Biometric Fingerprint System Using an Online Based Pattern Recognition for Candidates Authentication in Nigeria Institution Examinations. The Design Perspective

A study of Joint University Preliminary Examination Board (JUPEB) in Samuel Adegboyega University

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Abstract:

The level of examination malpractices in various Examinations conducted in Nigeria institutions and the rate at which it negatively affects the Nigeria educational system is at the high side. Examination impersonation was the focus in this paper. So many candidates have relent in developing individual skills towards self-confidence in writing an Examination but rely on Examination impersonation to archive what they want at all cost. In other to eliminate any form of impersonation during examination, this paper focus on the development of a secure fingerprint Biometrics system authentication, on this note a study of Joint University Preliminary Examination Board (JUPEB) Biometric Fingerprint System for candidate's authentication was implemented as a case study. This will go a long way to assist in eliminating examination impersonation in Nigeria Institutions. The paper focused on the design perspective of the system. The implementation was done using Visual Studio 2017 with some optimization at coding level and algorithm level were proposed to improve the performance of the fingerprint recognition system.

Keywords: Biometric, Fingerprint, Examination Impersonation, Authentication

1. Introduction

In Information Technology (IT), biometrics refers to technologies for measuring and analyzing human physiological characteristics such as fingerprints, eye retinas and irises, voice patterns, facial patterns, and hand measurements, especially for authentication purposes (Olaniyi, Omotosho, Oluwatosin, Adegoke, and Akinmukomi, 2012).

Biometrics is the science of measuring physical and/or behavioral characteristics that are unique to each individual and they verify that an individual is who he or she claims to be (Pankaj 2014). This biometric system will uniquely identify a student and will be authenticated to take part in an examination. In this case a unique characteristic like Fingerprint of each candidate is use to prevent unauthorized access to take part in an examination by checking the behavior characteristics. As said by Jaiswa, Bhadauria and Jadon (2011) that Biometric is commonly used today to refer to the authentication of a person by analyzing physical characteristics, such as fingerprints, or behavioral characteristics, such as signatures.

Akaranga and Ongong (2013) sited that, Examination is the most common tool around which the entire system of education revolves. There is hardly any educational system which does not include one form or another of assessment as an indicator of the said system of education. It is the instrument used to decide who is permitted to go to the next academic level. In fact, it is the results of examinations and teachers' judgments which form the grading system in which all the students are classified annually or more frequently.

The level of impersonation as part of Examination practices in Nigeria Institutions Examination among Candidates is increasing on daily basis especially in today's world when the general paper-pen tests/exams are now slowly being replaced by the online internet based testing system. Candidates engaging in various means of impersonation as means of boycotting the rules of examination to pass an exam without relying on their ability. Oduwole (2013) sited by Macpherson and Smart (2015) reported in the Saturday Sun that WAEC cancelled individual subject results of 83, 745 candidates, released the results of 1,549 and barred, for two years 3,321 candidates from sitting for the Council examination over misconduct during the school examinations. The same source reported that a total of 112, 000 results of candidates out of 1,695,878 candidates that sat for the May/June 2013 WAEC were withheld for their involvement in various degrees of examination malpractice. With respect to WAEC, examination malpractice is so alarming that WAEC Committee on Examination Malpractice, in conjunction with the Nigeria Examinations

Committee (NEC), recommended that 465 secondary schools in Nigeria be warned for aiding and abetting examination malpractice during the 2012 May/June WAEC.

Emaikwu and Eba, (2007) sited by Akinrefon, Ikpah and Bamigbala (2016) that in Nigeria, the educational system and other systems are in crisis ridden. Some recent researches have shown that the majority of students who gained admissions in tertiary institutions in Nigeria are products of examination malpractices.

Reduction or Eradicating impersonation during exam among Candidates in Nigeria Education System is the focus of this Study. Several methods of reducing this impersonation has been deployed and used like E- Invigilation which is the use of remote-controlled terminals that are linked with the main servers of any institutions. E-invigilation is very important in managing both offline and online invigilation of examinations. This is vital for eradicating examination malpractice on the part of the Students. (Fayomi, Amodu, Ayo, Idowu and Iyoha, 2015)

Thorough Invigilation on Candidates taking part in an examination should be exercised on the other hand keeping watch over candidates that are taking an examination in order to prevent them from indulging in examination impersonation either by paper based or Computer based Examination in Nigeria Universities.

The implementation of online Based Biometric Fingerprints pattern Recognition will reduce various factors analyzed by so many literatures as The causes of Examination malpractices , Oko and Adie (2016) revealed an array of factors responsible for examination malpractice in Nigeria to includes what most respondents called "wrong value system which leads to serious quest for certification instead of knowledge and skills", Laziness, lack of preparation or in-adequate preparation for examination, lack of self-confidence, poor school facilities etc., when candidate writing an examination has no way of boycotting the rules of examination such candidate will have to prepare well for self confidence in writing the Examination. This paper will implement a Finger Print Biometric system that will reduce the level of impersonation in Nigeria Institutions Examinations.

1.1.   Statement of Problem

The increase Rate of Examination impersonation among candidates in the Institutions as reduces their self-developing skills and self-confidence towards reading and writing an Examination. It also has negative effect on the growth of Educational system in Nigeria despite various strategies deployed by stakeholders to ensure candidates obeyed the rules governing an examination. In Nigeria, having a certificate is much more important than getting an individual skills and these have prompted students to engage in various means to boycott in other to get what they want. therefore, students are now lazy to study, lazy to get self-confidence (inadequate preparation for examination). The implementation of a Biometric fingerprint pattern Recognition will reduce or remove access to impersonation in an examination.

2. Related Literature Review

According to Kinoti, Sylvester and Henry, (2015) The most commonly used biometrics for authentication are the fingerprints, a special device which might be a portable fingerprint scanner with USB connector is required to scan users imprints and compare with the fingerprint pattern already on the database as captured during registration of candidate. Some laptops and some personal computers already have inbuilt fingerprint scanners. Employing knowledge factors such as biometrics is surest way to address Type B impersonation threat but the scheme may be susceptible to Type C impersonation threat in which the right candidate is correctly authenticated but leaves another person to complete the examination. To address Type C impersonation threat, continuous re-scan of the candidate's biometrics throughout the test session is required.

In Jaiswa et al. (2011), Biometric authentication can be used to control the security of computer networks, electronic commerce and banking transactions, and restricted areas in office buildings and factories. It can help prevent fraud by verifying identities of voters and holders of driver's license or visas. In authentication, a sensor captures a digital image of the characteristic being used to verify the user's identity. A computer program extracts a pattern of

distinguishing features from the digital image. Another program compares this pattern with the one representing the user that was recorded earlier and stored in the system database. If the patterns match well enough, the biometric system will conclude that the person is who he or she claims to be.

In Ramu and Arivoli (2013). Proposes a Framework of secured biometric authentication in Online Examination. A framework uses a multi-modal authentication approach to secure online examination. The solution comprises of two layers of authentication i.e. student biometric authentication using keystroke dynamics and Knowledge based authentication. It shows the series of steps of online exam starting with the secured login using biometrics and system login through server till the end of exam results. The following steps are describing the proposed framework

Step 1: Student Identification: The system will check the identity of the student by using keystroke dynamics biometrics before entering the exam. This will also check whether the student is eligible for that particular exam.

Step 2: Exam Domain Login: The student will log into the exam domain of the Institutions with the user name and password and profile information provided by the Institutions domain login. If the user name and password and profile information are correct, then the user will be able to log into the exam.

Step 3: Online Exam Proctor (Supervisor) Password: The supervisor password is given to the students who are successfully logged into the exam domain. This gives them access to the exam and the exam session begins for that specific exam.

 Step 4: Random questions: The random questions are given to the students, who submit the answers to the server.

Step5: Exam Results: When session is completed, the system generates the results of the examination on the screen.

Adeoye (2010) presented a Multimode Biometric Solution for Examination Malpractices. A raw biometric of each student is captured by the biometric sensing device, characteristics that are unique to individual and distinguish each student from another are extracted from the raw biometric transformed into a biometric template. The template is then stored in a suitable storage medium such as a database on a disk storage device or on a portable device such as

a smart card, whereby later comparisons can be made easily. Once enrolment is complete, the system can authenticate individual student by means of using the stored template.

Saheed, Hambali, Adeniji, and Kadri, (2017) proposed a Fingerprint Based Approach for Examination Clearance in Higher Institutions. It has four sections (Enrolment, Verification, Registration and Exams). The first section is where the administrator enrolls the student's bio-data, capture the fingerprint and passport photo. Figures 4 and 5 show the details. After the enrolment stage and student's bio-data registration, the verification can be done later most especially when it is time for examination to verify the authentication of student, in order to get admitted into examination hall.

3. Methodology Adopted

The study adopted a Design Science Approach which is qualitative research method as implemented and sited in the work of Omogbhemhe and Awojide (2017) that it as a good approach that provides a method of conducting research and provide a model for the research. We proposed to formulate and implement a simplified, efficient and reliable model for managing candidates' examination authentication based on biometric fingerprint pattern in Nigeria institutions. The model was implemented using ASP.Net Framework and C# Programming language and the back-end makes use of Microsoft SQL Server as the Database.

4. Architecture, System Model and Flowchart diagrams for the Biometric Fingerprint Authentication system

the fingerprint of each candidates is captured during registration using a fingerprint reader in this case Digital Persona Fingerprint Reader scanner was used. the unique features are extracted and stored in database as a template for the subject along with the student ID. These features form a template that is used to determine the identity of the student, formulating the process of authentication. The registration process is carried out by an administrator. During authentication, the fingerprint of the user is captured again and the extracted features are compared with the stored features in the database to determine a match. this procedure is shown in the Sequence diagram in Figs 1 and 3
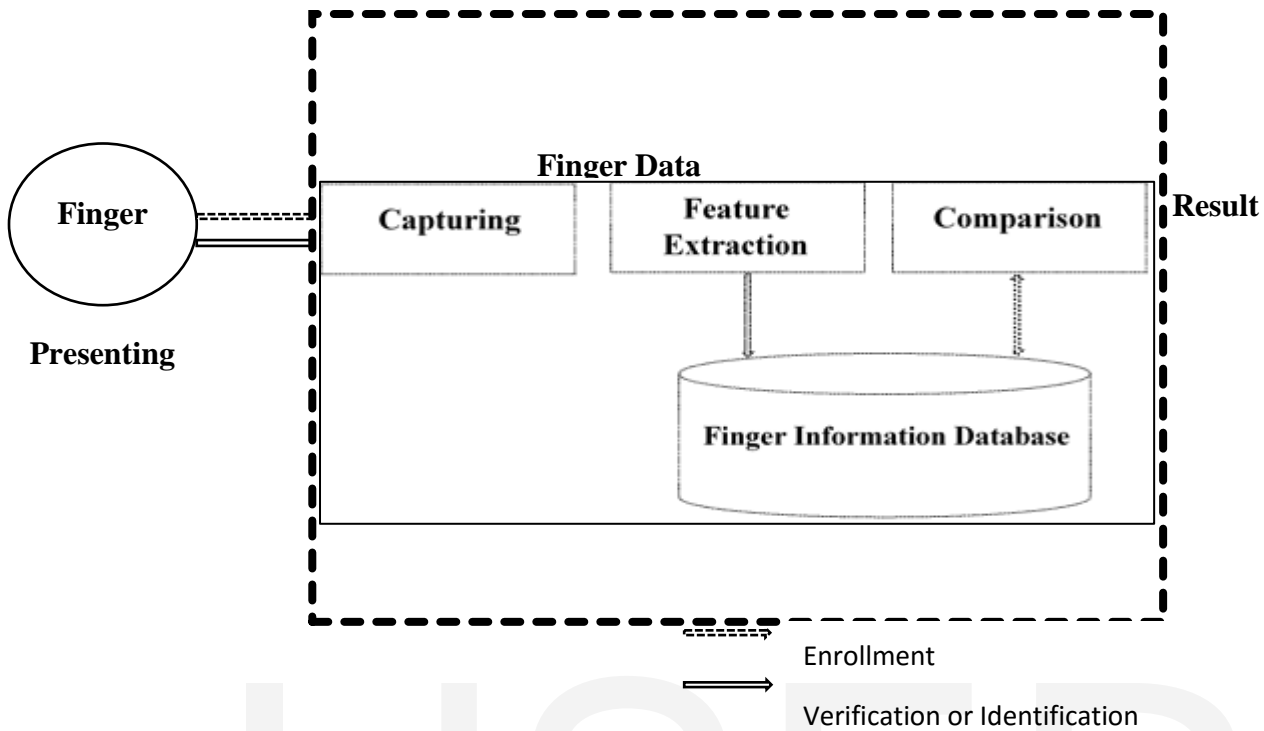
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Finger Data

Finger

Presenting

| Capturing | Feature Extraction | Comparison |

Result

Finger Information Database

Enrollment

Verification or Identification

Fig 1. Architecture of a Biometric Fingerprint Pattern recognition system

ADMINISTRATOR

BIOMETRIC FINGERFPRINT STSYETEM

FINGERPRINT DATABASE

Validate Fingerprint

Return Response

Upload Captured

Cross Match Fingerprint

Return

Check-In

Check-Out
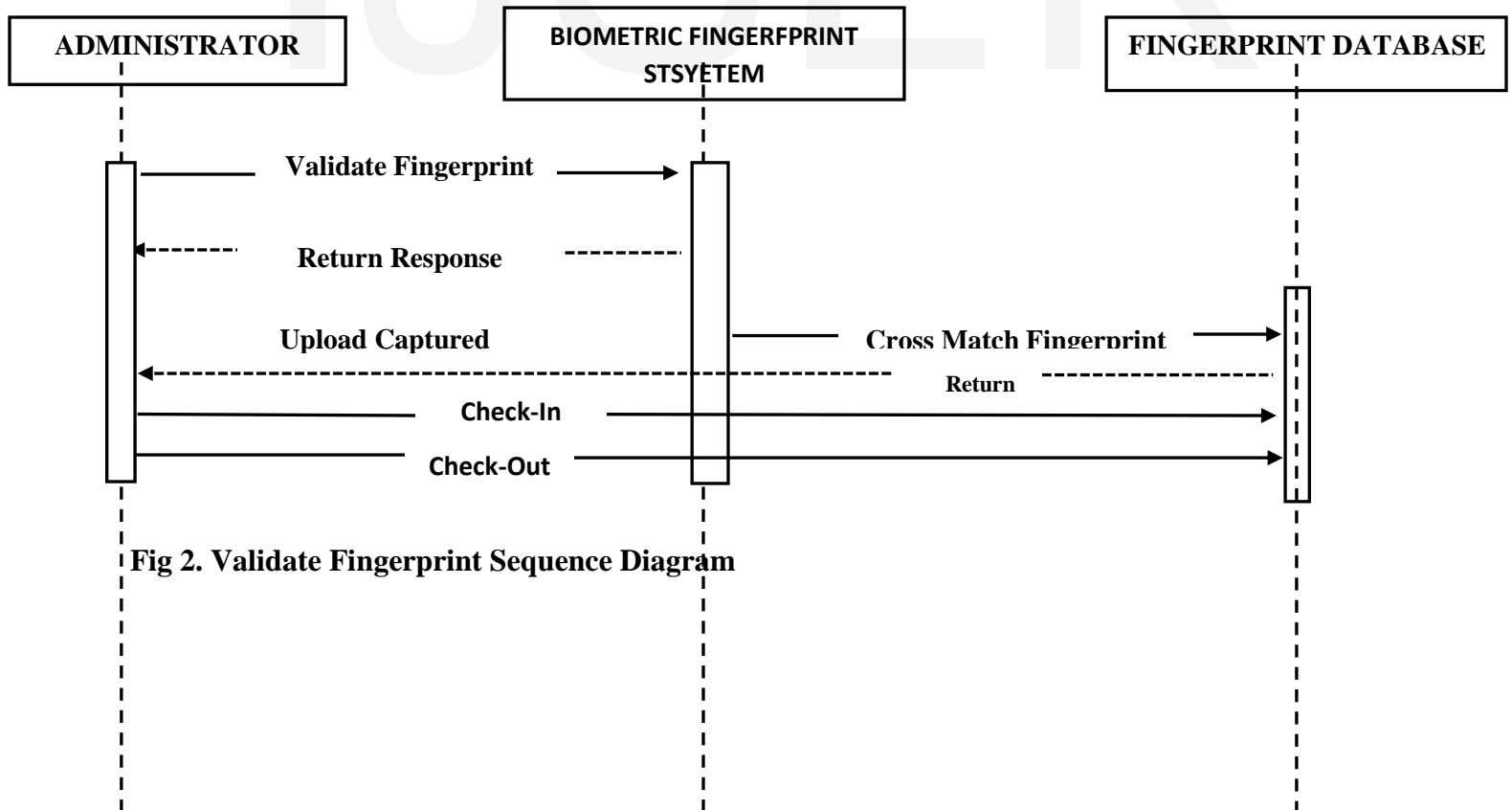
Fig 2. Validate Fingerprint Sequence Diagram
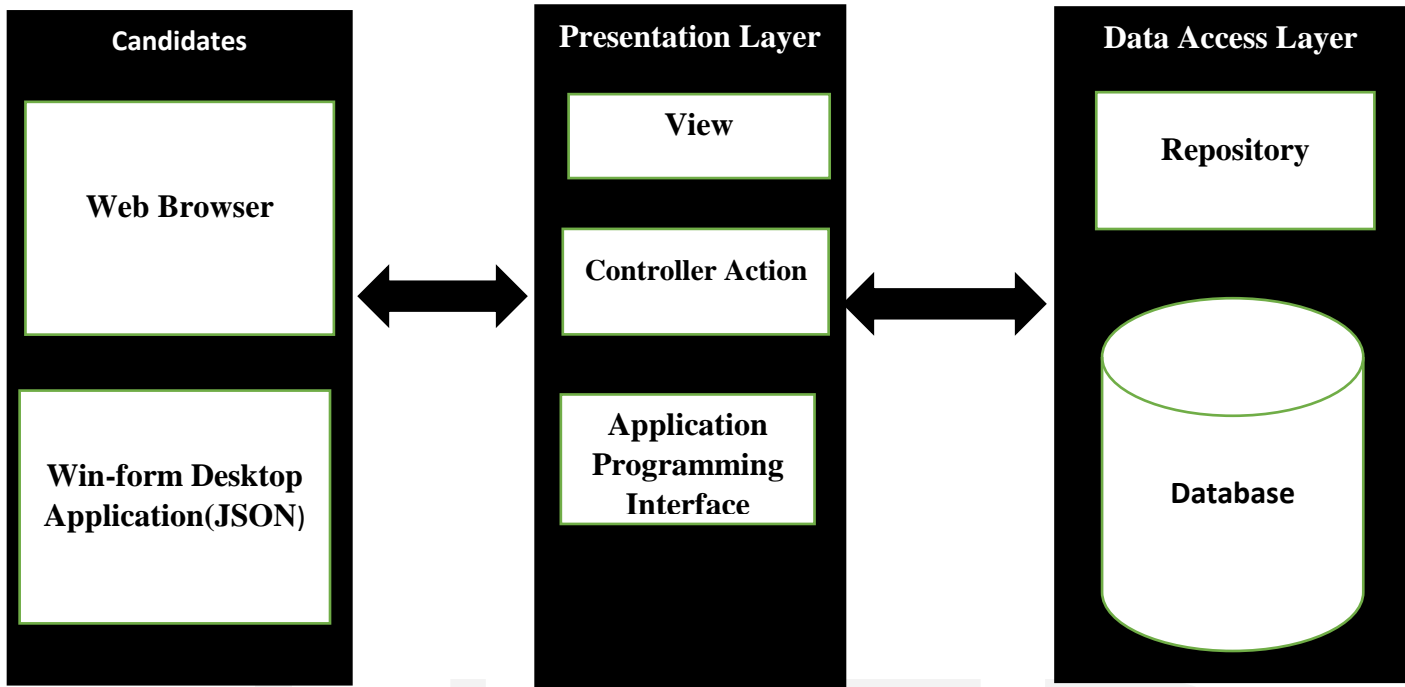
Fig. 3 System Model Design
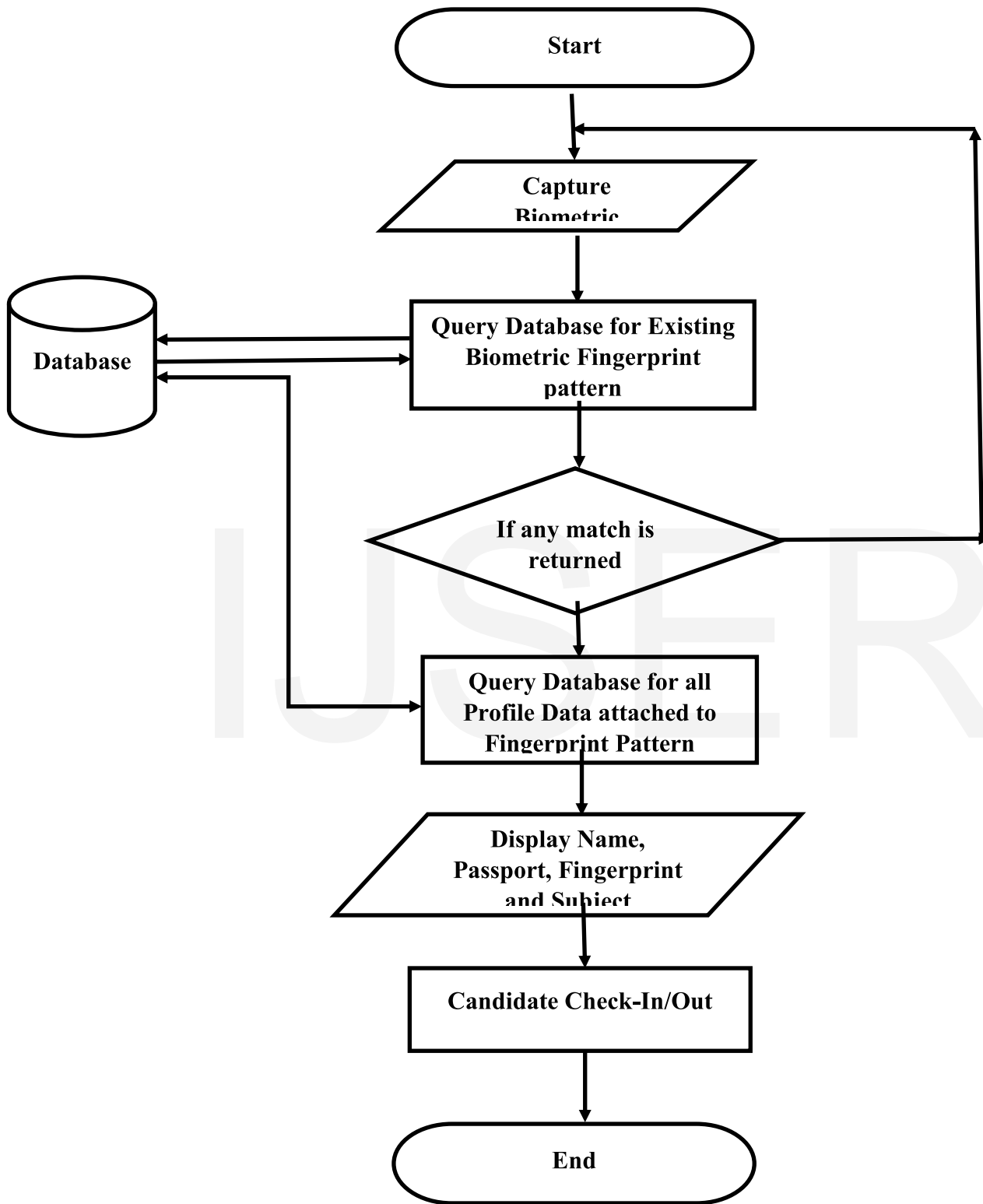
Fig 4. Flowchart of the Biometric Fingerprint verification

Fig 5. below is used to store the information or profile for each candidate. The diagram below shows the Database Schema which contains different tables like CandidateList, FingerPrints, Passports, SubjectCombinations, AspNetUser. From the tables we can see the various fields and the type of data to be entered into them
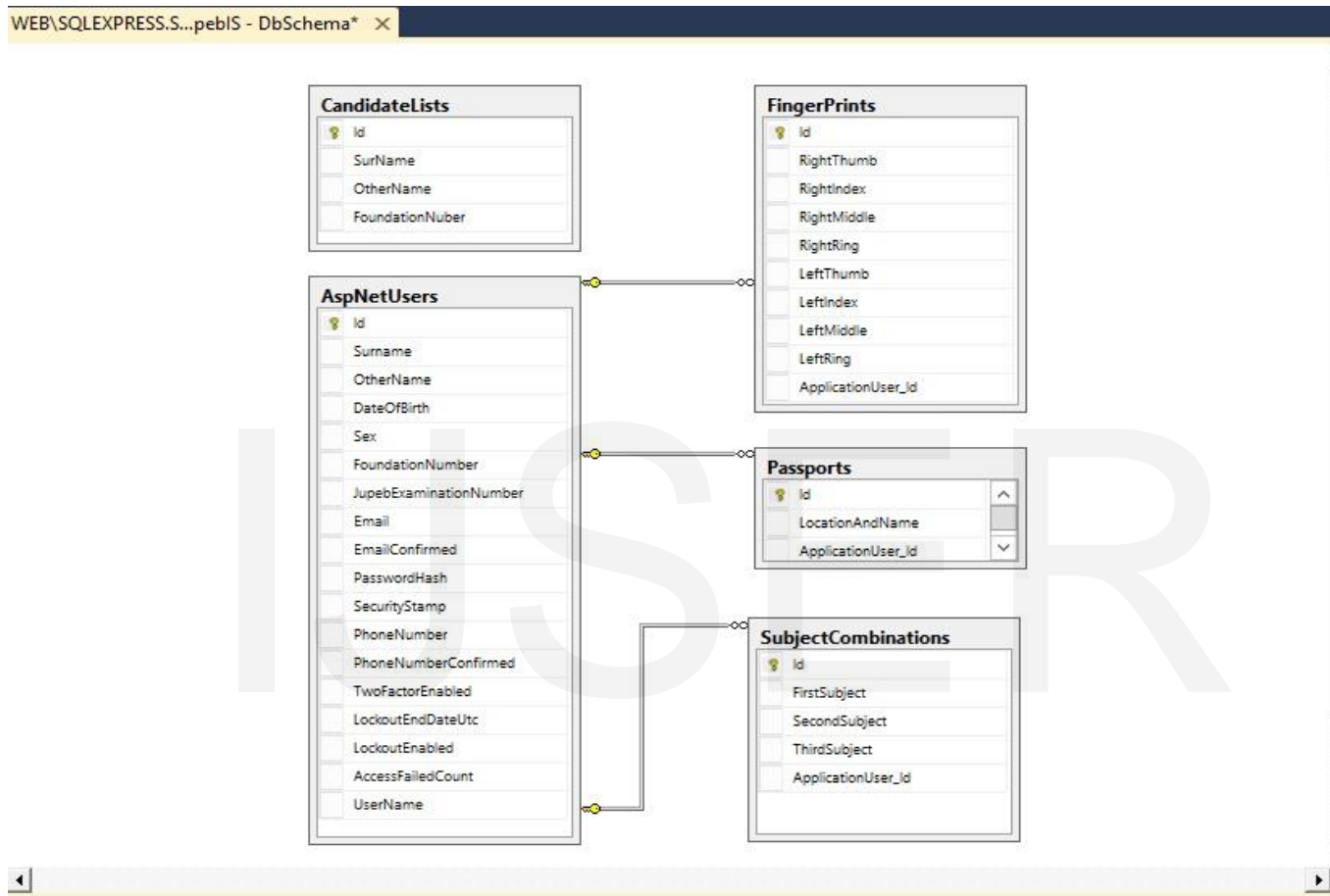

Fig 5. Database Schema for the System

The proposed fingerprint Pattern Authentication System has four sections (authentication Registration, Verification, and Exams). The first section is where the student signs up for authentication for registration, in the second section the administrator Register the student's bio-data, capture the fingerprint and passport photo figure. After the registration stage and student's bio-data registration, the third section is the verification page before and after the examination. The interface of each section is shown in Fig.7, Fig. 8 and Fig. 9 below.
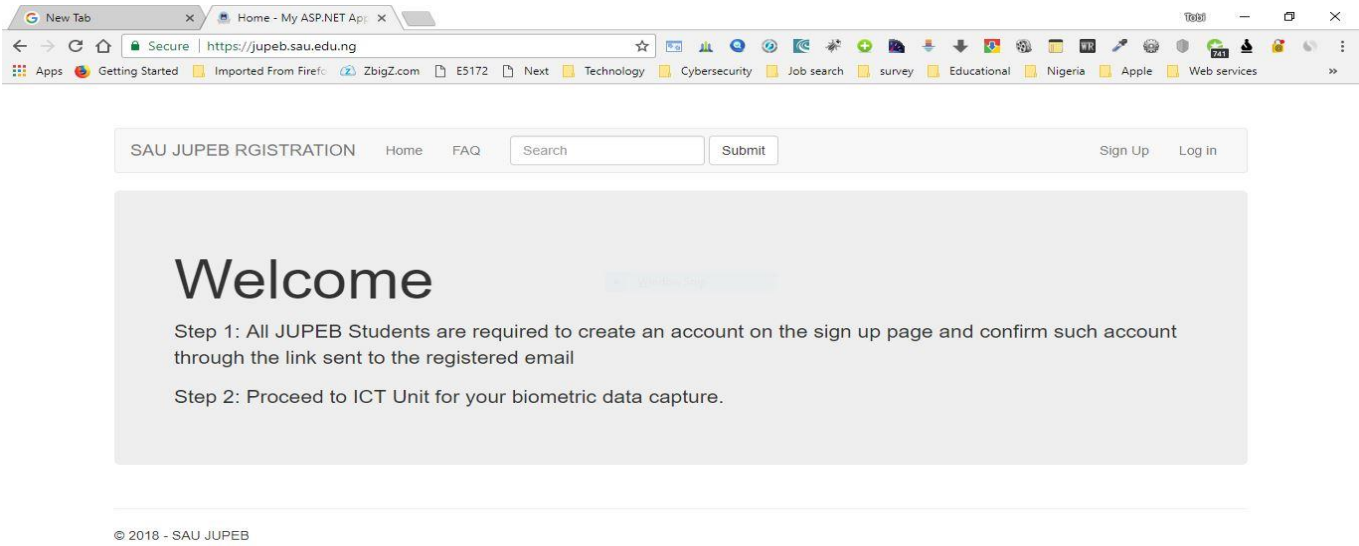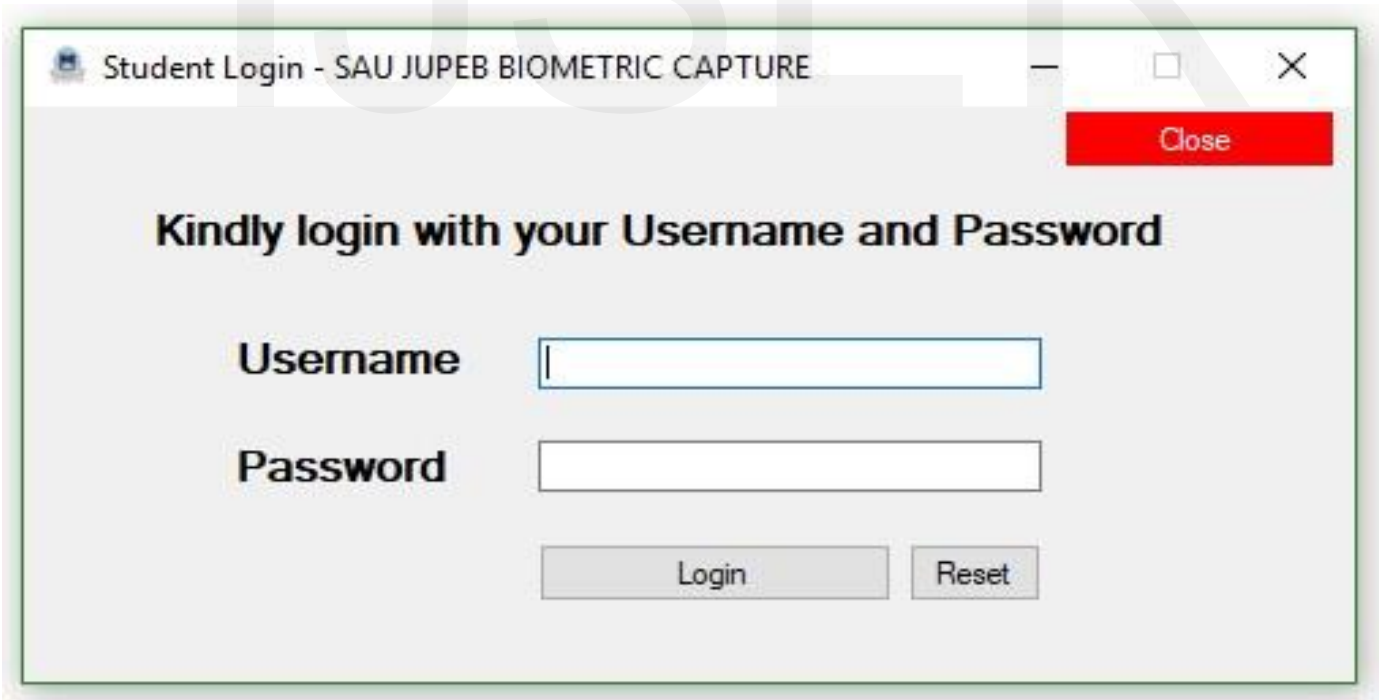
1,690

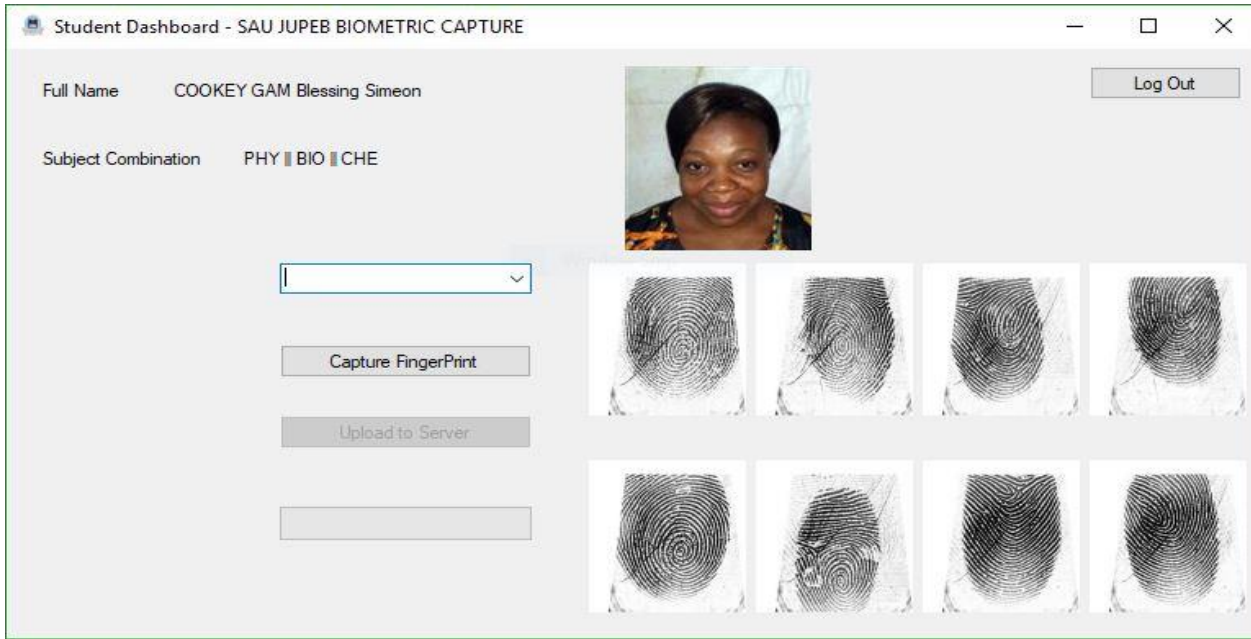**Fig. 6 Welcome Page for Registration**

Fig. 7 Student Login Page
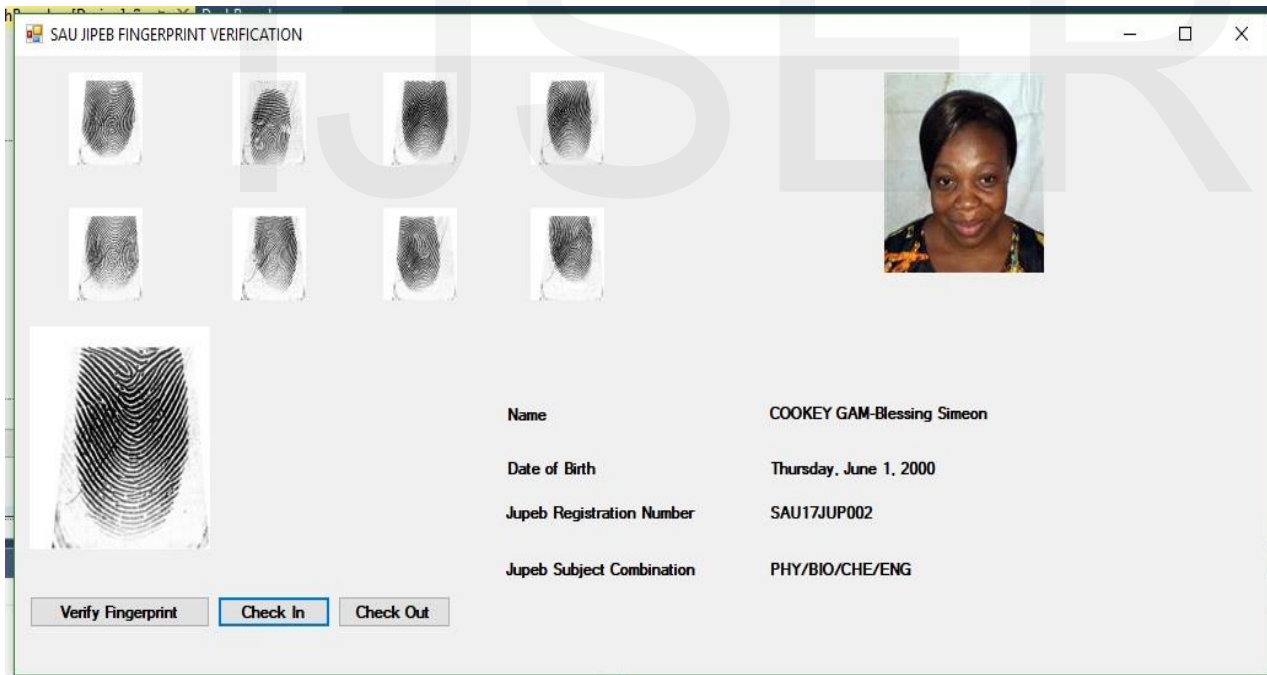
Fig. 8 Dashboard Window for Student

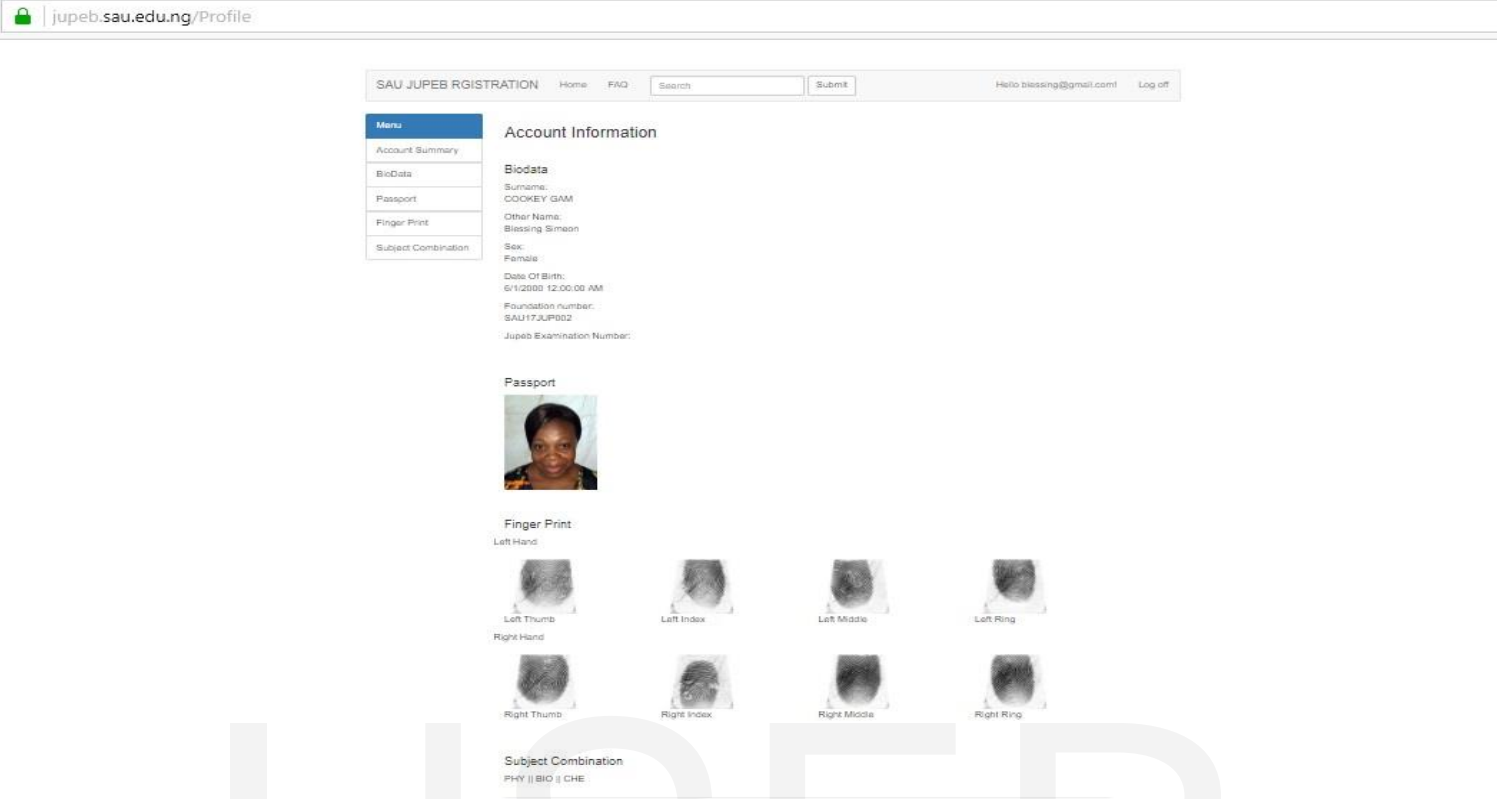**Fig. 9 Verification window Page before and after Examination**

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Fig. 10 Student Portal Profile Page

Conclusion

In this 21ˢᵗ century, the use of Biometric Technology is now the focused in so many areas of discipline for security reasons. The natural uniqueness of Fingerprint Pattern makes it a reliable access control. This paper shows the important and effectiveness of biometric Fingerprint System in conducting Examination in Nigeria Institutions. Nigeria Education system has been abused due to the widespread of examination impersonation. on this note this paper shows the introduction of Biometric Fingerprint Pattern Recognition system which can be used to secure and authenticate candidates for an examination in Nigeria institutions. The study will go a long way in addressing the issues of examination impersonation in our Nigeria institutions

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