

RADIO FREQUENCY IDENTIFICATION AND FACE EIGEN FACTORS BASED STAFF/STUDENTS ATTENDANCE SYSTEM

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Abstract:

Radio Frequency Identification (RFID) and eigen face factors based attendance system is a system that can automatically capture attendance by a person passing through an RFID reader with camera that captures their tags' electronic product code (EPC) and images respectively, compare and match them with what is already existing in the database for proper validation and authentication. The tools used in achieving this system were C variant, Arduino based programming language and Java programming language was used for serial communication, the image training, detection and recognition and for the application interfaces. The system comprises of the RFID module reader, RFID tags and serial communication peripherals. At the completion of this work, a system that automatically captures attendance by RFID reader, that is able to provide security and privacy in such a way that the tags with their unique product codes and identification were not compromised because each person is uniquely identify by their images attached to their unique tag electronic product code (EPC). The system sends alarm to indicate that the right or wrong person passed through the RFID reader, this can draw the attention of the person in charge in the case of a person with another person's tag.

Key Words: Radio Frequency Identification (RFID) reader, Arduino nano Technology, electronic product code (EPC), RFID tags

I. Introduction

Educational institutions' administrators and organizations (even my office at Electronic Development Institute, Awka, NASENI) in our country and the whole world are concerned about regularity of students and staff attendance (Abdul and Jyothi, 2013)). Students and staff overall performance is affected by it. The conventional method of taking attendance by calling names or signing on paper is very time consuming, and hence inefficient. The most common means of tracking students and staff attendance in the classroom and workplace

is by enforcing the students and staff to manually sign the attendance sheet, which is normally passed around the classroom while the lecturer is conducting the lecture or kept in certain position for staff to sign. This at times leads to false attendance record. As a result, research was done on how to involve automatic identification (AUTO-ID) approaches that will help to handle the issues of conventional/manual attendance system. During the research it was found out that there are different AUTO-ID technology namely, infrared technology, Barcodes technology and the Radio Frequency Identification (RFID) technology (Lim *et al*, 2009). Radio Frequency Identification (RFID) technology was chosen which overcomes the limitations of other automatic identification approaches that use light to communicate, (such as bar codes and infrared technology) because a tag may be hidden or invisible to the eye and can be used in a harsh or dirty environment. Readers can be set to remotely and automatically read without labor-intensive manual scanning of the object as in most bar code systems. Radio Detection and Ranging is a communication medium to subliminally detect objects that are miles away, invisible to the naked eye.

Radio Frequency Identification (RFID) is a technology that is used to collect information automatically by radio frequency data communication between a mobile object and an RFID reader to identify, categorize and track them (Lim *et al*, 2009). RFID tags can be read from several meters away and beyond the line of sight of the reader. RFID systems have been widely used in many different application areas, such as: product tracking through manufacturing and assembly, control of inventory, parking lot access and control, container tracking, equipment tracking in hospitals, etc. An RFID system primarily comprises of RFID Tags, RFID Reader, Middleware, Antenna and a Backend database.

II. Problem Statement

- i. The conventional method of taking attendance by calling names or signing on paper is very time consuming, and hence inefficient as mentioned in the introduction section.
- ii. Another issue of having the attendance record in a hardcopy form is that the institution or organization may lose or misplace the attendance sheet and might not keep record of the attendance.
- iii. In terms of attendance analysis, the persons in charge will be force to perform manual computation to obtain the attendance percentage for assessment or appraisal, this consumes a lot of time. From Figure 1, one can see the gap between the manual attendance entry system and Radio Frequency Identification (RFID) based attendance system, therefore, it poses problem to academic and workplace progress.

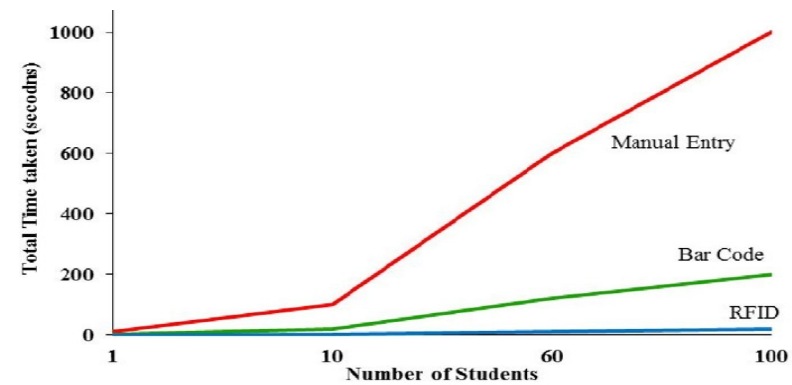


Figure 1: A line graph showing the comparison of total time taken to record the attendance of students (Sumita et al (2013))

III. Objectives of the Research

- iv. To develop a system that can automatically capture students or staff attendance by flashing their student/staff card at the RFID reader or passing under the reader without physical site of contact, this will be achieved by writing codes in arduino C variant language, building the codes via the universal programmer into the microcontroller AT89C51/52 (in arduino platform) in the constructed system.
- v. To develop Radio Frequency Identification (RFID) based attendance system that will provide security and privacy in such a way that the tags with their unique product codes and identification will not be compromised because each student/staff will be uniquely identify by their images attached to their unique tag electronic product code (EPC).
- vi. To develop a system that will accept images and tag EPC from student/staff and store it in a database (MySQL) through serial communication COM ports with the help of the line drivers (MAX 233) attached to the hardware.
- vii. To develop a system that will process the incoming images and tag EPC from students/staff, recognize and match them with the preregistered ones in the database and assign attendance or reject attendance.
- viii. To develop The system will be able to send alarm to indicate that the right or wrong person passed through the RFID reader, this can draw the attention of the person in charge in the case of a student/staff with another person's tag.
- ix. To develop a system that will have an interactive interface designed with net bean (Java programming language) that can enable institutions and organization register the students and staff, view and edit their records, view, edit and print out the attendance weekly, at the end of the month and at the end of the semester/year.

IV. The design methodology

The design methodology used for the research work is Embedded system development methodology. In the core of this embedded system is the embedded software. In order to

develop the embedded software efficiently and ensure that the developed software is of high quality, there is a need to execute the appropriate tasks in the appropriate sequence in the course of development. This trend has led the development of embedded software to expand in scale in order to meet the ever-growing functional needs. In earlier days, the developers of embedded software did not have to be that conscious about development process to build the software required to be embedded in the final product, since their scope of development was relatively limited. But due to the recent expansion in scale of software development, numerous problems attributable to embedded software or embedded system have come to surface. As a result, more and more attention is given now to improve the development process to address these emerging problems.

V. SYSTEM MODE OF OPERATION

Figure 2 to figure 23 are the comprehensive system design, the application modules and the hardware modules of the attendance system. We designed the application module with net bean, the first design we did was the lecture/admin login, the second design is the selection page where the lecturers can choose whether to take attendance or do fresh students' registration, the third design the port serial communication with Java . For the application to establish communication with the hardware via USB, a form for selected and connecting to the hardware must be designed. In the design, we have the list control for selecting the buadrate which is also the bandwidth at which the serial converter must be before it can communicate, we have to choose the highest bandwidth [9600] for fast data transfer to and from the hardware .

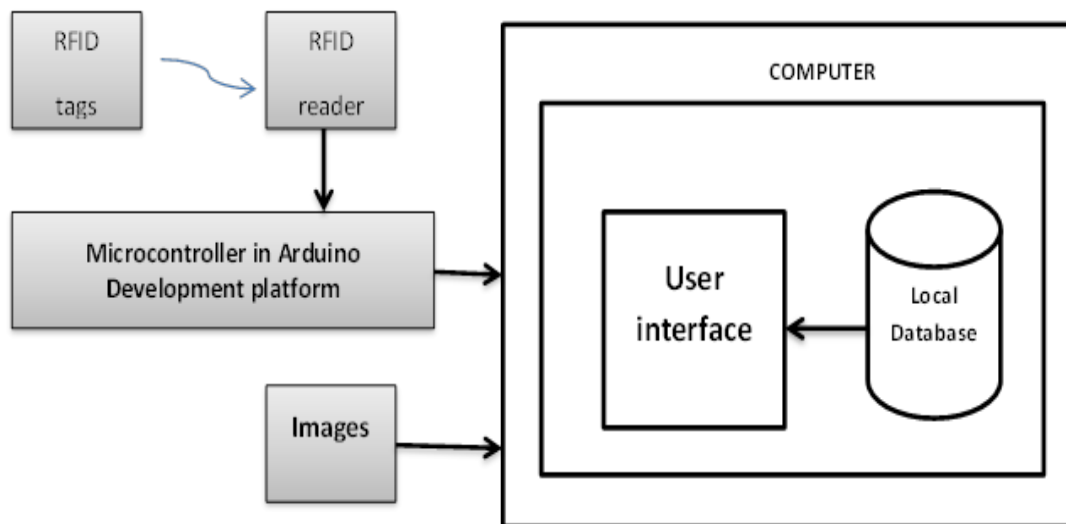


Figure 2: the system block diagram

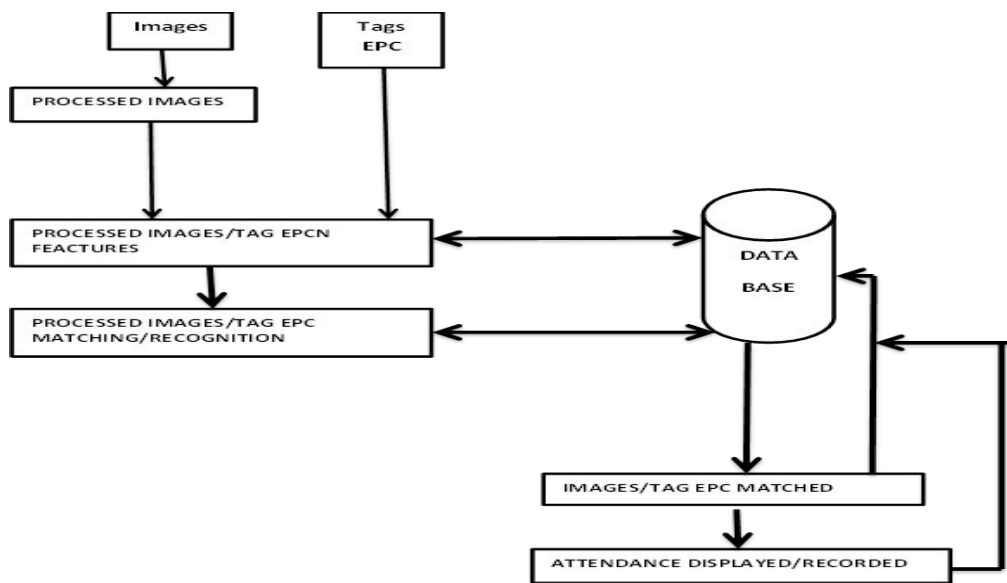


Figure 3: the system structural diagram

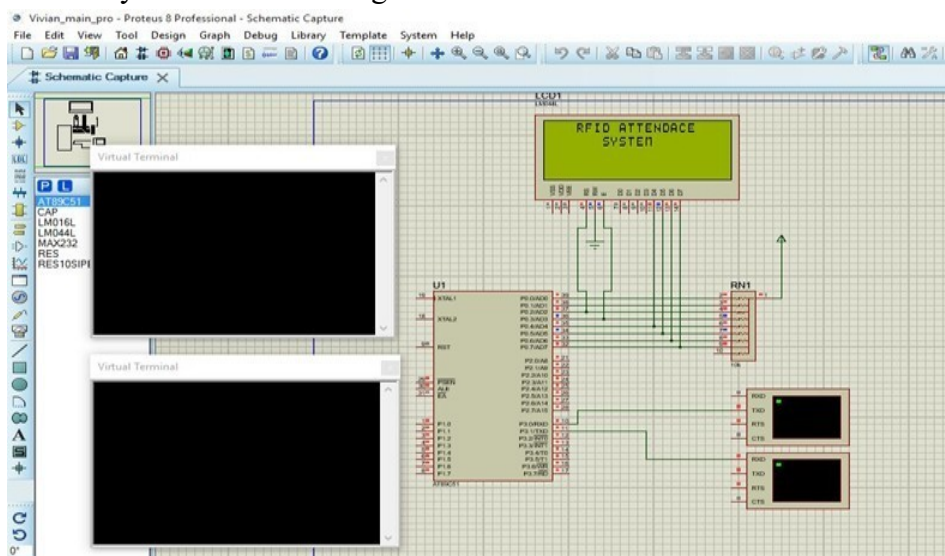


Figure 4: the system circuit diagram

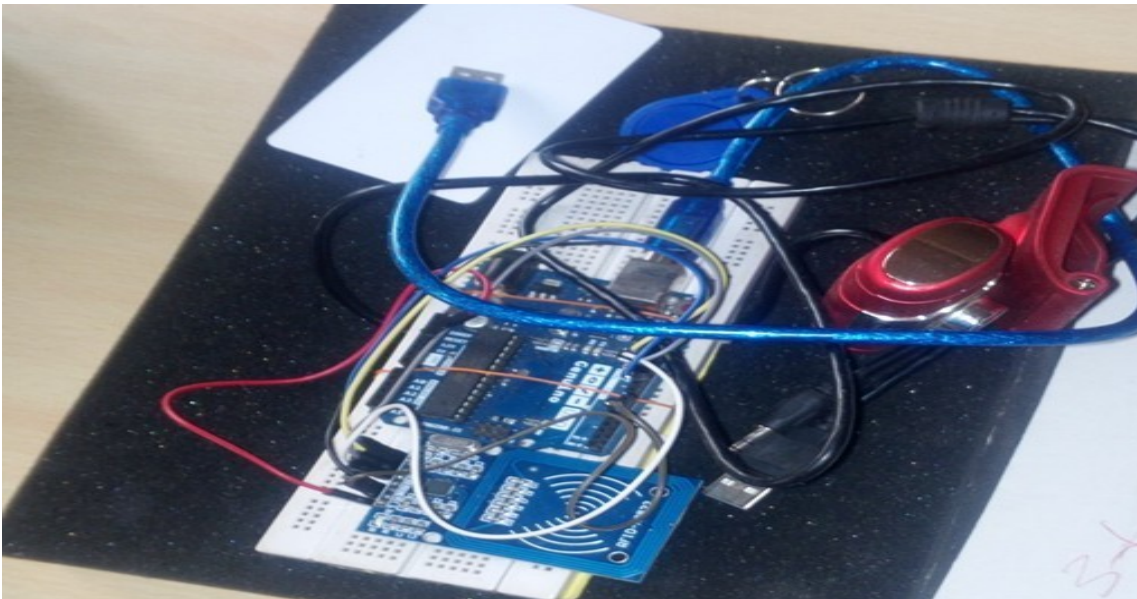


Figure 5: the hardware design

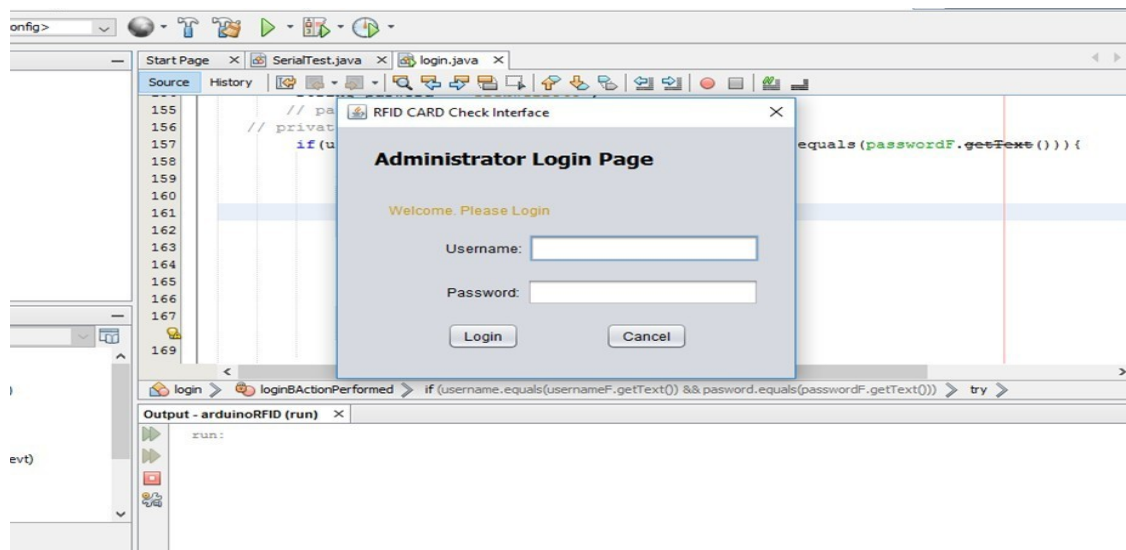


Figure 6: the admin login

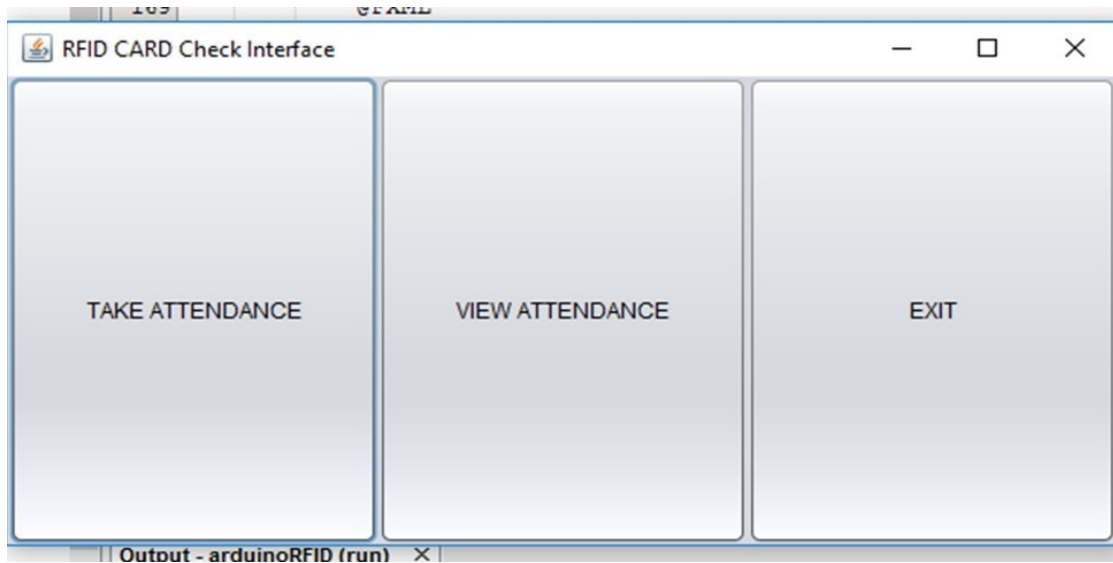


Figure 7: the attendance interface

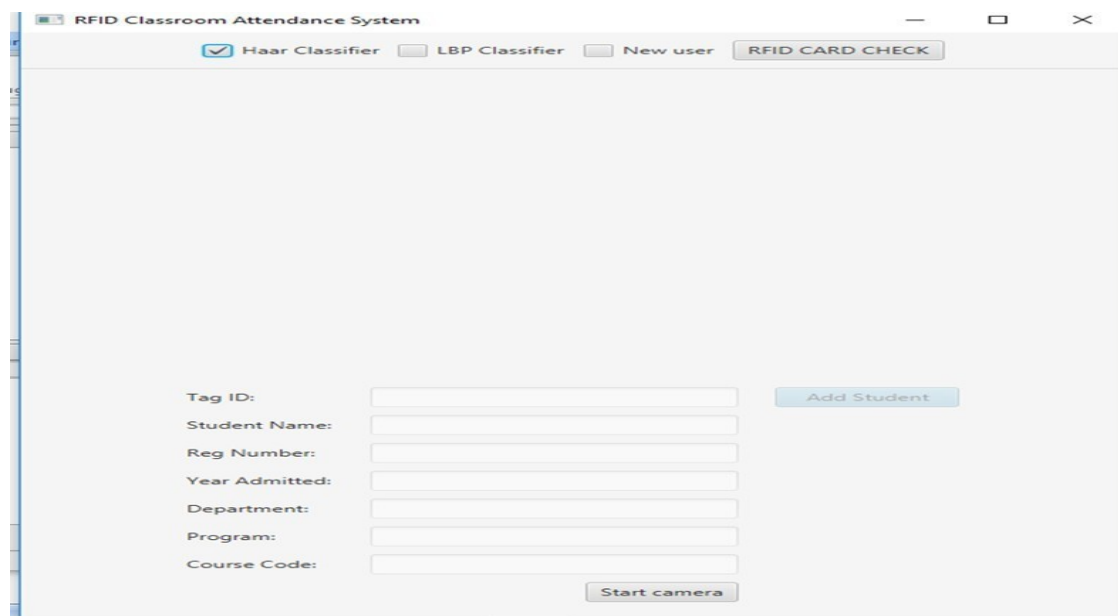
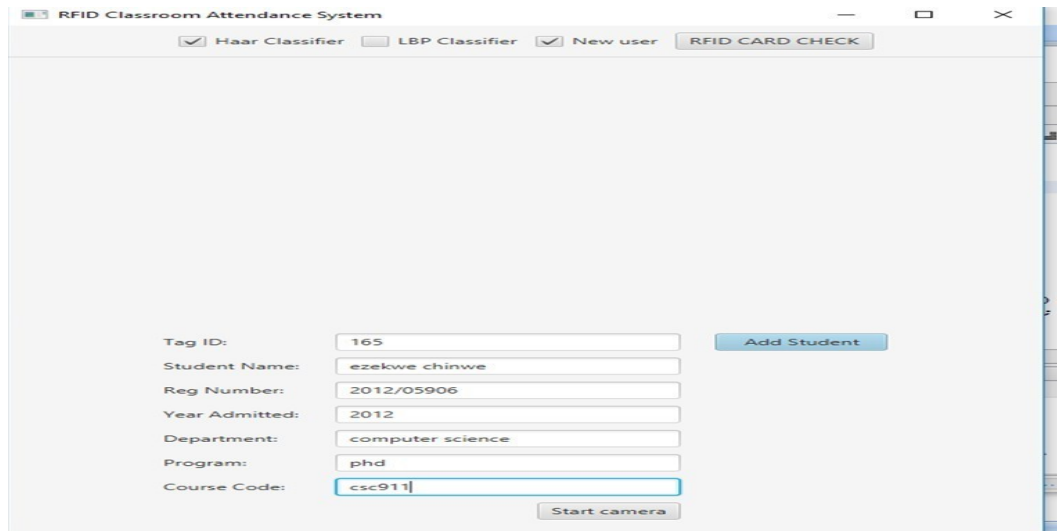


Figure 8: the registration and image processing interface

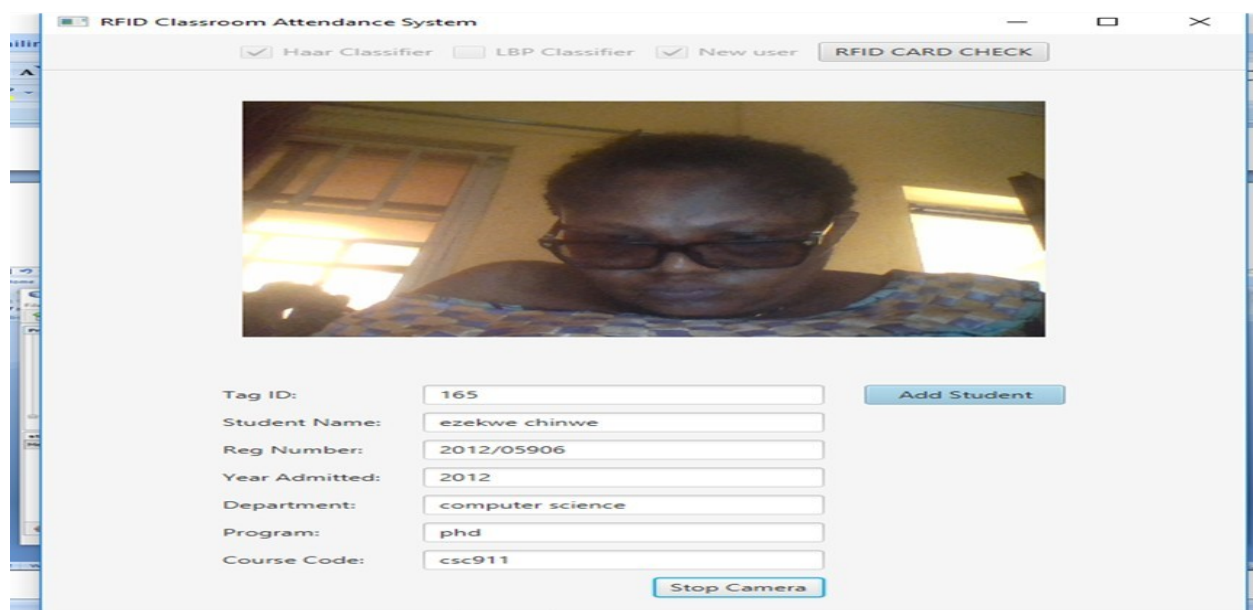


The screenshot shows the 'RFID Classroom Attendance System' window. At the top, there are checkboxes for 'Haar Classifier' (checked), 'LBP Classifier' (unchecked), and 'New user' (checked), along with a button labeled 'RFID CARD CHECK'. Below this, the registration form contains the following fields and values:

Field	Value
Tag ID:	165
Student Name:	ezekwe chinwe
Reg Number:	2012/05906
Year Admitted:	2012
Department:	computer science
Program:	phd
Course Code:	csc911

Buttons for 'Add Student' and 'Start camera' are located at the bottom right of the form area.

Figure 9: the registration in progress



This screenshot shows the same 'RFID Classroom Attendance System' window, but with a camera feed active. The registration form fields and values are identical to the previous screenshot. A video feed of a person wearing glasses is displayed in the upper central part of the window. The 'Add Student' button remains visible, and a new 'Stop Camera' button has appeared at the bottom right of the form area.

Figure 10: image training

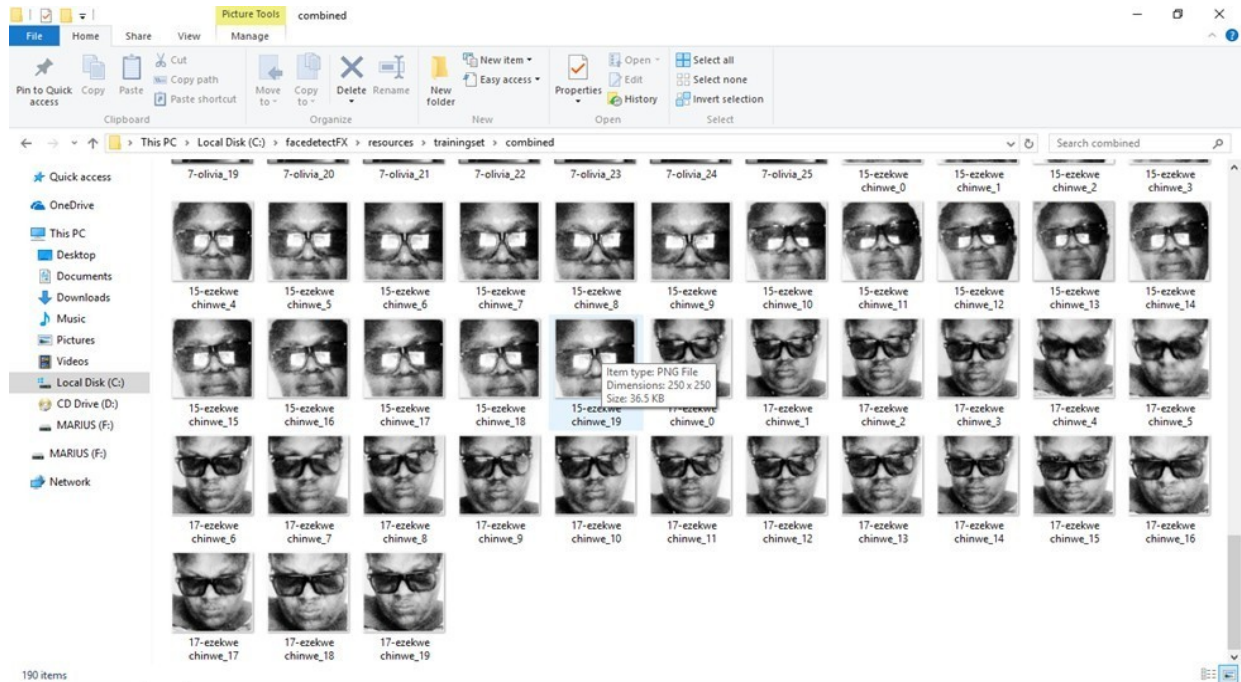


Figure 11: different face eigen factors generated after training

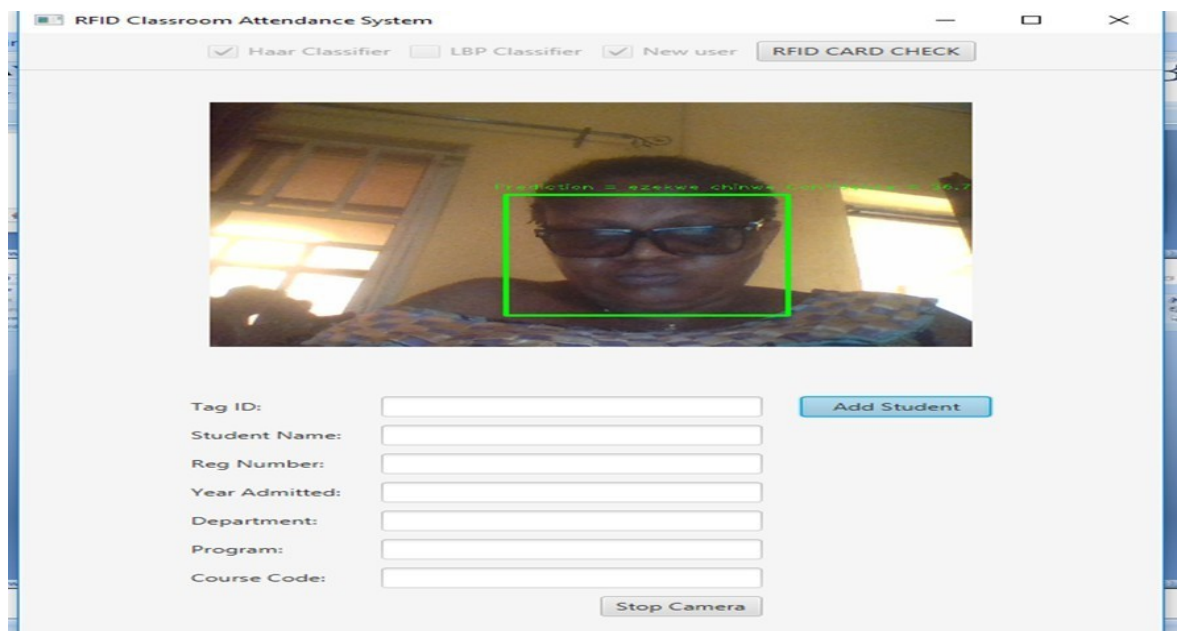


Figure 12: face eigen factors recognition for taking attendance

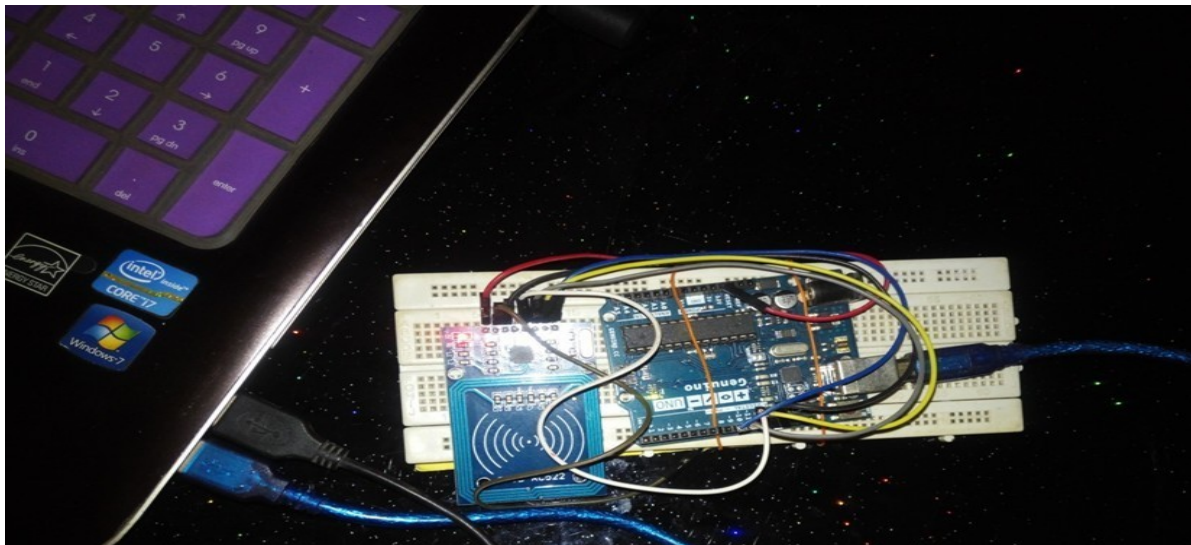


Figure 13: hardware interfaced ready for taking attendance

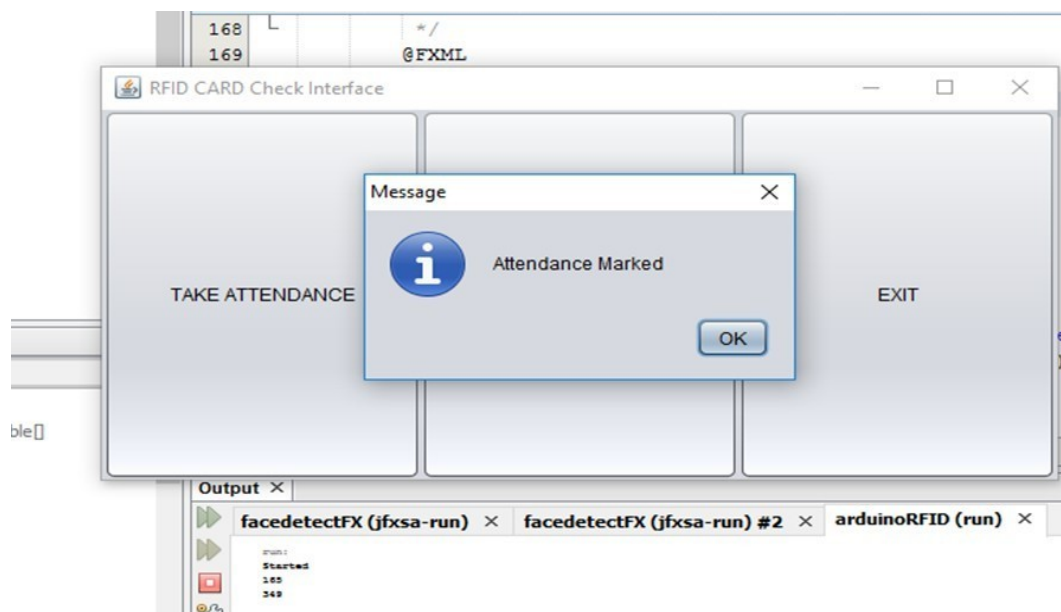


Figure 14: attendance taken with the right tag EPC and face eigen factors

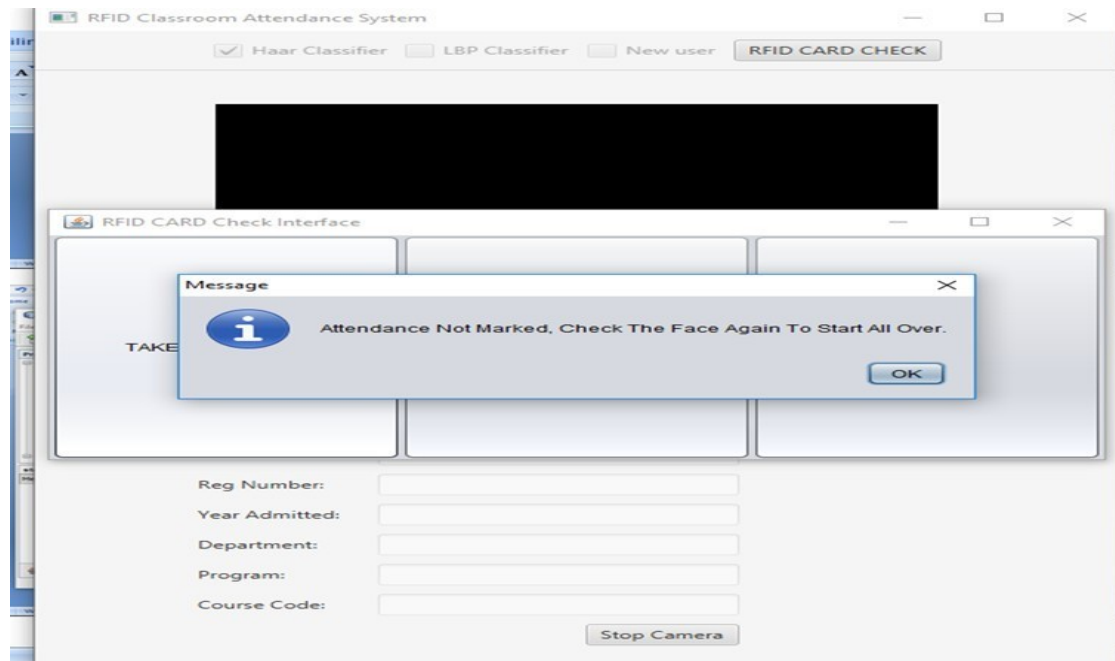


Figure 15: attendance not taken because of wrong face eigen factors

VI. Test Results

The software performance was very good, very flexible and easy to use interface. Performance evaluation was designed to test the system and compare it with other existing system like the manual method, RFID with finger print. This is represented in the table 2 showing that the time take to take an attendance using RFID with image is only 0.2 second compared with the others that took 5 seconds and 10 seconds respectively and so on. A graph was generated as shown figure 2 to explain this more using Microsoft excel.

Table 1: attendance evaluation table from 3 different attendance methods

Method	Total Number of Students			
	1	10	60	100
Manual Entry	10 seconds	100 seconds	600 seconds	1000 seconds
RFID with finger print	5 seconds	50 seconds	300 seconds	500 seconds
RFID with image	0.2 seconds	2 seconds	12 seconds	20 seconds

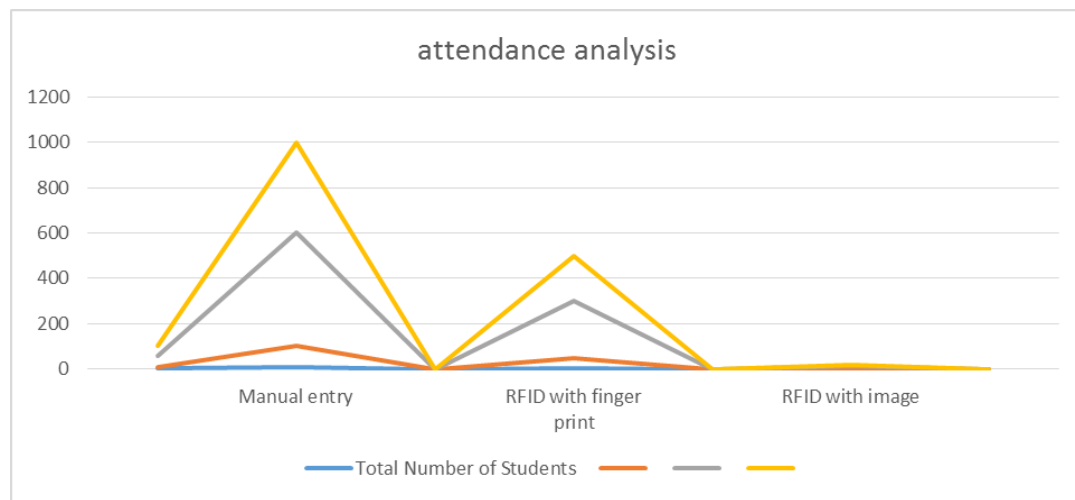


Figure 16: attendance evaluation graph from 3 methods

VII. Conclusion and Recommendation

Summary of the need and potential of the idea.

The primary aim of this work was to develop and implement a Radio Frequency Identification technology (RFID) and face eigen factors based attendance system which will significantly improve the process of students/staff attendance recording and tracking system in schools and offices. The system was able to promote a fully-automated approach in capturing attendance using the tag Electronic product code (EPC) and images.

The revenue generation from these product will be high and interesting because the high number of schools and organizations in Nigeria.

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