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Fingerprint based Identity Authentication for Students Attendance and Examinations in Educational Institutions

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ABSTRACT

Identity authentication has always been a major challenge in all types of examination. Verification of the authentic candidate is not an easy task, and also it consumes a lot of time and process. The use of Biometric Technology is now the focus in so many areas of discipline for security reasons. The natural uniqueness of Fingerprint Pattern makes it a reliable access control. In this paper, a system is designed using the SSADM (Structured System Analysis and Design Methodology) and Prototype Model which are object oriented. The model was implemented using .Net Framework and the back-end makes use of MySQL as the database, a SecuGen fingerprint scanner was used to capture live fingerprint image, Microsoft SQL server database 2016 and .Net framework 4.5 were also used as development tools in the implementation of the system. The Fingerprint based identity authentication student attendance and exam system was able to authenticate and verify the student's exam fingerprint scan and block non-verified users in order to eradicate examination impersonation in educational Institutions.

Key words: Examination, fingerprint, Authentication, verification, student attendance.

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1. BACKGROUND TO THE STUDY

An examination maybe described as an assessment of the performance of a person when faced with a series of questions, issues, or tasks that is set before him, in order to evaluate the amount of information he has gained, the degree to which he can use it, or the quality and effectiveness of the skills he has developed. Over the years, exams have been a popular way to measure student results, but student identification and authentication have been a major problem in most exam centres (Yakub et al., 2017). Authentication, privacy or data independence, authorisation or access control, data veracity and non-repudiation are the top benefits of Biometric technology. Examinations are widely considered as instruments for performing an objective and consistent assessment of student abilities at these institutions nationwide. Government and universities have also enacted relevant laws to protect the dignity, reputation and efficiency of exams, ensure students leave school with employable skills, and punish any violation of the regulations and processes for exams (Okey and Ewa, 2019). Examination is a very critical criterion in many schools and academic organizations, and is used for the assessment, evaluation and promotion of students or employees. Today, many industries as well as schools are experiencing technological innovation and changes in the way they carry out their operations (Mohammed et al, 2017).

In each examination, there is a need to establish a secure method of registration, verification, identification and authentication in order to ensure that the person registered at the beginning of the year is the person who will be seated to write the examination. According to Akinrefon et al, 2016, the education system and other institutions in Nigeria are crisis ridden. E-invigilation is very critical in handling exam surveillance both offline and online. This is crucial to the Students' eradication of exam malpractice (Fayomi, Amodu, Ayo, Idowu, and Iyoha, 2015). For the reasons of Examination malpractice, Oko and Adie (2018) revealed a number of factors responsible for examination malpractice in Nigeria that included what most respondents called the "wrong value system that leads to a severe search for qualification rather than knowledge and skills" Laziness, lack of preparedness or insufficient preparation for examination, lack of self-confidence, poor facilities for the school. Currently used systems are not safe as it allows a student to have such physical documentation such as student cards, admission slip for tests, etc. Practically everyone in this fast-growing information technology environment can forge these types of methods (documents). Adoption of e-attendance to verify that the student attended class lectures and a Fingerprint-based Exam Authentication system that allows only registered students to access the examination hall and block those not identified.

A Biometric Authentication Method for Examination Behaviour in Nigerian Universities was suggested at Ekwonwune and Okonkwo (2019). The purpose of the research is to devise a program to resolve issues of examination fraud such as impersonation, and to expose the effectiveness of the biometric system using fingerprints in performing examination clearance. The proposed system used a biometric technique of fingerprinting; the system recognizes a person by matching his / her biometrics with each record in the database, rather than using the old manual process. Security vulnerabilities as well as assurance measures have strongly influenced the popularity of online exams. As an example, the issue. The online exam's popularity was closely influenced by security vulnerabilities as well as assurance measures. As an example, the issue of cheating in the form of impersonation will have to be addressed appropriately. Using the conventional method of user identification and password authentication has proved insufficient to verify an online student's identity. For this reason a computer network must be monitored on an ongoing basis to guard an individual taking the exam at some predetermined place.

Security vulnerabilities as well as assurance measures have strongly influenced the popularity of online exams. For instance, the problem According to Kinoti et al , 2015, the most commonly used biometrics for authentication are the fingerprints, a special device that could be a portable fingerprint scanner with a USB connector is required to scan user imprints and compare the fingerprint pattern already on the database as captured during candidate registration. Some laptops and some personal computers have fingerprint scanners already installed into them. Using information factors like biometrics is the best way to tackle the danger of Type B impersonation Security vulnerabilities as well as security initiatives have greatly affected the success of online exams. For example, the issue is the scheme may be susceptible to the danger of Type C impersonation in which the right applicant is properly authenticated is leaves another person to complete the exam. A continuous re-scan of the candidate's biometrics during the test session is needed to resolve the danger of Type C impersonation.

Biometric authentication can be used in Jaiswa et al, 2011, to monitor computer network access, electronic commerce, and banking transactions, as well as restricted areas in office buildings and factories. This can help deter fraud by checking voter identification and driver's license holders or visas. In Awojide et al, 2018, a sensor captures a digital image of the characteristic used to verify the identity of the user, for authentication. A computer program generates a pattern of distinguishing features from the digital image, which is compared by another program to the pattern representing the user that was previously registered and stored in the system database. The biometric device will assume that if the patterns fit well enough the individual is who he or she claims to be.

For online exams, Ramu and Arivoli (2013) suggested a system for safe biometric authentication. A system makes use of a multi-modal authentication method to secure online analysis. Yakub et al, (2017) suggested a Higher Institutions Fingerprint Based Approach to Examination Clearance. It has four parts (Enroll, Check, Sign, and Exam). The first section is where the administrator enrols bio-data of the applicant, collects the fingerprint and passport picture. After the enrolment stage and the registration of the student's bio-data, the verification may be carried out later in particular when it is time to check the identification of the students in order to be admitted to the examination hall.

2. STATEMENT OF PROBLEM

The increased rate of impersonation of exams among candidates in higher institutions has reduced their self-developing abilities and self-confidence in reading and writing exams. Given numerous strategies implemented by stakeholders to ensure candidates follow the rules governing examination conduct in Nigeria, it also has a negative impact on the growth of the educational system in Nigeria Many students find it much more essential to get a credential than to learn individual skills, and these prompted students to participate in different ways to skip lectures and to impersonate in other exams to get what they want. Therefore, students are now lazy to study, lazy to get self-confidence (inadequate preparation for examination). The Development of a Fingerprint based identity authentication system for student attendance and examination will eradicate impersonation in our higher institutions.

3. OBJECTIVE

The aim of this research is to develop a fingerprint based identity authentication system for students' attendance and examinations in educational institutions

4. METHODOLOGY

The study adopted an internationally accepted model of software engineering, this system is designed using the object oriented SSADM (Structured System Analysis and Design Methodology) and Prototype Model. The SSADM is a system approach to information system analysis and design. This requires the execution of a series of tasks related to the study of the existing system's logical data design and the logical process design. The architecture was developed using the. Net Framework, and the implementation uses MySQL as both the database and reference. SecuGen fingerprint scanner was used for capturing live images of fingerprints. Microsoft SQL server database 2016 and. Net framework 4.5 are the development tools that were used in implementing the system design. For students attending classes for each course, a fingerprint scan is taken to create students-attendance record.

Only those students authenticated with a 75 percent total attendance and have paid school fees will be registered by the system. The same students will also be authenticated using the fingerprint scanner to check that they are the actual students present for each course scheduled for that day to write the slated exam. The system works by identifying a person, matching his / her biometrics with each record in the database and not with the old manual method in use. The expected result of the system is that the new system will compulsively prompt for biometrics (fingerprint) in order to allow the student access to authentication and identification of the actual student before entering the examination hall.

5. ANALYSIS OF THE EXISTING SYSTEM

In many institutions, the existing system of student exam authentication system in higher institutions is performed manually and the process is tedious, time wasting and has no capacity to track impersonators properly. The visit to the different departments at Nigeria Universities reported the following activities related to the student authentication process during the exams. There is student impersonation issue, ii. Insecure Student Authentication iii. System inefficiency due to population of the students or the scale of a class iv. The manual method is tedious in nature.

5.1 Drawbacks of the Existing System

The main problems which the existing system faces are listed as follows:

a) It is incredibly difficult to search for documents and to handle student details and identifications.
b) The manual process is unreliable in the hunt for impersonators, due to the large student population
c) It's a daunting job to find information for students to use quickly.
d) Some students typically don't answer the Summit exam sheet, this is because there is no system tracking the number of students taking the exam.

5.2 Design of the Proposed Fingerprint based Identity Authentication System

The proposed fingerprint based identity Authentication system would do the following:

1. Ease and secure the entry of students into the examination hall.
2. The system can easily eradicate impersonators since only authorize students through the biometric process will be allowed to take exam.
3. The system can easily detect student that did not summit his/her answer booklet.
4. Transcript compilation is possible online and could be printed
5. It can easily authenticate a large number of student
6. It is easy to use the authentication system.

The program flowchart is presented in figure 1.

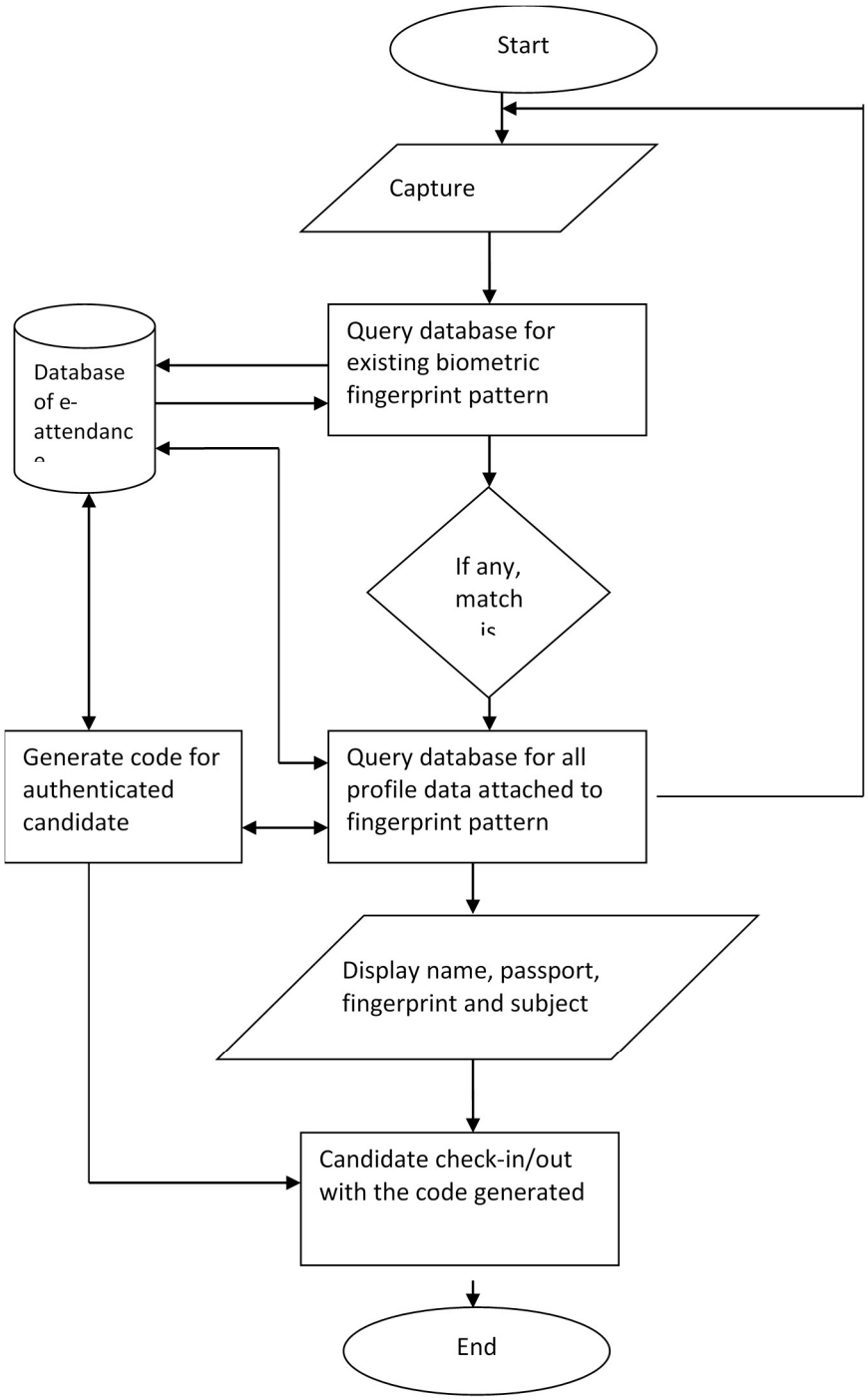


Figure 1: Program Flowchart

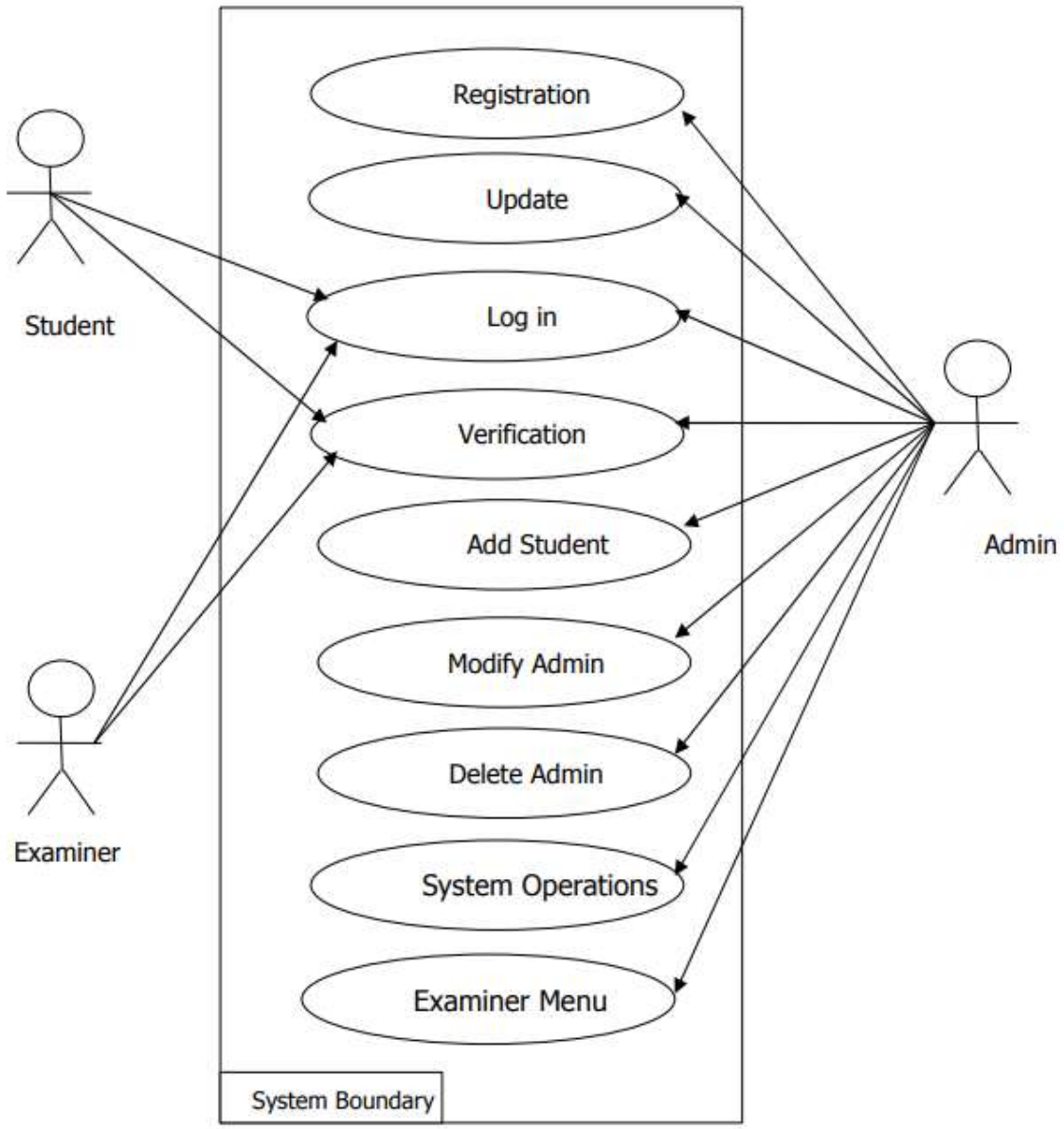


Figure 2: Use Case Diagram

Class Diagram

Unified Modelling Language (UML) is a structured general purpose, software engineering modelling language. The standard is developed and operated by the Object Management Community. UML provides a collection of graphic notation techniques for developing software-intensive visual models of structures. Here we use class diagrams to represent our model for the biometric operations proposed.

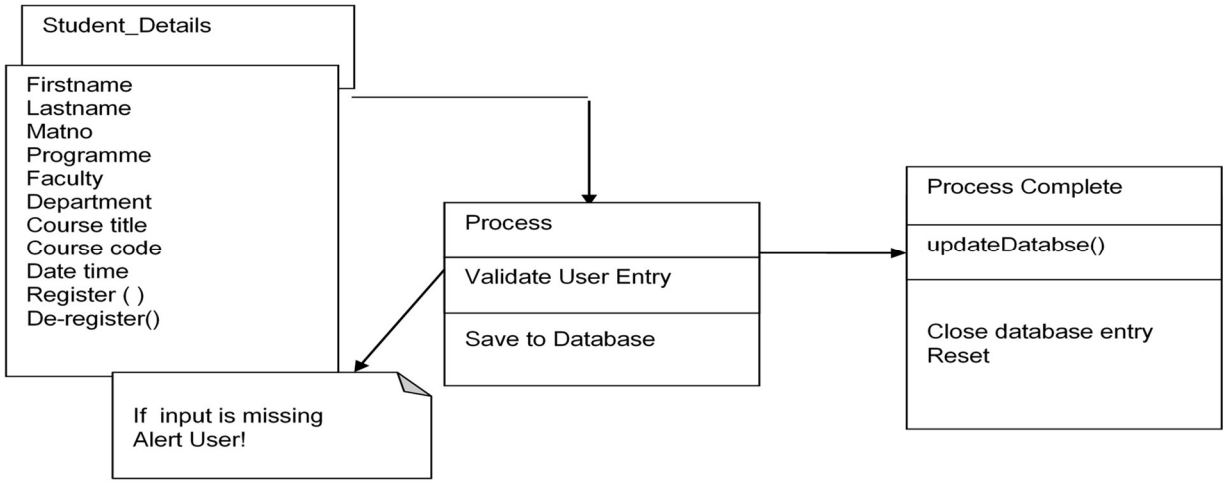


Figure 3: Student Registration Class

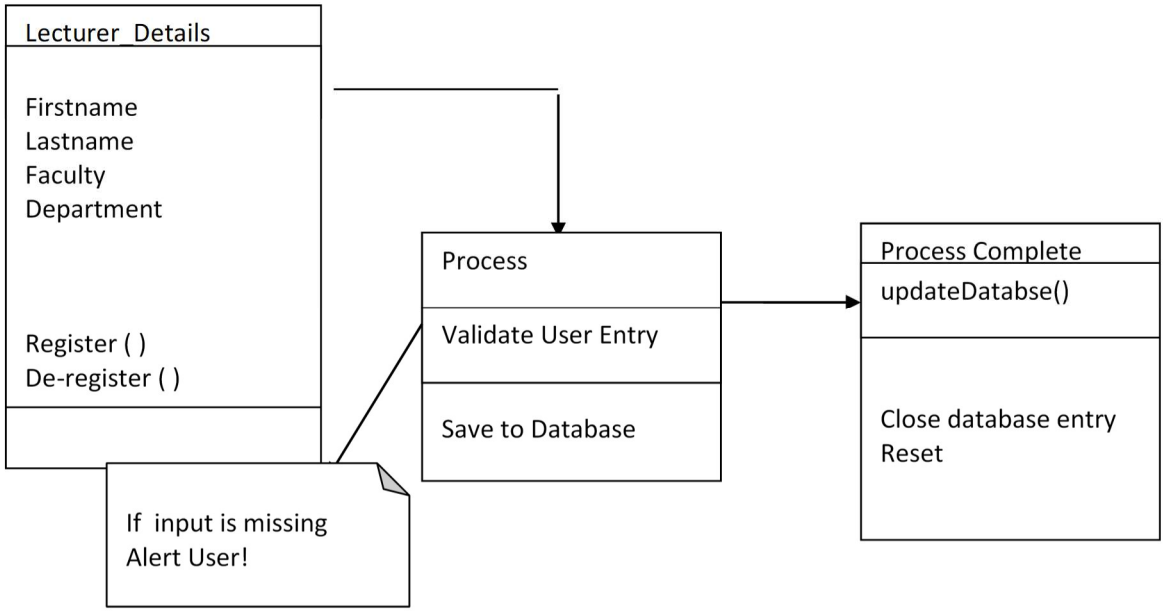


Figure 4: Lecturer Registration Class

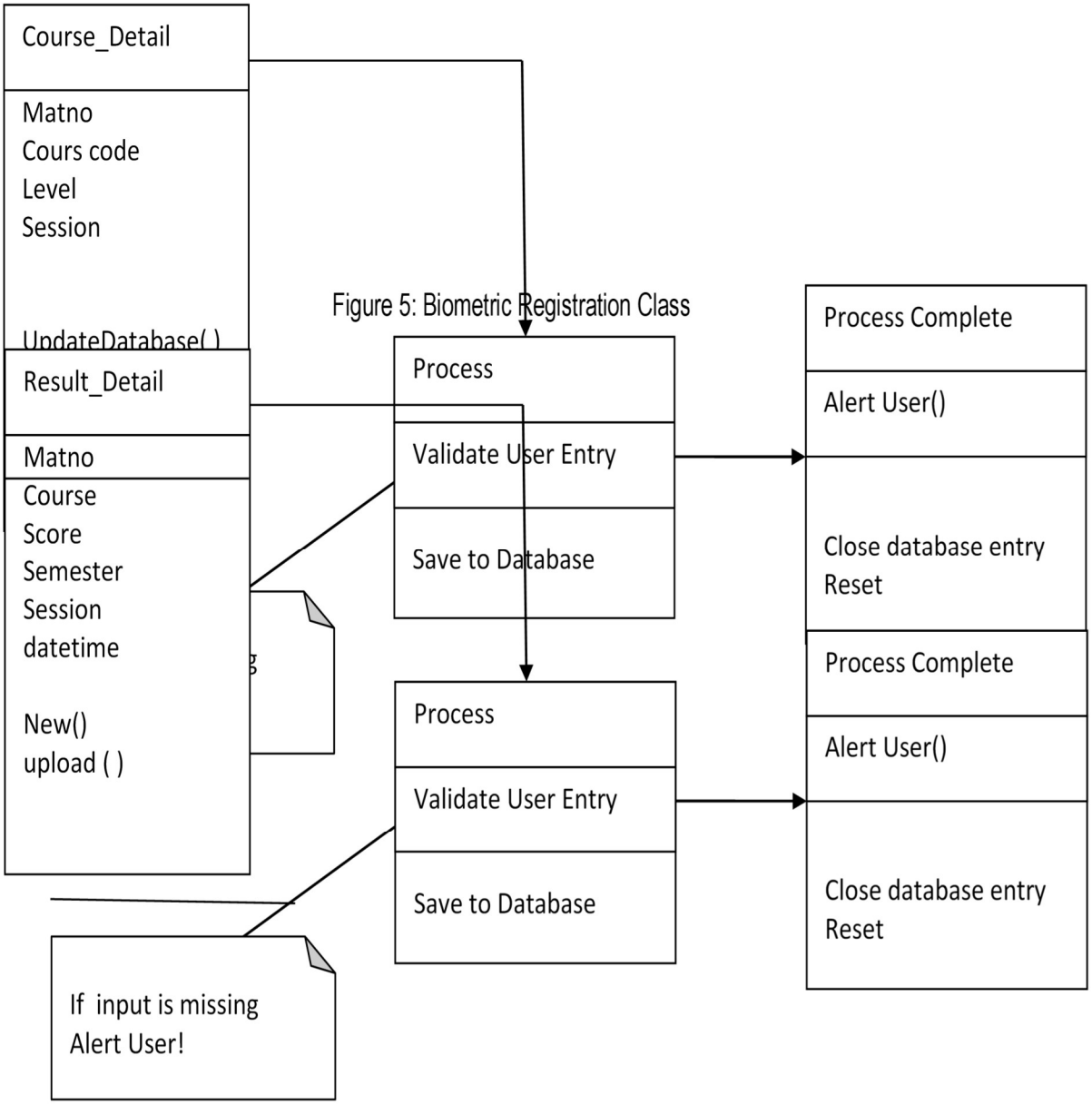


Figure 6: Course Registration Class

Interfaces:

Login Form

This is the first form that appears when the software is run. The user is required to provide the information (i.e. username and password) needed in order to access the features of the software. Students can login and register his/her detail. This is shown in figure below.

Figure 7: An Interface of Login Admin Panel for student attendance

The login page enable user to login with correct username and password to login.

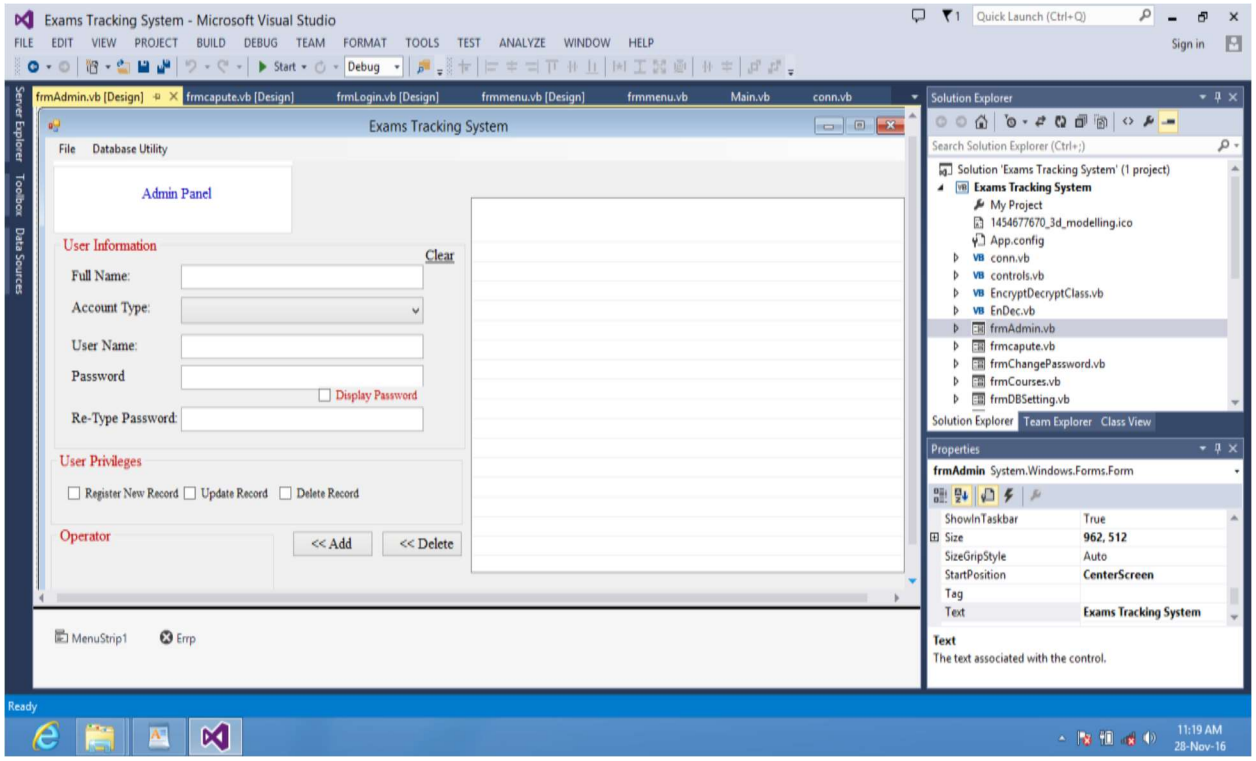


Figure 8: An Interface of Login for exam tracking for each registered students

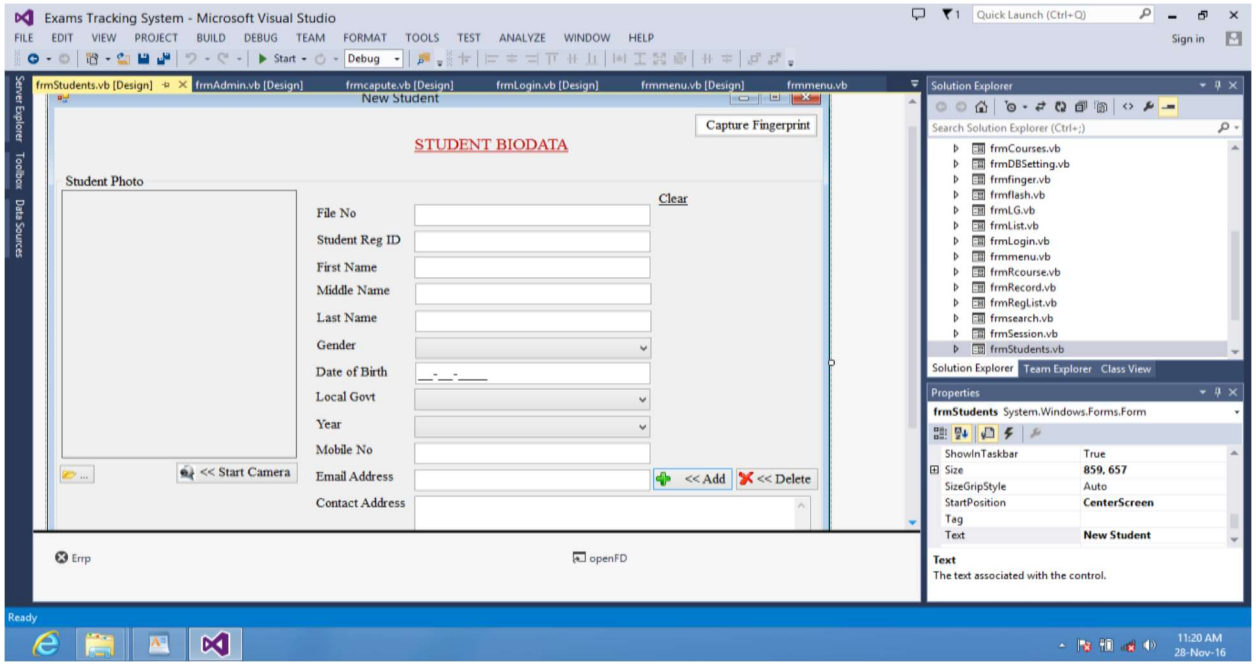


Figure 9: An Interface of Student Bio data

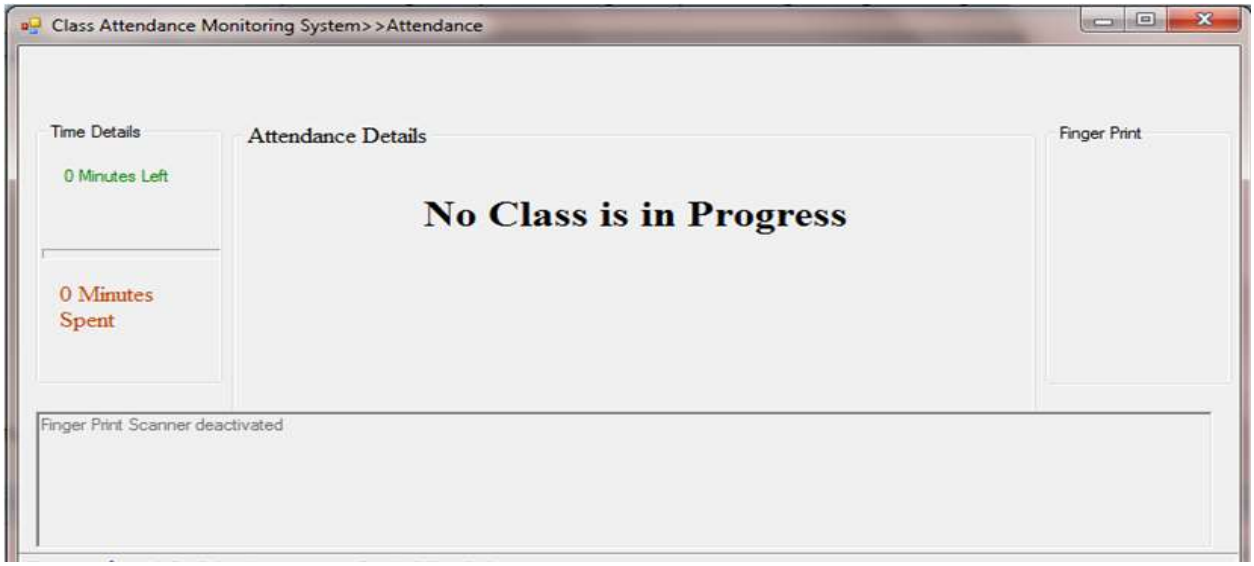


Figure 10: when there is no class in progress

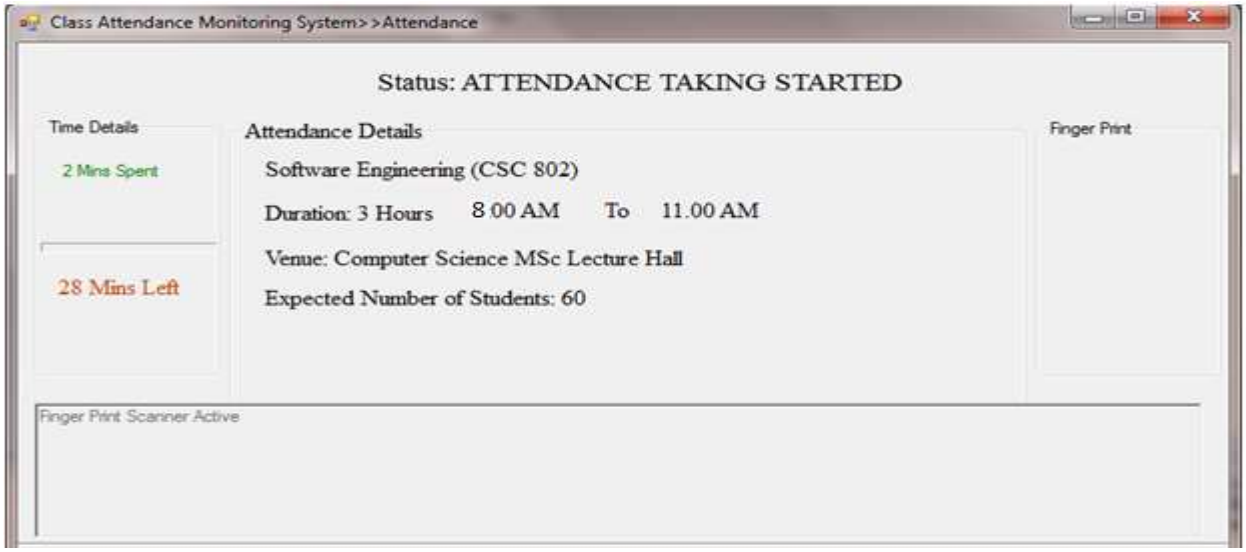


Figure 11: Biometric capture for students when attendance is taken (student attendance)

This page contains the fingerprint of the candidate taken during registration. The fingerprint of each student is scanned, the endpoints and intersections of the fingerprint are matched with the record present in the database and accordingly, the access is granted. The finger print of the student enables the administrator to authenticate student and eradicate impersonation of the candidates. This is shown in figure 5 below.

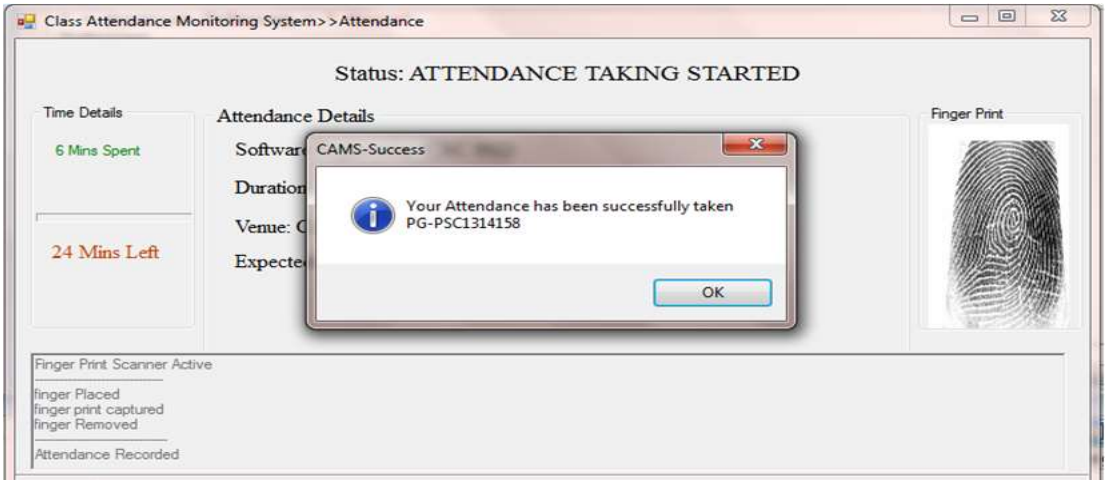


Figure 12: Attendance is successfully taken using biometric fingerprint

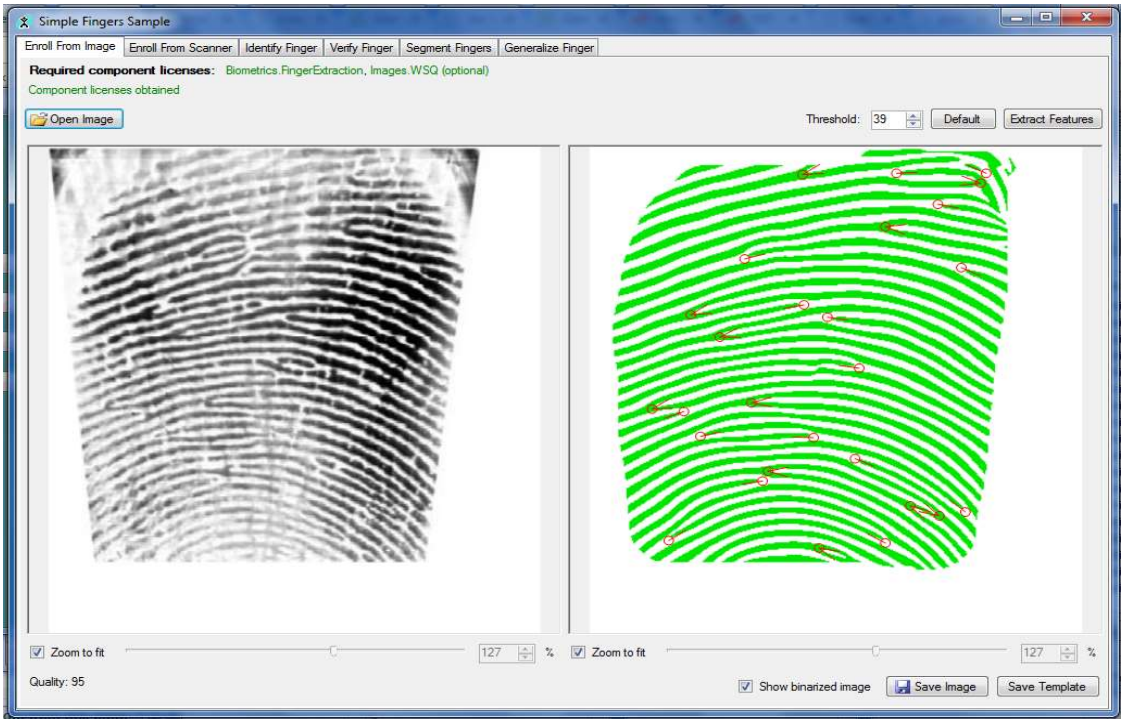


Figure 13: Biometric Capturing Page

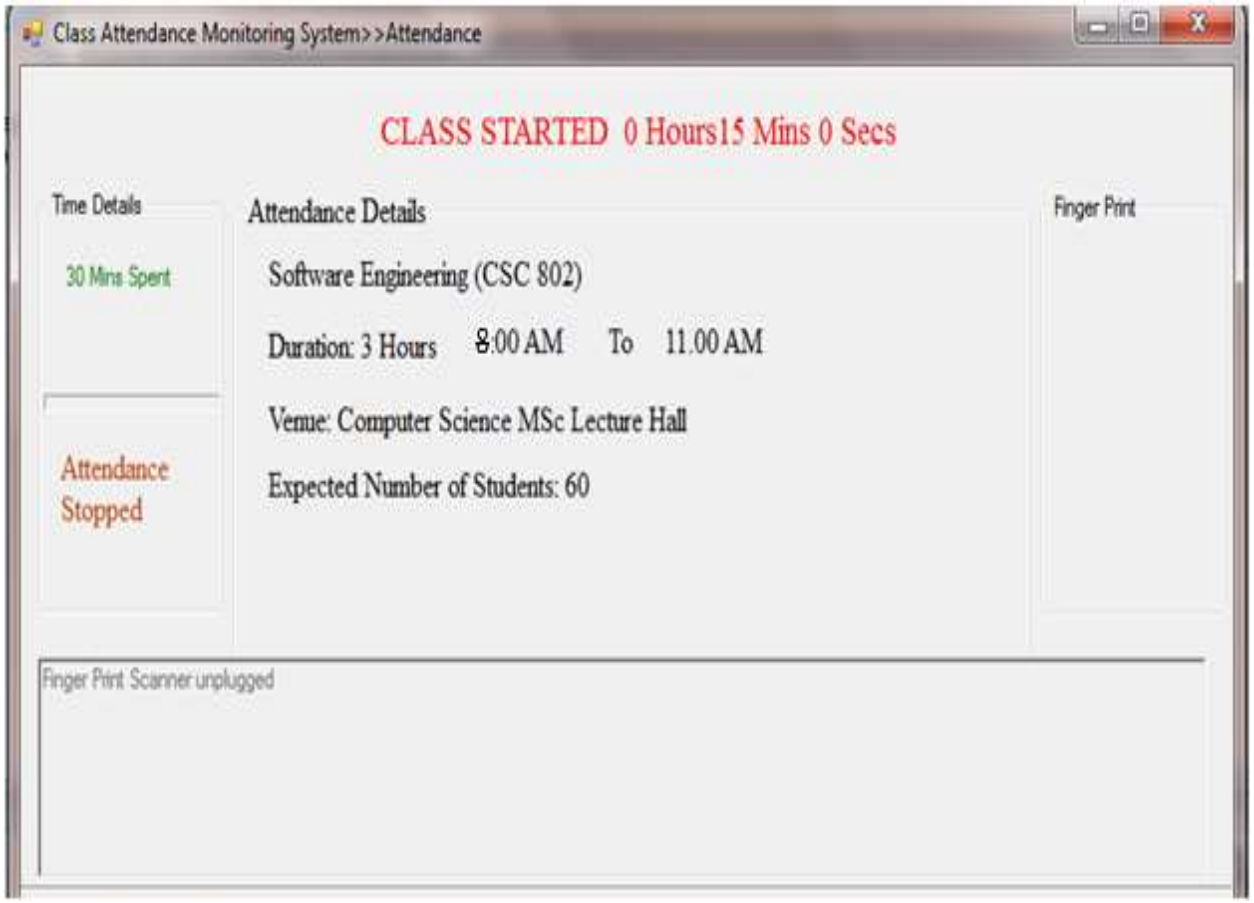
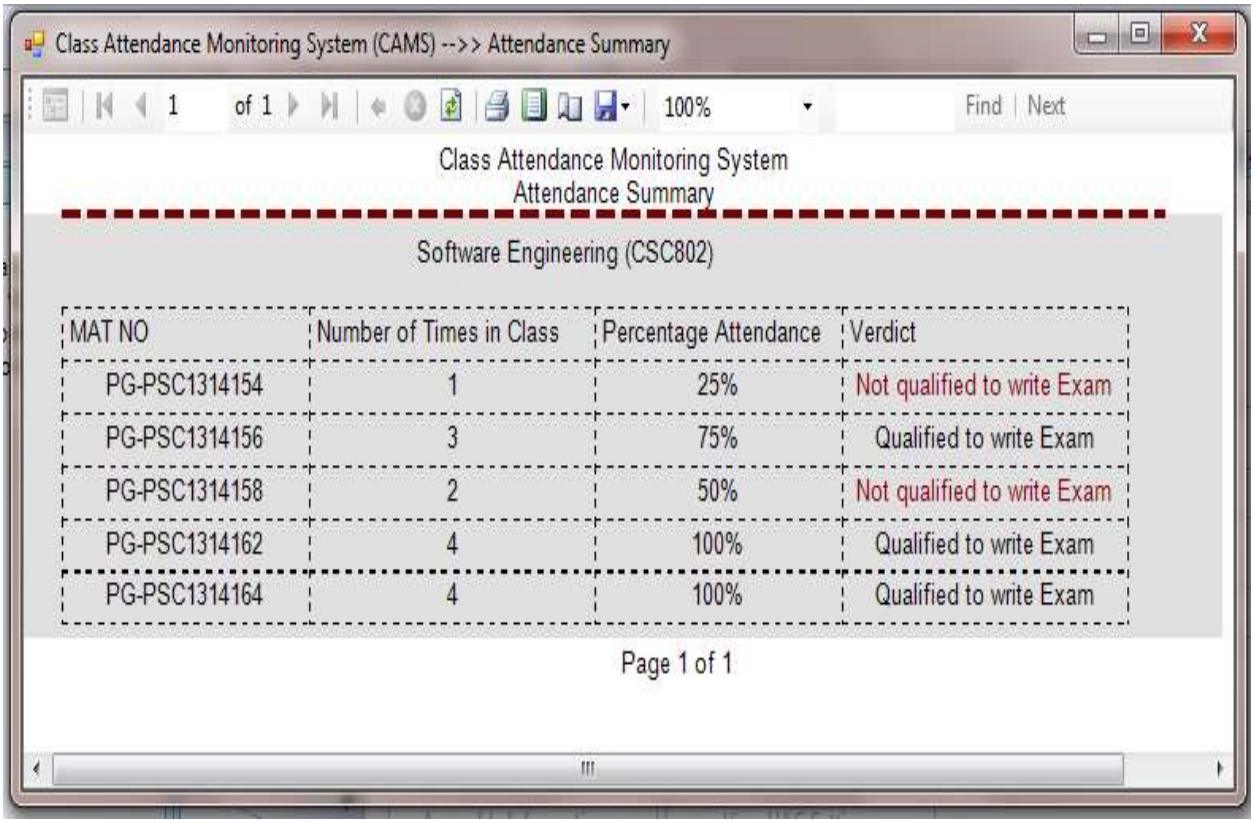


Figure 14: Final student attendance page for a course.

6. DISCUSSION AND RESULTS

The system was able to generate report showing a summary containing the matriculation numbers of all the eligible students for the course, the number of classes attended by each student, the percentage attendance met by each student and the verdict if the students if they met the required percentage of class attendance to be eligible to take the examination of that course at the end of the semester or not. This other test was carried out using 4 classes and a minimum of 75% attendance was required of a students to qualify to take the examination for that course at the end of that semester. Figure 8: below shows the report of the summary at the end of a course carried out using a record for students offering CSC802.



MAT NO	Number of Times in Class	Percentage Attendance	Verdict
PG-PSC1314154	1	25%	Not qualified to write Exam
PG-PSC1314156	3	75%	Qualified to write Exam
PG-PSC1314158	2	50%	Not qualified to write Exam
PG-PSC1314162	4	100%	Qualified to write Exam
PG-PSC1314164	4	100%	Qualified to write Exam

Figure 15: Attendance Summary showing verdicts

The student attendance monitoring system was able to generate a report showing the attendance details of the students. That is showing the matriculation numbers of the students taking the course, their attendance status (Present or absent) for all the classes held, the time they were authenticated (An arbitrary time 12:00 was assigned to those that were absent), and the corresponding dates the classes held.

The report of the attendance details at the end of the class carried out using for students offering CSC802 is shown in figure 16.

Class Attendance Monitoring System (CAMS)-->> Attendance Details

1 of 1 100%

Class Attendance Monitoring System (CAMS)
Attendance Details

Software Engineering (CSC802)

MAT NO	ATTENDANCE STATUS	TIME ARRIVED
PG-PSC1314154	Present	9:58:00 AM
PG-PSC1314156	Absent	12:00:00 PM
PG-PSC1314158	Present	8:48:00 AM
PG-PSC1314162	Present	9:50:00 AM
PG-PSC1314164	Present	9:14:00 AM
PG-PSC1314154	Present	9:14:00 AM
PG-PSC1314156	Present	8:48:00 AM
PG-PSC1314158	Present	9:14:00 AM
PG-PSC1314162	Present	9:01:56 AM
PG-PSC1314164	Present	9:03:22 AM
PG-PSC1314154	Absent	12:00:00 PM
PG-PSC1314156	Absent	12:00:00 PM
PG-PSC1314158	Absent	12:00:00 PM
PG-PSC1314162	Present	9:00:50 AM
PG-PSC1314164	Present	9:10:00 AM
PG-PSC1314154	Absent	12:00:00 PM
PG-PSC1314156	Present	9:07:58 AM
PG-PSC1314158	Absent	12:00:00 PM
PG-PSC1314162	Present	9:10:50 AM
PG-PSC1314164	Present	9:09:55 AM

Page 1 of 1

Figure 16: Attendance summary at the end of a class

Table 1: Login time for Manual Attendance (sec) and CAMS Attendance (sec)

S/N	MA (sec)	CA (sec)
1	14.97	6.02
2	15.16	6.07
3	15.18	7.05
4	16.54	7.07
5	16.59	7.12
6	16.92	7.14
7	16.95	7.26
8	17.61	7.54
9	17.72	7.55
10	17.78	8.02
11	18.01	8.05
12	18.25	8.13
13	18.62	8.24
14	19.19	8.45
15	19.34	8.52
16	19.67	8.55
17	19.72	8.62
18	19.85	8.72
19	19.89	9.45
20	20.52	9.55
21	20.91	10.05
22	22.03	10.12
23	23.16	10.14
24	23.19	11.52
25	24.21	11.64

Where, MA = Manual Attendance and CA = CAMS Attendance

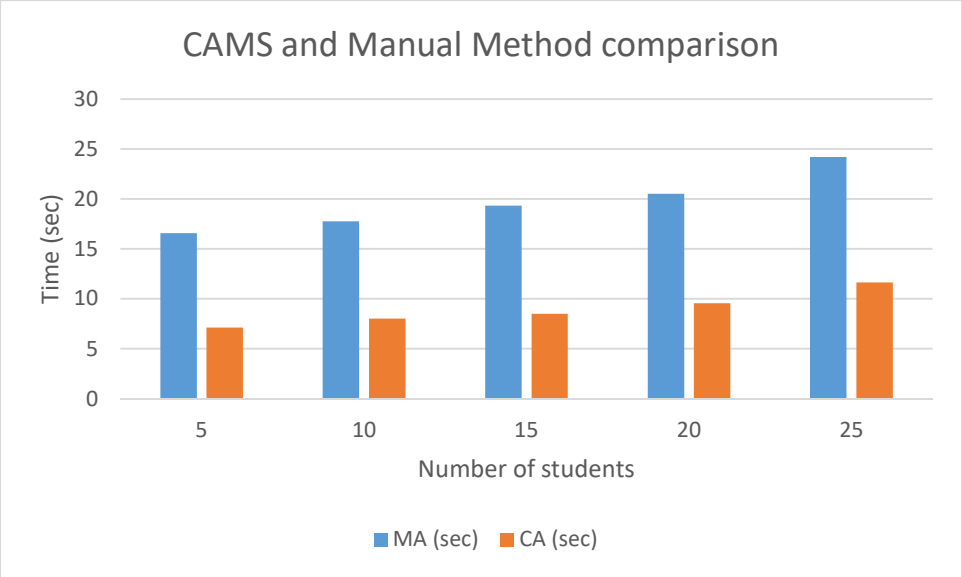


Figure 17: Bar chart showing time to login

From Table 1 and the bar chart in figure 17, it will be observed that it takes an average of 18.88 seconds to login for authentication using the manual authentication method as against 8.42 seconds to login for authentication using CAMS. This clearly shows that CAMS is over 10 seconds faster than the manual method of taking class attendance.

7. CONCLUDING REMARKS

Compared with manual systems, the Biometric system has proved more effective. The genuineness of using fingerprint makes it a safe technique for access control. The fact that a person would no longer need to carry identity cards and other identification documents illustrates the ease of use of CAMS system. Student attendance authentication redefines the manual verification system, while preventing academic fraud and unauthorized credential and proof of studentship. For security purposes, the use of Biometric Technology in this 21st century is now the subject in so many disciplinary fields. Fingerprint Pattern's inherent singularity makes it a secure access mechanism. This paper shows the important and effectiveness of biometric Fingerprint System in student attendance Authentication and conducting Examination in Nigeria Institutions. Nigeria Education system was undermined because of the widespread impersonation of exams. The aim of this research was achieved in its ability to demonstrate how Biometric Fingerprint Pattern Recognition system for both student attendance and Exams can be used to protect and authenticate examination candidates in our institutions. The research will go a long way to resolve the issues of the impersonation of exams in our educational institutions.

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