DETAILED PROPOSAL

Submission Title (Project Name) *

Radio frequency identification and face Eigen factors based staff/students attendance system

Include Team Members (Maximum of 5 People) *

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UCHENNA ONWE,
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Executive summary

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.

1. 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.

2. 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.

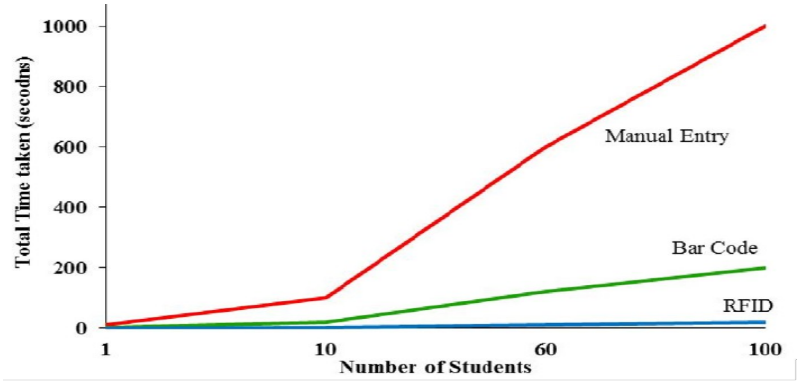

Figure 1: A line graph showing the comparison of total time taken to record the attendance of students (Sumita et al (2013)

3. Objectives of the Research

i. 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.
ii. 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).
iii. 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.
iv. 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.
v. 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.
vi. 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.

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4. Target Beneficiaries/Users

- Primary beneficiaries: (Schools and other organization(private, public and hybrid).)
- Secondary beneficiaries: (service providers, policymakers, the government)
- Estimated reach: starting with 30 million persons.

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5. Technical Feasibility

i. Technology used

Two methodologies were used were used namely; embedded system development methodology for the hardware part and object oriented paradigm of systems analysis and design for the software development.

ii. Innovation element:

This research distinguishes itself from earlier projects by Radio Frequency Identification (RFID) signals (unique tag electronic product code (EPC)) attached in every individual unique face eigen factors, making it almost impossible to be compromised.

- Readiness level: physical prototype level
- Scalability: as many quantity as possible can be manufactured to serve the schools and organization

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6. Resource Requirements

(For development, testing, and deployment)

i. Human resources

planners, system analyst, frontend designers, backend designers, embedded system programmers, electronic engineers, electrical engineers, implementers, database administrators, system administrators, PCB designer and package designers.

ii. Infrastructure: Equipment, facilities, and tools needed.
Core i7 laptop, arduino 2.x, windows, IntelliJ IDEA and NetBeans, FlutLab.io, draw.io, BrowserStack, SAP2000, Jama Software, KiCAD and autodesk EAGLE, automatic super high speed sticker labelling

iii. Materials: Raw materials or components
RFID reader, RFID tags, IP cameras, DC-DCStep-Down (Buck) Converter, 12V Power Supply Adapter (Power Pack), Arduino Nano Microtroller, 16x2 LCD Display Module. BC337 NPN Bipolar Junction Transistor, 10K Resistor, 330ohms Resistor, Laser Diode, 10K Potentitiometer (Variable Resistor), 1K Resistor, 100nF Capacitor, Push Button Switch, Male and Female Header Connectors, Soldering Wire (Solder Lead), ULN2003 Darlington Transistor Array, 12V Electromechanical Relay, Connecting Wires, Red LEDs (Light Emitting Diodes), Printed Circuit Board (PCB), and Flexible Electrical Wire (Flex Wire)

iv. Funding: Estimated budget breakdown 100 functional

table 1: BUDGET

SN	DESCRIPTION OF ITEM	PROPOSED COST (N)	Breakdown(N)
1	**Personne Costs/Allowances (12 months)**	**6,000,000**	
1.1	Principal Researcher		1,440,000
1.2	Team Memebers x 8		4,560,000
2	**Equipment (Production of 100 attendance systems)**	**9,131,951**	
2.1	HP Probook 440 G10 13th Gen - Intel Core i7 - 16GB RAM - 512GB SSD - Backlit Keyboard Fp - Wins 11 Pro **x 5pcs @N1,413,360 each**		7,066,800
2.2	arduino 2.x		201,600
2.3	IntelliJ IDEA and NetBeans @$16.90/month, $202.80/year		304,200
2.4	FlutLab.io @ $29.25. per month, $351/year		526,500
2.5	draw.io @$5/month, $60/year		90,000
2.6	SAP2000 @$510		765,000
2.7	BrowserStack @$12.50/month, $150/year		225,000
2.8	KiCAD and autodesk EAGLE @$545		817,500
2.9	automatic super high speed sticker labelling		6,890,651
3	**Supplies and Consumables (production of 100 attendance system)**	**163,199,162.40**	
3.1	**RFID reader (zebra fx9600 long range)100pcs with extra 20 @ 1,250,097**		150,011,640
3.2	**RFID tags (wrist bands) @2500 for 1000pcs**		2,500,000
3.3	IP cameras @72,000, 100 pcs		7,200,000
3.4	12V Power Supply Adapter @3650 , 100PCS, 20 EXTRA		438,000
3.5	Arduino Nano Microtroller @7500, 100PCS, 10 EXTRA		823,000

3.6	16x2 LCD Display Module @6,053, 100PCS, 10 EXTRA		665,830
3.7	BC337 NPN Junction Transistor @150,100PCS, 10		16,500
3.8	10K Resistor @20, 100PCS, 50 EXTRA		3,000
3.9	330ohms Resistor@20, 100 PCS , 50 EXTRA		3000
3.10	Laser Diode @400, 100 PCS, 20 EXTRA		48,000
3.11	10K Potentitiometer @ 150, 100PCS, 20 EXTRA		18,000
3.12	1K Resistor @20, 100PCS, 50 EXTRA		3,000
3.13	100nF Capacitor @36.77, 100PCS, 20 EXTRA		4412.40
3.14	Push Button Switch @550, 100, 10 EXTRA		60,500
3.15	Male and Female Header Connectors @1,809, 100 EACH		361,800
3.16	Soldering Wire (Solder Lead) @6,531, 10PCS		65,310
3.17	ransistor Array@5809, 100PCS, 10EXTRA		638,990
3.18	12V Electromechanical Relay @ 550, 100PCS, 10		60,500
3.19	Connecting Wires @7706, 10 ROLLS		77,060
3.20	Red LEDs (Light Emitting Diodes)@20, 200 PCS		4,000
3.21	Printed Circuit Board (PCB) @1500, 100PCS		150,000
3.22	Flexible Electrical Wire (Flex Wire) @4662, 10 ROLLS		46,620
5	**Travels and Accommodation**	**3,577,020**	
5.1	Travels /logistics		2,300,000
5.2	Hotel		1,277,020
6	**Dissemination**	**886,435**	
6.1	Presentation / publication of findings in Conferences, Workshops, Seminars and Academic / Industry Journals		886,435
	Total Direct Cost	**181,908,133.40**	
8	**Indirect Cost**	**886,435**	
	Grand Total	**182,794,568.40**	**182,794,568.40**

- Timeframe: twelve months

The prototype is already on ground, the process

7. Risks and Constraints

i. During the research, it was noticed that physical limitations like reading through liquid or metals still exist. Accurate reading rates on some items can be very low. Nylon conveyor belts and other RFs can disrupt the tag transmissions in class rooms.

ii. Radio Frequency Identification (RFID) equipment encountered interferences from equipment such as handheld devices like walkie-talkies, mobile devices like GSM phones and even from mobile

phones towers located near the university or organization, which transmit at the high end of the frequency band, sometimes leak unwanted radio waves into RFID readers.

iii. Increase in expenses – due to physical limitation, effective Radio Frequency Identification (RFID) equipments have to be used for better transmission of signals from one point to the other. All these mean additional cost.

iv. With the present technology, if a student/staff can go to the extent of facial surgery, the system aim will be defeated at the point of verification and authentication.

8. Impact Assessment

- Economic impact

for the first one thousand produced that might not go round the schools and organizations in Nigeria, will create more that five thousand jobs and more revenue will be generated from the sales and installation of system to schools and organization.

- Social impact

The development of Student Attendance System using Radio Frequency Identification technology and face eigen factors will significantly improve the procedures of taking students/staff attendance, recording and tracking system in schools and offices.

- Environmental impact:

The product is under Goal 4 of the united nation sustainable development goals which aims at ensuring inclusive and equitable quality education and promote lifelong learning opportunities for all. This goal supports the reduction of disparities and inequities in education, both in terms of access and quality. It recognizes the need to provide quality education for all, and most especially vulnerable populations, including poor children, children living in rural areas, persons with disabilities, indigenous people and refugee children.

It also under the Goal 8, that is the quest for decent work for all men and women, for productive, high-quality employment and for inclusive labour markets, it is also seen as a cross-cutting topic, underlying other goals as well and intertwined with many targets across the 2030 Agenda.

9. Implementation Strategy

Outline the phases and activities to take the idea from its current stage to full realization.
The current stage of the product is at prototype level, the activities required to bring it to finish products are:

i. a. testing - testing of the prototype is to discover errors before the production stage.
ii. manufacturing stage – mass produce the design
iii. Skimming Strategy – for putting price on the products
iv. market Penetration Strategy
v. **product Growth Stage**
vi. **product update to next version**

Identify key partners or stakeholders.
National Agency for Science and Engineering Infrastructure (NASENI) and the federal government of Nigeria

10.UN SDG goal alignment with the product

The product is under Goal 4 of the united nation sustainable development goals which aims at ensuring inclusive and equitable quality education and promote lifelong learning opportunities for all. This goal supports the reduction of disparities and inequities in education, both in terms of access and quality. It recognizes the need to provide quality education for all, and most especially vulnerable populations, including poor children, children living in rural areas, persons with disabilities, indigenous people and refugee children.

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11. 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 2: 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

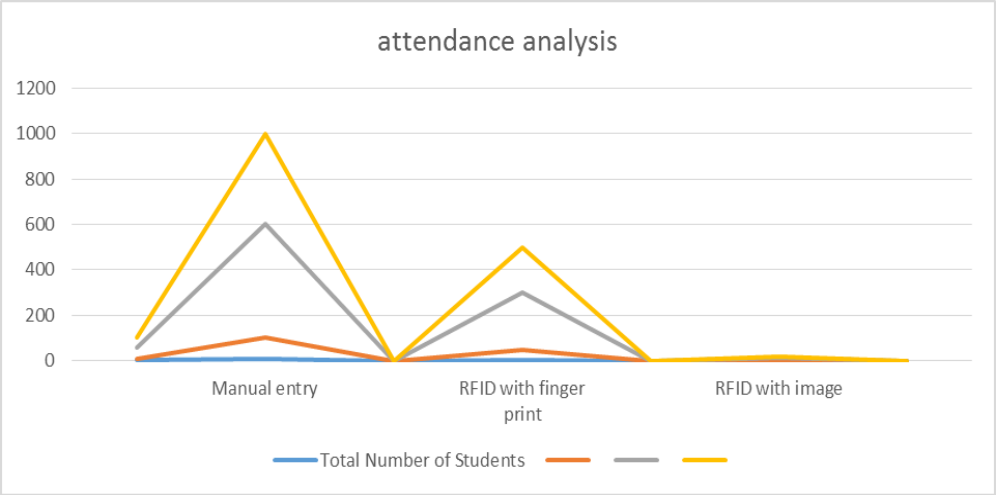

Figure 2: attendance evaluation graph from 3 methods

12. 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.

Recommended next step (e.g., prototype development, pilot testing, commercialization, or partnership exploration).
These are the next steps to take for full commercialization;

i. testing - testing of the prototype is to discover errors before the production stage.
ii. manufacturing stage – mass produce the design
iii. Skimming Strategy – for putting price on the products
iv. market Penetration Strategy
v. **product Growth Stage**
vi. **product update to next version**

References

Abdul A. M. and Jyothi K. (2013). *Web-Server based Student Attendance System using RFID Technology*, International Journal of Engineering Trends and Technology (IJETT)–Volume 4 Issue 5 pp 23-36

Lim T.S., Sim S.C. and Mansor M.M.(2009). *RFID Based Attendance Syste*m. in Proceedings of the IEEE Symposium on Industrial Electronics and Applications.

Sumita N., Romin P. and Tanvi S. (2013). *RFID Technology Based Attendance Management System.* International Journal of Information and Computation

Attachments: *(Include any other document)*

a. Diagrams/Drawings/Blueprints

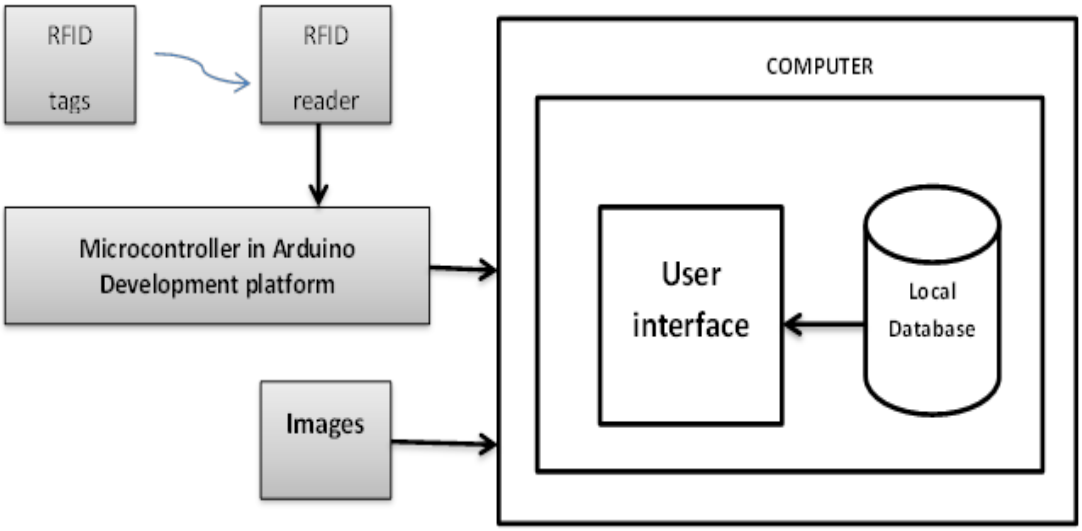

Figure 3: the system block diagram

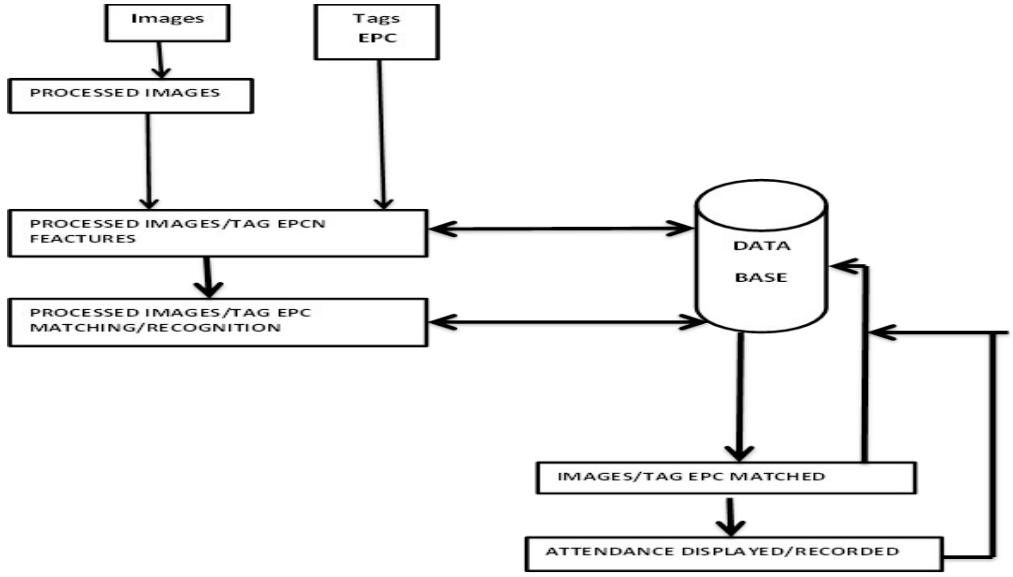

Figure 4: the system structural diagram

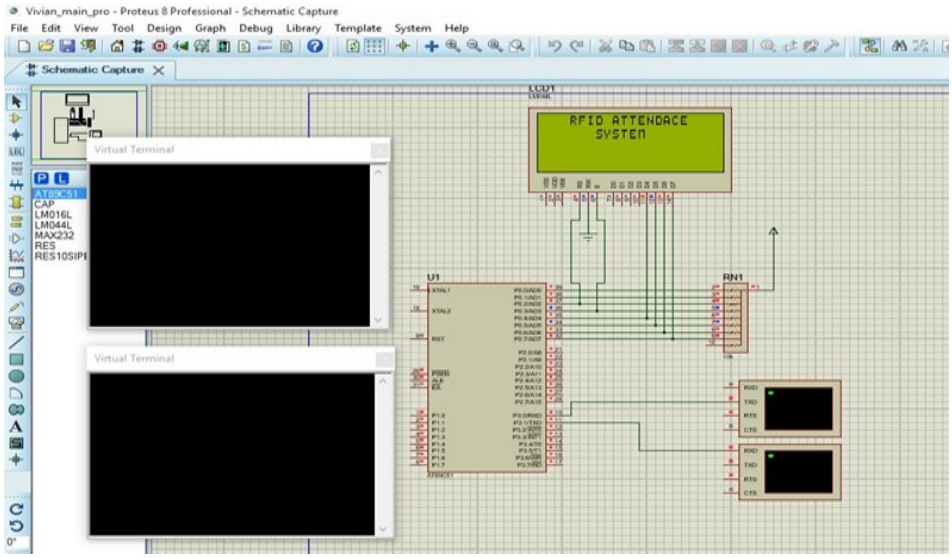

Figure 5: the system circuit diagram

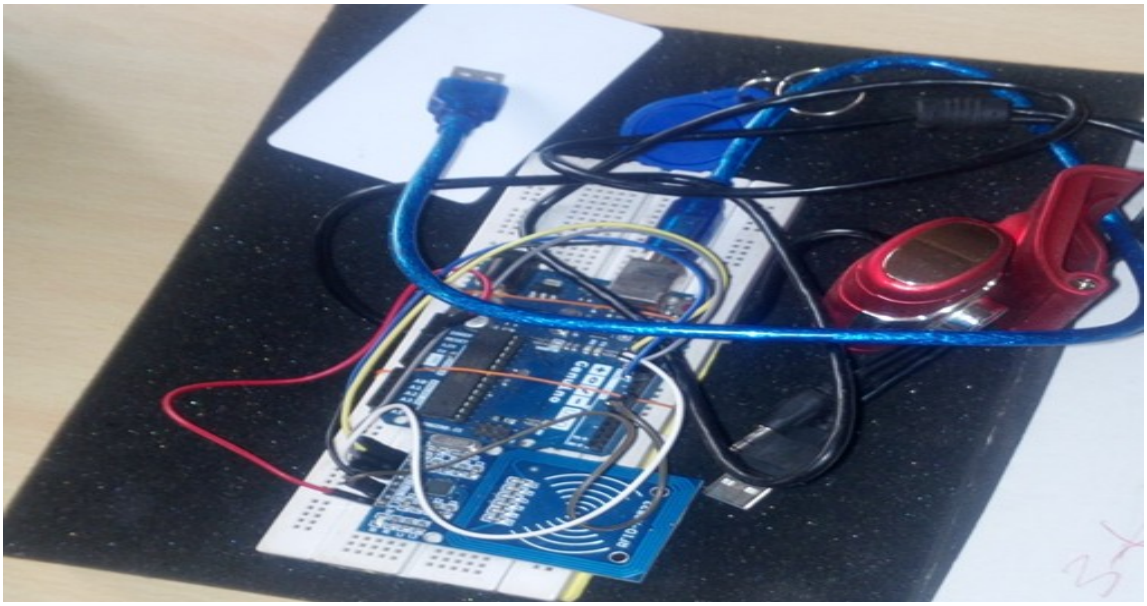

Figure 6: the hardware design

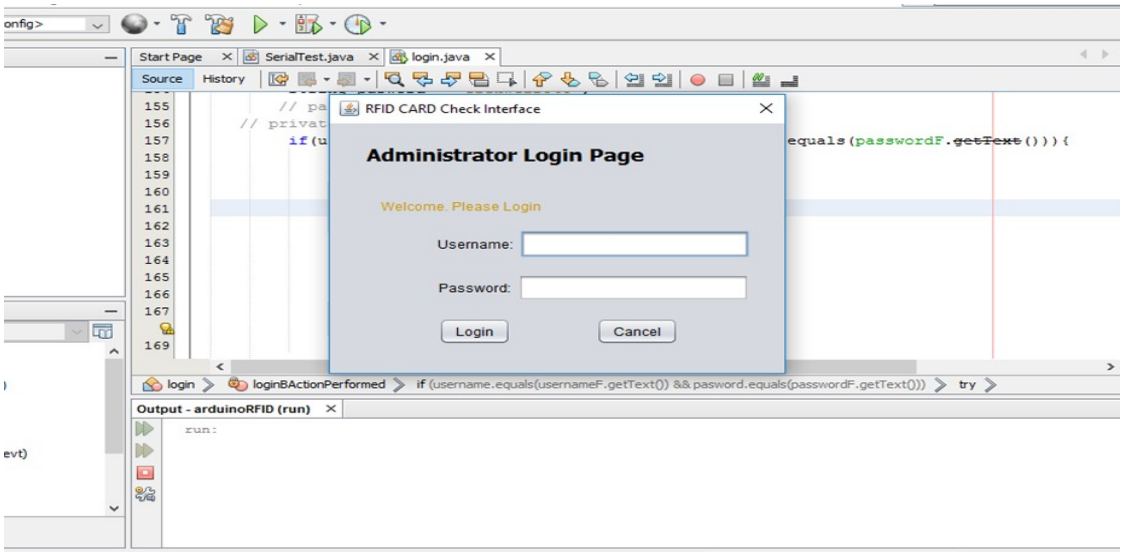

Figure 7: the admin login

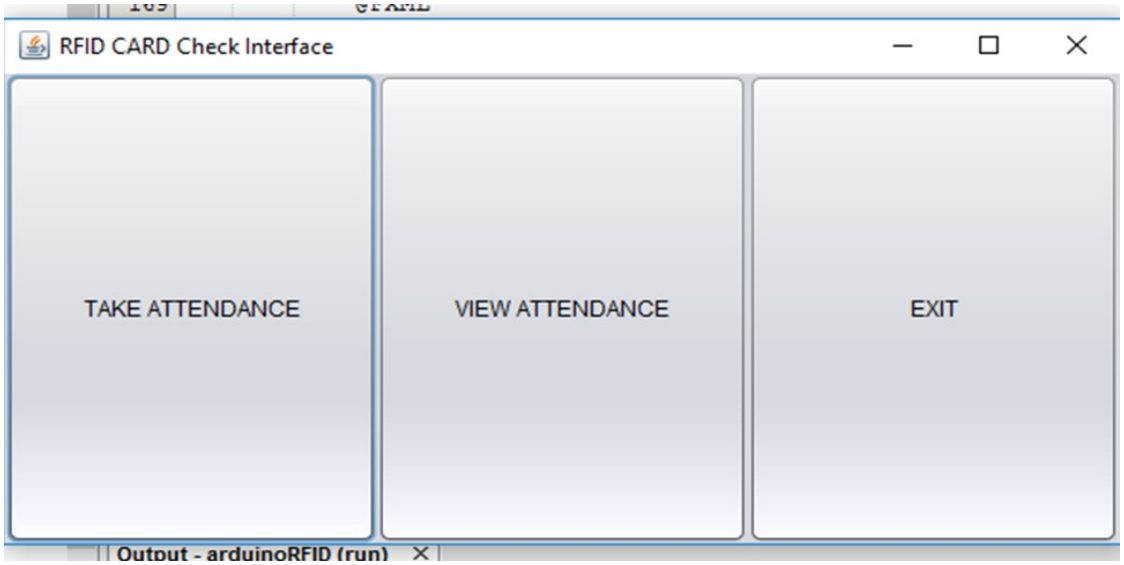

Figure 8: the attendance interface

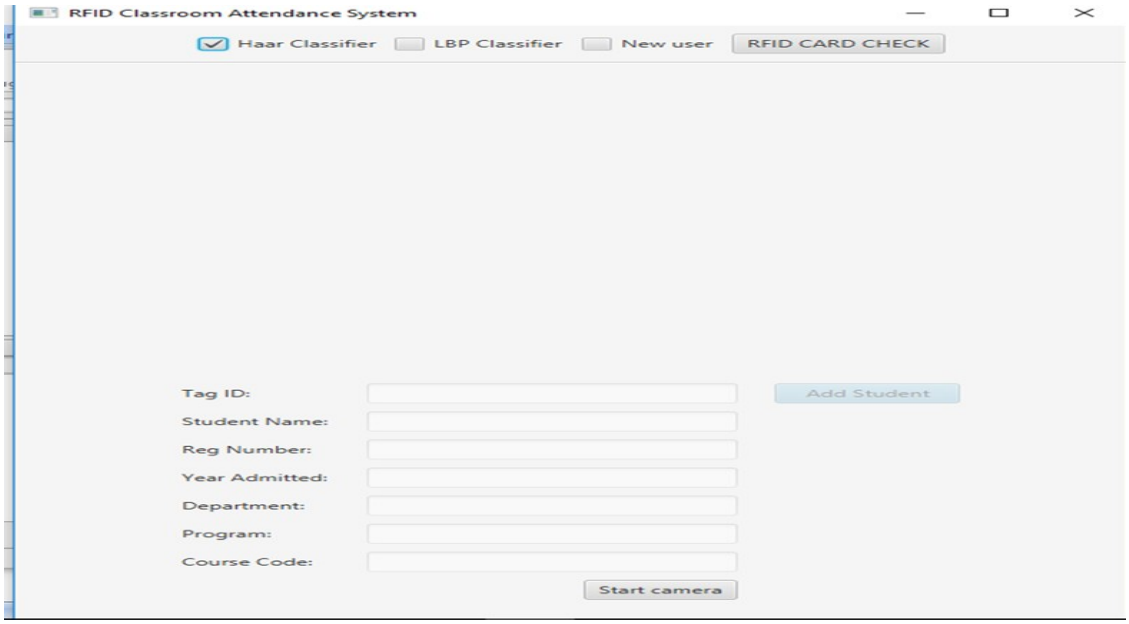

Figure 9: the registration and image processing interface

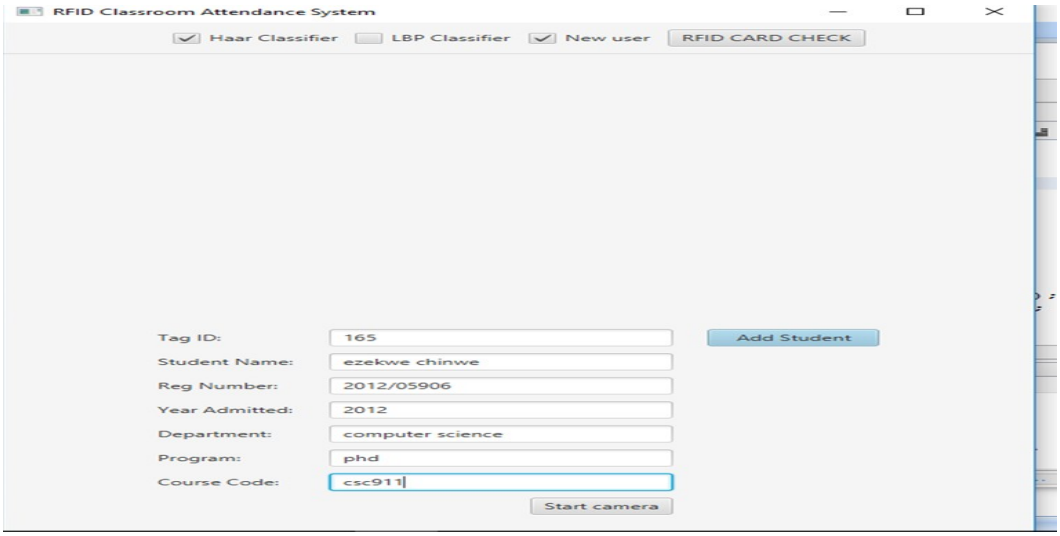

Figure 10: the registration in progress

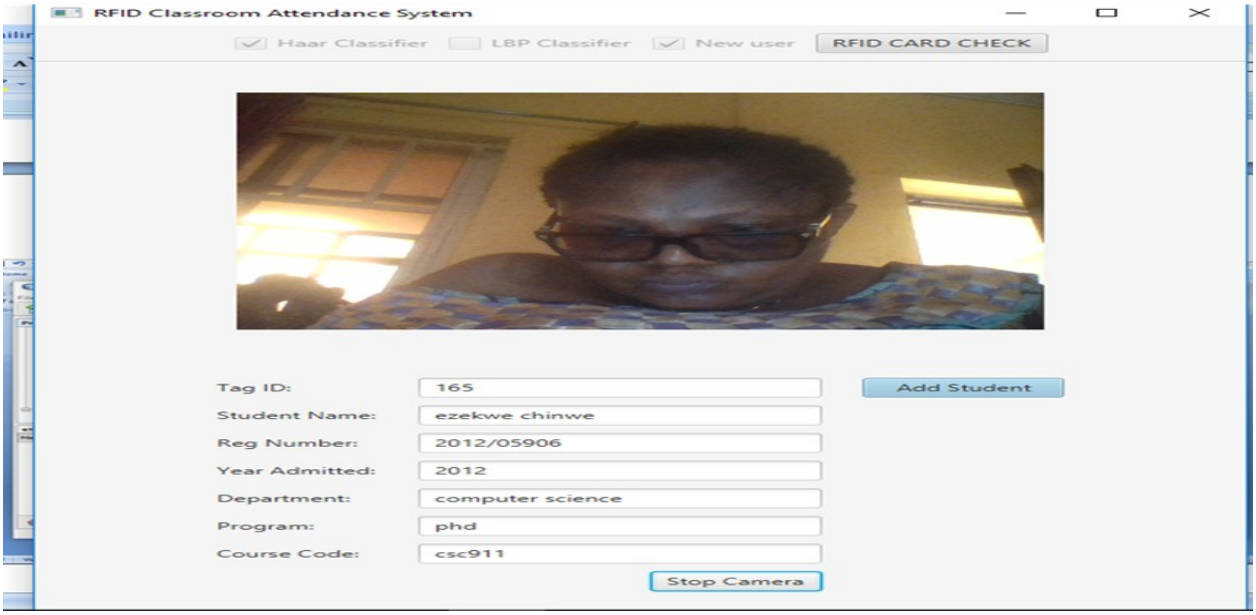

Figure 11: image training

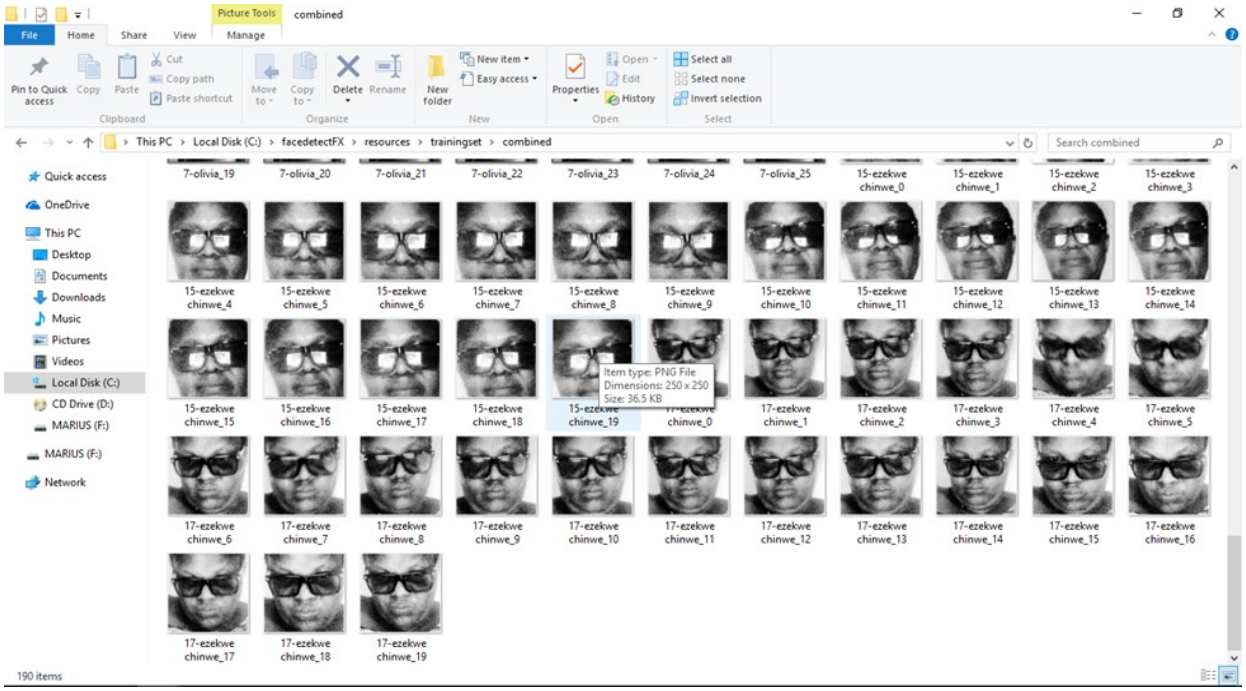

Figure 12: different face eigen factors generated after training

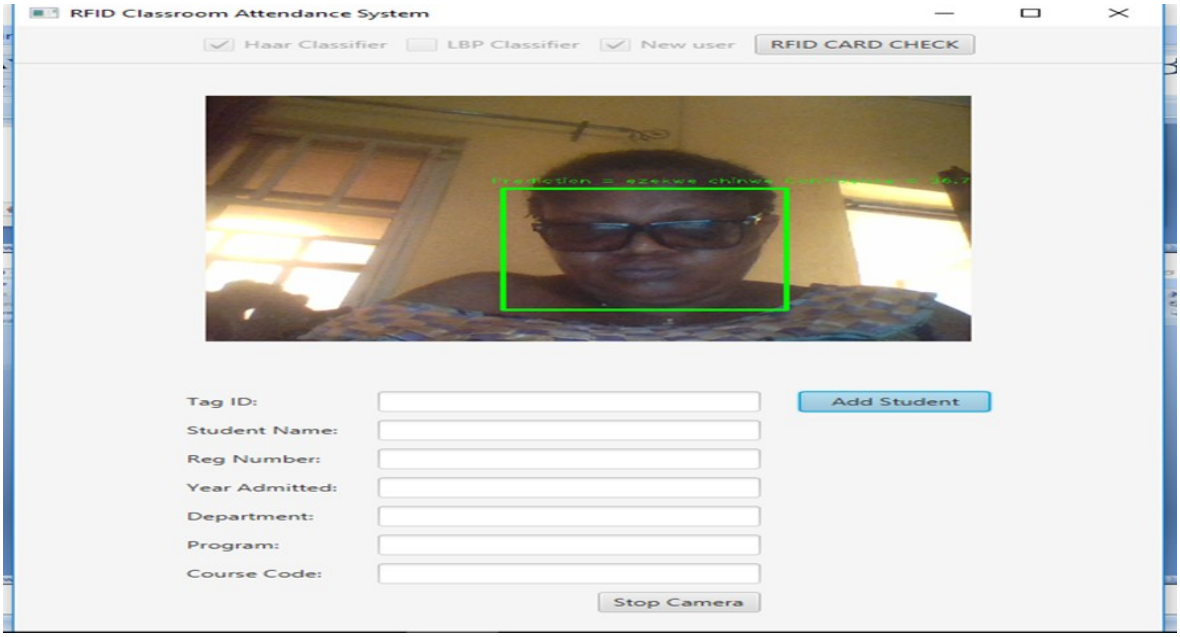

Figure 13: face eigen factors recognition for taking attendance

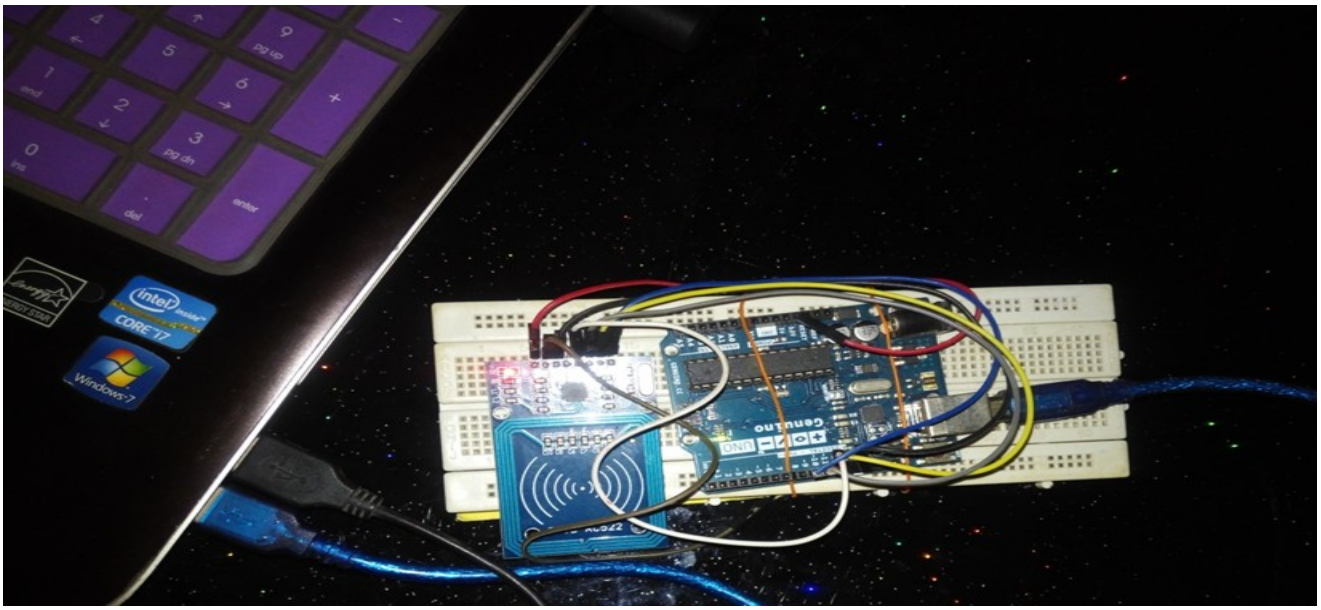

Figure 14: hardware interfaced ready for taking attendance

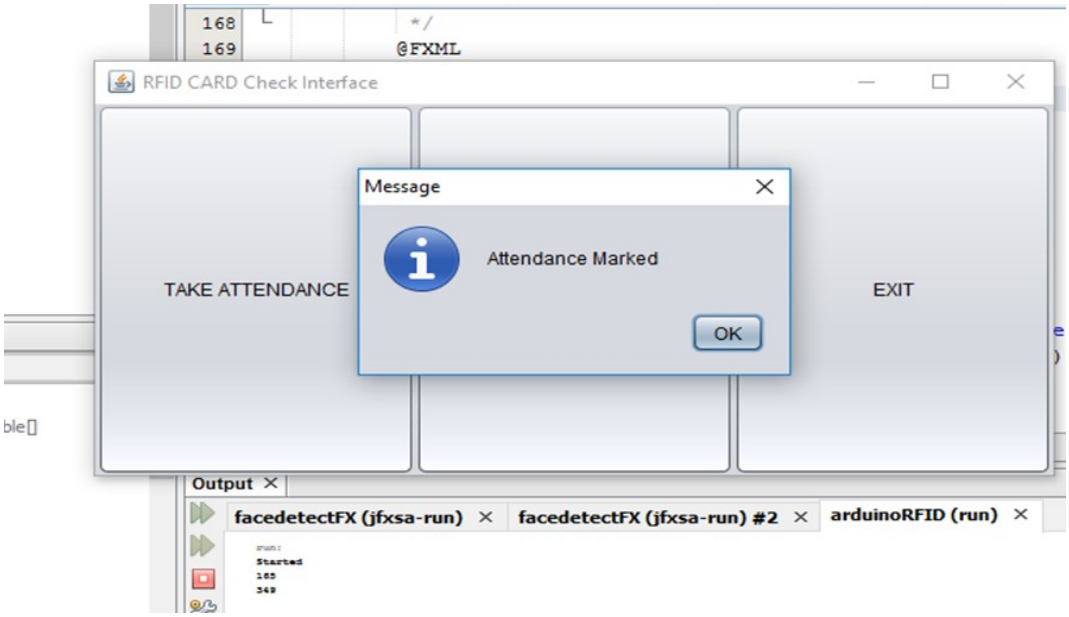

Figure 15: attendance taken with the right tag EPC and face eigen factors

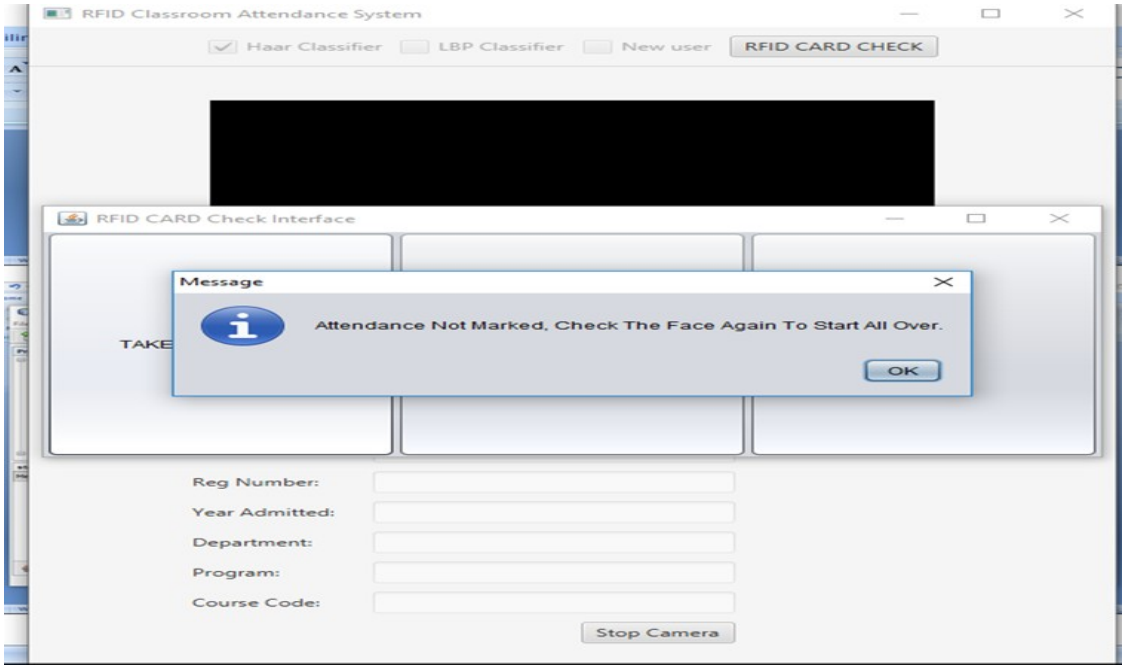

Figure 16: attendance not taken because of wrong face eigen factors