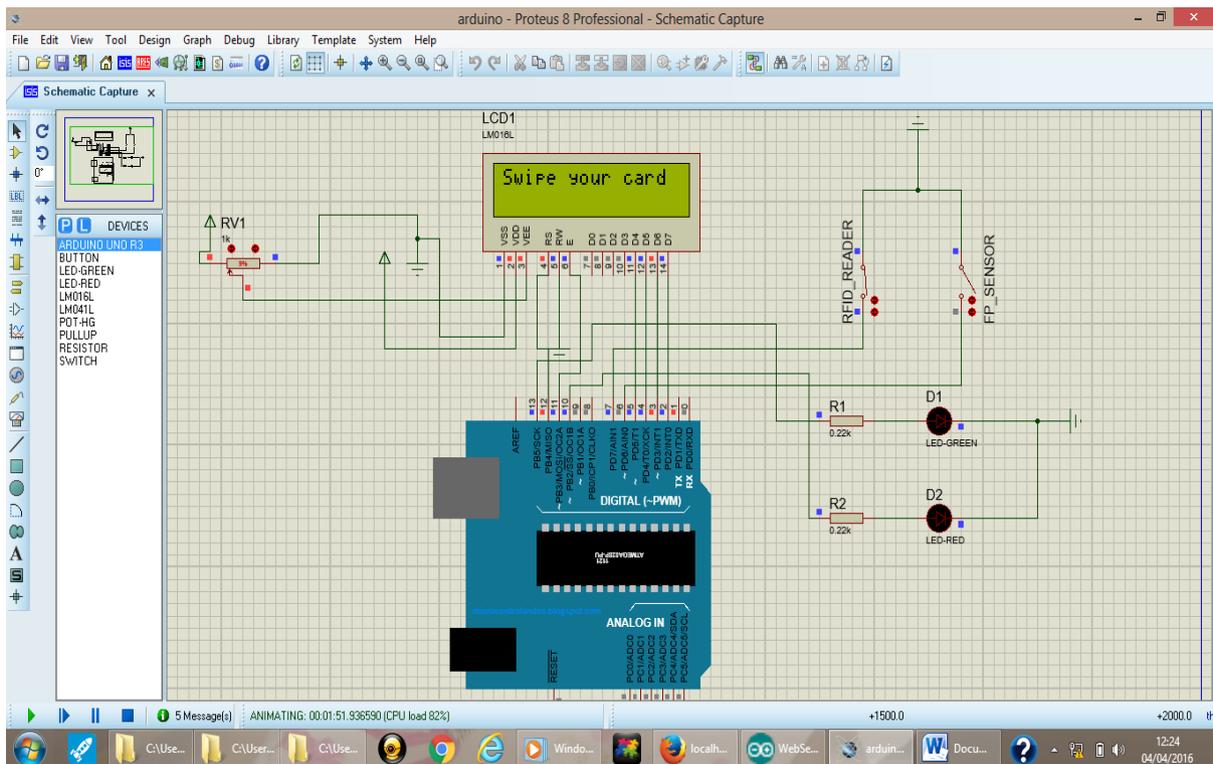


Fig. 4.2 Simulation prompting student to swipe RFID card

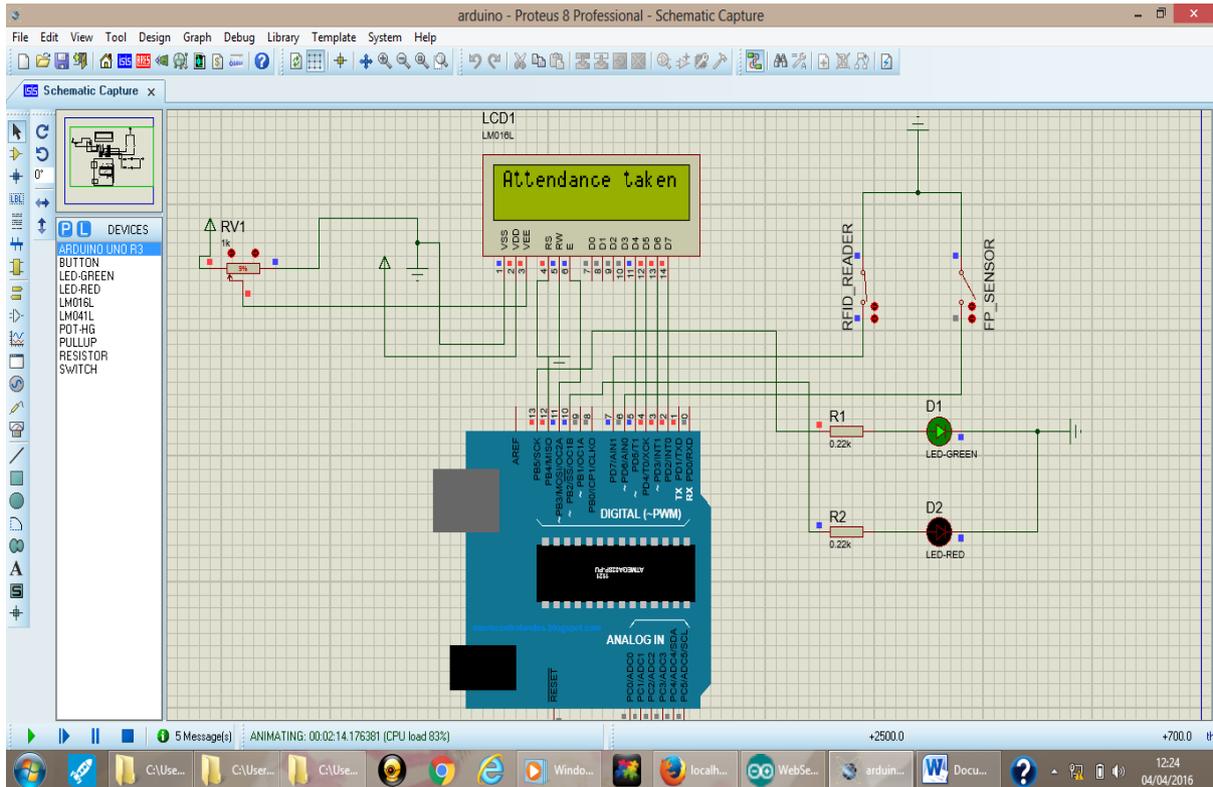


Fig.4.3 Simulation showing attendance taking

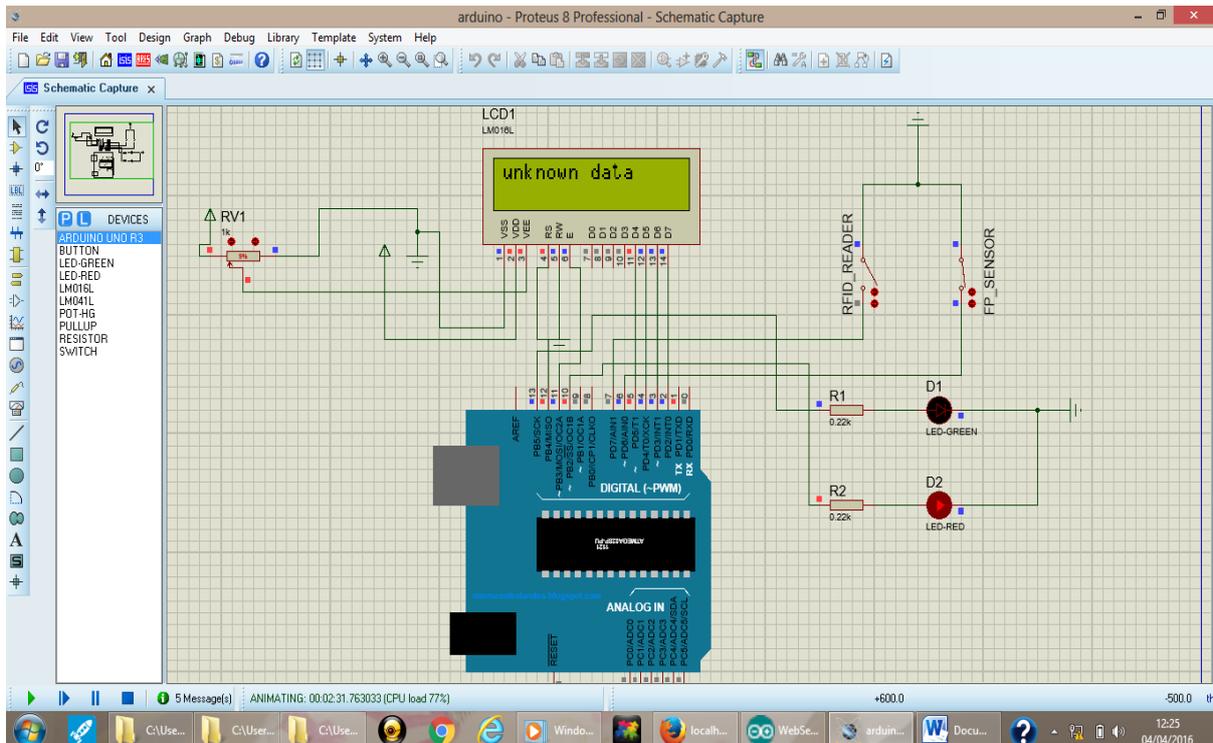


Fig. 4.4 Simulation showing when student's data is not found in the database

V. Database Interface

The figures below shows the screenshots of the MySQL database interfaces in fig. 5.1 and the web based database interface in fig. 5.2 and fig. 5.3.

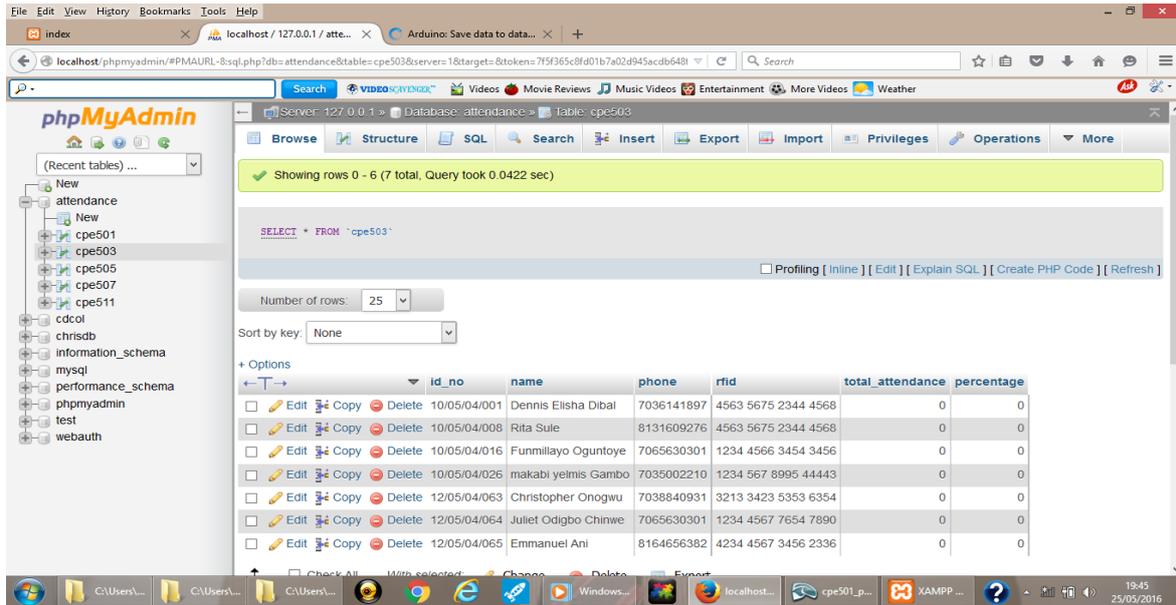


Fig. 5.1 MySQL database displaying enrolled students before attendance was taken



Fig 5.2 Homepage of web based database

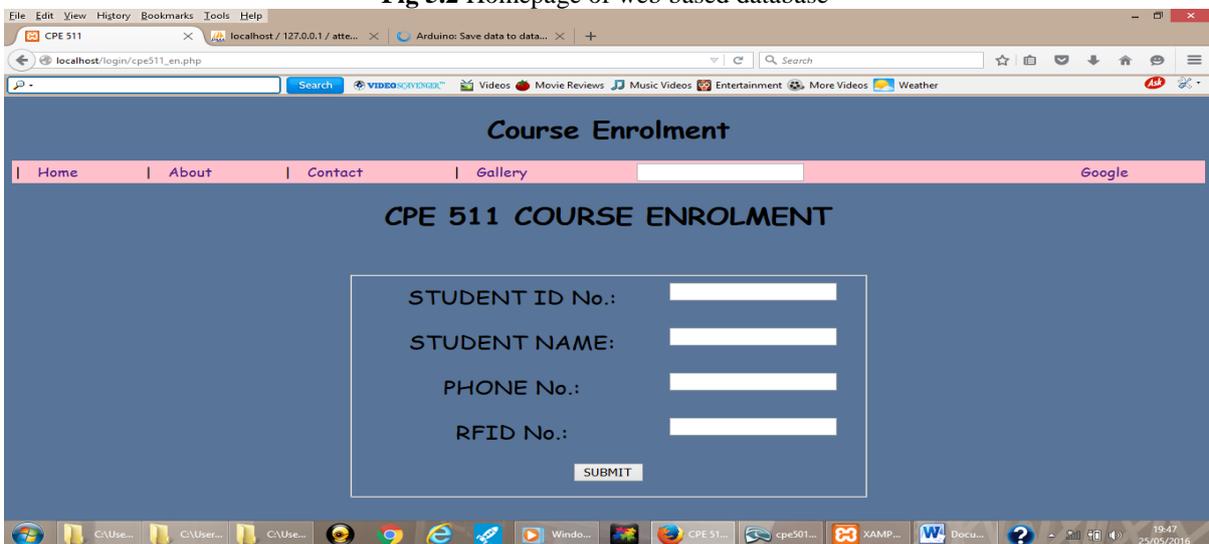


Fig 5.3 Enrolment interface of web base database

VI. Results

The outcome of the attendance taken for testing was retrieved from the MySQL database on the PC via a locally hosted website. An assumption was made for that the maximum attendance of 10 for each course for a semester and when a student takes one attendance it is 10%.

$$\text{percentage} = \frac{\text{total number of attendance taken}}{\text{maximum number of attendance for semester}} \times 100\%$$

where *maximum number of attendance for semester* = 10

The figures 6.1, 6.2 below shows the attendance of students for each registered course.

ID NUMBER	NAME	RFID NUMBER	TOTAL	PERCENTAGES
10/05/04/001	Elisha Dennis Dibal	25 F2 B1 65	6	60
10/05/04/016	Funmilayo Oguntoye	2C 0C 40 D5	5	50
10/05/04/026	Makabi Yelmis Gambo	7A 93 41 D5	4	40
12/05/04/063	Christopher Onogwu	8C 3D 38 D5	6	60
12/05/04/065	Emmanuel Ani	23 6A 40 D5	4	40

Fig.6.1 CPE 511 attendance summary

ID NUMBER	NAME	RFID NUMBER	TOTAL	PERCENTAGES
12/05/04/065	Emmanuel Ani	23 6A 40 D5	5	50
10/05/04/001	Elisha Dennis Dibal	25 F2 B1 65	6	60
10/05/04/016	Funmilayo Oguntoye	2C 0C 40 D5	7	70
10/05/04/026	Makabi Yelmis Gambo	7A 93 41 D5	6	60
12/05/04/063	Christopher Onogwu	8C 3D 38 D5	6	60

Fig. 6.2 CPE 503 attendance summary

VII. Conclusion

An RFID and fingerprint automated attendance system was designed and implemented. Each student's RFID card as well as fingerprint is captured and stored in the database. During attendance taking, the system prompts the student to place his/her finger on the fingerprint sensor, the print is then captured and compared to the one stored in the database if there is a match it then prompts the student to swipe his/her RFID card on the RFID reader, the card number is read and compared to the one in the database and if there is a match, the attendance of that student is marked the whole process is viewed through the Liquid crystal display (LCD).

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