A Biometric Fingerprint Student Attendance Management System

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Abstract— Student's nonchalant attitude towards attending lectures, engaging in extra social activities that is of no importance to the objectives of the university and a lot more, tend to explain why some student students don't attend classes. Because of all these, lecturers and administrators in most universities have had to come up with ways to ensure students attend lectures and laboratory work to protect the student-lecturer interactive relationship for optimal educational development. Management of attendance is one of the important activities in university that require attention from stakeholders in order to address its challenges. The challenges are largely as a result of growing number of students that gain entry into the universities especially in developing countries. The traditional attendance registration and management is difficult, time consuming and inefficient. This paper presents a biometric fingerprint based attendance management system developed to address the challenges of academic attendance management in universities. Finger print method of verification and identification is used, since no two people have identical fingerprint. The system addressed the issues surrounding traditional attendance systems and improve the existing biometric attendance system as it provides faster, accurate percentage of student's attendance and the actual number of lectures conducted by individual lecturer, an efficient means of registering and managing students' attendance that eliminates attendance related problems such as friend signing, loss of attendance sheet, and control lecturer/ student skip lecture rate.

Keywords— Biometric, fingerprint, student attendance

I. INTRODUCTION

Student's nonchalant attitude towards attending lectures, engaging in extra social activities that is of no importance to the objectives of the university and a lot more, tend to explain why some student students don't attend classes. Because of all these, lecturers and administrators in most tertiary institutions have had to come up with ways to ensure students attend lectures and laboratory work to protect the student-lecturer interactive relationship for optimal educational development. These efforts in some cases have come in simple forms like roll calls, while in more interesting cases, they have manifested formats like surprise test [7]. Seventy-five percent of lecture attendance is required in most institutions to qualify a student for writing exams. This policy has not been adhered to due to various challenges including the manual method of taking class attendance for students. The manual method involves the use of sheets of paper in taking student attendance; which gives room for impersonation. Lecture attendance taking in this form is also time consuming and it is difficult to ascertain the number of students that have made the minimum percentage and thus eligible for exam.

The need to uniquely identify students and lecturers in various activities of which they were to partake has become very important in tertiary institutions in developing countries. This is to help checkmate truancy by students and lateness to class or non-conduction of lectures by lecturers. One of the technological developments that is available to stem down the growing incidences of absenteeism by students and lecturers' skip of lectures is the biometric authentication system based on fingerprint.

Biometric 'authentication' is an automatic 'identification' or identity verification of an individual based on physiological and behavioural characteristics. Verification in this context means comparing the captured physiological or behavioural characteristics with previously enrolled physiological or behavioural characteristics reference template stored in the system. This is simply a one-to-one comparison. On the other hand, 'Identification' recognizes an individual by searching the entire enrolment in the database for a match, one-to-many matching [1]. The advancement in technology in the field of biometrics has made it possible to capture and store persons' fingerprint for the purpose of verification or authentication.

Fingerprints are ideal for personal identification because our ten fingerprints are different from one another and from those of every other person. Even identical twins have unique fingerprints. 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 [3]. For attendance, the student places his/ her finger over the fingerprint device and the student's matriculation number is recorded in the database as having attended that particular lecture [2]. At the end of the semester, reports are generated listing the names of students and number of times the student attended lecture alongside the percentage, also number of lectures conducted by the lecturer within the semester.

In this paper, a biometric fingerprint based attendance management system that addresses the challenges of academic attendance management in universities is proposed. The system allows authentication and automatic identity verification of an individual based on physiological and behavioural characteristics

II.   RELATED WORK

Shoewu and Idowu [1] developed an attendance management system using biometrics, the system is designed to overcome the challenges in lectures and examination attendance. The system keeps track of students' basic biodata information and fingerprints. Reports are generated at the end of semesters to determine the eligibility of student to write examination. Their system was tested using the biodata of 80 students in the department of Electronics and Computer Engineering Lagos State University, Nigeria with success rate of over 94%.

Wireless fingerprint-based college attendance system using Zigbee Technology [2]. The system allows students to register for lecture attendance through a fingerprint device. A database of students' information and fingerprints is developed and maintained. The system runs on Intranet to Internet, thereby generating and sending 15 days' attendance reports to students, parents, teachers and Head of Department. The system was tested for a class of 70 students with 98.57% accuracy level.

An integrated approach of physical biometric authentication system [3] was proposed to secure online payments for goods. The system stores bank customers' information including finger, iris and palm prints. For any payment to be effected, user biometrics has to be authenticated. This was achieved through the use of Discrete Wavelet Transform (DWT), Minutiae and Support Vector Machine (SVM) algorithms. The system performance was evaluated using MATLAB Simulation and the results shows that their system provides a more secured online shopping experiences.

Basheer and Raghu [4] proposed a fingerprint attendance system for classroom needs. The system allows students to enroll and scan their fingerprints during the first

class while, faculty staff on the other hand can perform tasks like adding students, import and export attendance data. They concluded that the result of the prototype implementation testing shows that the system is working perfectly without any error.

Another attendance management system using Bluetooth smart technology [5] was proposed. The system is designed to utilize the capabilities of Bluetooth smart technology to register students' lecture attendance without physical contact to any device. The Bluetooth smart chip is programmed and configured such that it works with an Android application via Bluetooth. Students are assigned cards while lecturers have the application on the mobile device. Students attend lectures with the card and attendance entries are entered into the database with time stamp as the lecturer moves around the class and the application automatically detects the tags.

Automation of attendance system using RFID, Biometrics, GSM modem with .Net framework [6]. The system is designed to detect and maintain attendance of student using a wireless system. Radio-frequency identification (RFID) is used to for student identification through a card and finalized when the fingerprint is verified using the biometric fingerprint scanner. A text notification is sent to the student's parent notifying him the presence of the student on campus. Transponders are installed to allow the system detect the location of student and staff. In addition, website is provided to allow students, teacher and guardians view attendance and location of a student on campus.

Security of Biometric System [8] highlights on relatively simple way ways one can break through a fingerprint system. In their work, methods one can employ to create a "fake" fingerprint was also highlighted. Reliability test of fingerprint were tested using series of measurement and the results show possibility of attack on a biometric system.

Nawaz *et al* [9] developed an academic attendance monitoring system using fingerprint identification, the paper automates the entire process of taking attendance and maintaining its records. The system is designed such that students mark their attendance within 30 minutes of commencement of lectures. The system was tested for a class of 50 students and accuracy of 98% was recorded.

Design of wireless fingerprint attendance system [10] is an attendance system designed to solve the attendance problem in an institution. To test their system, 300 fingerprint samples were collected. There was a total of 1200 times of matching, and the verification rate is 98.3% while the rejection rate is 9.2%. In the wireless transmission testing, they found that transmission is relatively steady and reliable and transmission distance satisfies system needs.

The above reviewed papers have implemented biometric attendance system using different techniques and

implementation tools with varying degree of success. However, this paper presents a biometric fingerprint based attendance management system that address the challenges of academic attendance management in universities. This was achieved using different implementation tools and technique.

III. SYSTEM ARCHITECTURE AND DESIGN

The proposed system is a desktop-based attendance system developed for universities and colleges that allow student to scan their fingerprint to verify their identity and register attendance. The system has a web-based interface designed for administrators to manage users and attendance and lecturers to view and analyses student attendance by generating different attendance reports. The system provides faster, accurate, and efficient way of registering and managing students' attendance that eliminates attendance related problems such as friend signing, loss of attendance sheet, and control student skip class rate.

The system was developed using both hardware and software tools. The Hardware tools are biometric fingerprint reader (DigitalPersona U.Are.U 4500) and personal computers. The software tools are Flexcode SDK for registration and verification of fingerprint, MySQL Server for storage and management of database, and NetBeans IDE for the user interface design.
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A   ARCHITECTURE OF THE PROPOSED SYSTEM

The main components of the system are users, user interface and database. The users are the actor who perform various roles and interact with each other and the system. The users include the Student, Lecturer and the Administrator. The student enrolls his/her fingerprint during registration using the Desktop-based Application, which will later be used for verification during lecture hours. The lecturer enrolls his/her fingerprint for registration and verification using the Desktop-based Application. The lecturer also can login to Wed-based Application to view the student attendance. The Administrator adds or removes courses and manages the users of the system.

The user interface is the part of the proposed attendance system that users interact with. They include forms, notice board and report generator. The database stores and manages all the data that are sent from the user interfaces. It is the storage area of the system where all the data pertaining to the automated attendance system are kept.

The architecture of the proposed attendance system is illustrated in figure 1. The system is made up of five components, which are **Users, Browser, Fingerprint Application, Servers and Database**.
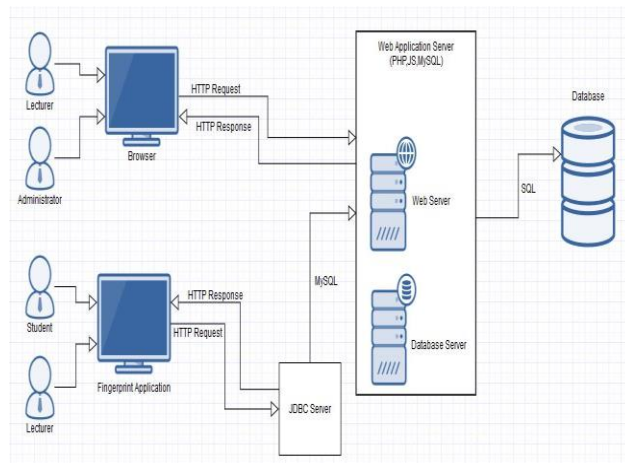

Figure 1 Propose System Architecture

Users: the users of this system interact with either the web browser or the fingerprint desktop-based application. The lectures interact with both the web-based and the desktop-based application while the students interact with the desktop-based application and the administrator with only the web-based application.

Browser: the browser is the system that allows communication between the web-based application server and users (lecturer and administrator). This is possible by sending HTTP Requests to the web-based application server and receiving HTTP Responses from the web-based application server.

Fingerprint Application: the application is responsible for the lectures' and students' enrolment and verification for the entire system.

Servers: the database and web application servers are the intermediaries between the applications and the database storage.

Database: this is where the entire data related to the attendance resides. The database is updated as the system is being used.

B   Flow Diagram for Student

Once the system starts, the student placed his finger on the fingerprint reader for either enrolment or verification, if the fingerprint is recognized by the system then it should check for verification and update the database as appropriate and send report, else it perform an enrolment process. Once a student is enrolled and register some courses, he/she can be authenticated during lecture hour. Figure 2 represents the flow chart for the student.
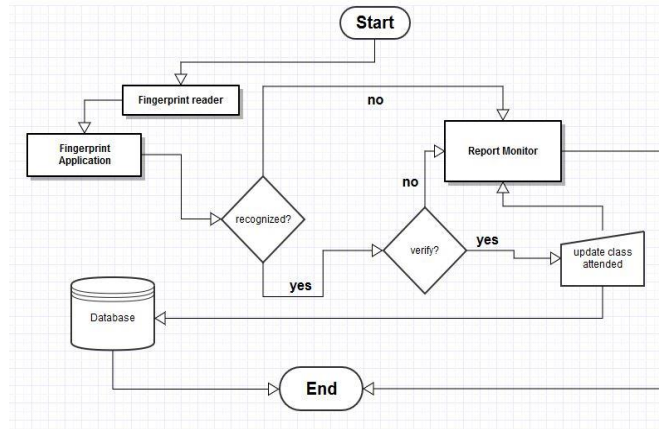
Figure 2 Flow Chart for Student

C   Data Flow Diagram (DFD)

A DFD shows how information is passed into and out of a system, how the data will advance through the system, the sources and destination of the information, and where the data will be stored. Figure 3 illustrates the data flow diagram of the proposed system; it shows how data flows from all the system users (student, lecturer, and administrator) to the fingerprint recognition and student attendance management system.
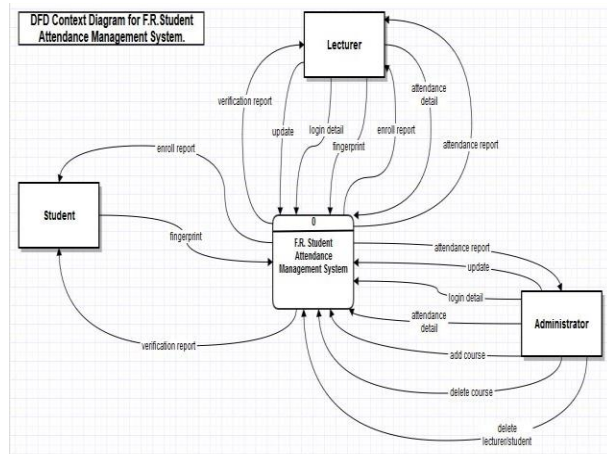

Figure 3 Data Flow Diagram

It can be observed from the figure that the rectangular shape represent user and square shape represents the system. The student passes his/her fingerprint to the system and receives either enrolment report or verification report from the system. The lecture passes his/her fingerprint template and receives either enrolment report or verification report. The lecturer can also login to generate attendance report and update the database as appropriate. The administrator can login to the system to add course, delete course, manage users or update the entire system.

IV.   SYSTEM IMPLEMENTATION

This section present the system implementation and detail description of the major components of the Biometric Fingerprint Based Student Attendance Management System.

The system was implemented on Windows Operating System and have the following functionalities:

A.   Staff Login

Login page also serve as the index page for the application interface, which comprises of username and password. If the username and password matched correctly, that means that the user is registered in the database then, the system checks which type user to provide the appropriate user mode (admin or lecturer mode). Figure 4 shows the login window of the application. If the login credentials are not correct, it will prompt an error alerting the user of Invalid Username or Password!

Fig. 4. Login Form

B.   Attendance Information Interface

After the access granted, the private zone form will appear to the student user. This interface allows user to carry out a number of operation, which include but not limited to change of password, profile information, etc. as shown in figure 5. Lecturer can use the navigation to students in attendance for the course, generate report and or download an excel file with extension ".CSV" for later use.
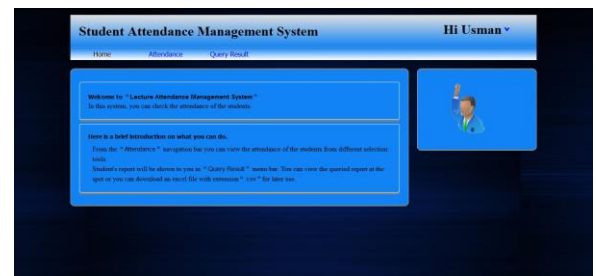

Fig. 5. Lecturer navigation page

C.   Specific Course Information Interface

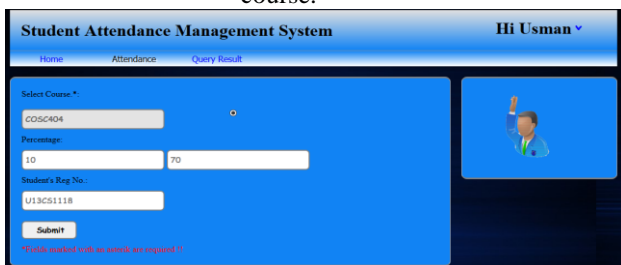Figure 6 shows a student's attendance for a particular course.

Fig. 6. Sample of course attendance page

D. Individual Student attendance Report

The page displays the report for the query executed, and it give the lecturer ability to download the report in an excel file format. It shows the number of class conducted, class attended and attendance percentage of each student.
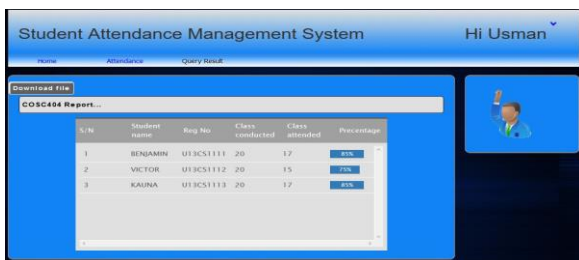

Fig. 7. List student attendance for a course

E. Adding and Managing Student

The system allows the admin user to add and drop course, also can view attendance reports for all courses as well as add student profile to enable them view attendance status. Figure 7 shows add course window.
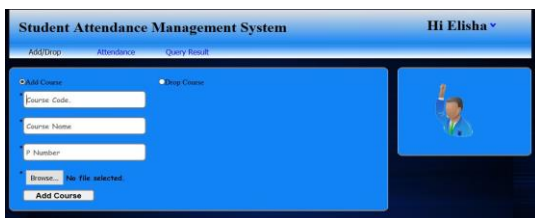

Fig . 7. Add course form

F. Desktop-based Enrolment Interface

Figure 8 presents the Enrolment process that captures the student's fingerprints and store it in the database. It also displays the fingerprint picture as it captured for accuracy and give report as the process continue.
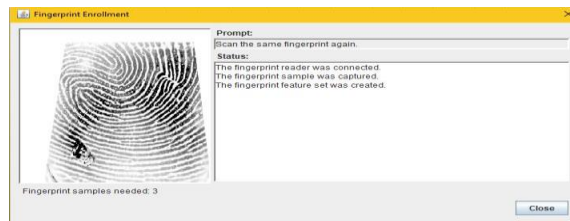

Fig. 8. Enrolment Interface

G. Desktop-based Verification Interface

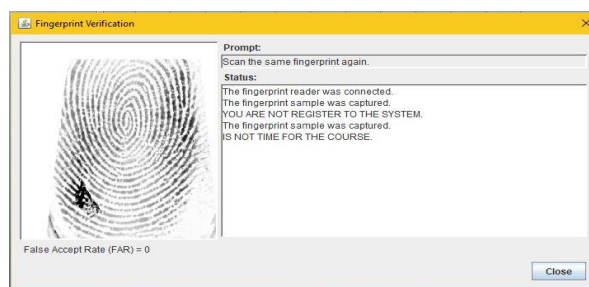The interface displays the fingerprint scanned and shows the attendance report status as shown in fig. 9

Fig. 9. Fingerprint verification page

V. CONCLUSION

Registration and management of attendance is one of the important activities in higher education institutions that require attention from stakeholders in order to address its challenges. The challenges are largely as a result of growing number of students that gain entry into academic institutions especially in developing countries. The traditional attendance registration and management is difficult, time consuming and inefficient. As a result, a fingerprint attendance management system was developed and presented in this paper. Fingerprint technology was chosen because it is proved to be a convenient and reliable way of verifying the identity of people. It is popularly used method of verification and identification since no two people have identical fingerprint. The system is a desktop-based attendance system that allow student to verify their identity by scanning their fingerprint and register attendance. The system has an interface designed for administrators to manage users and attendance and lecturers to view and analyse student attendance by generating different type of reports.

The system addressed the issues surrounding traditional attendance systems since it provides faster, accurate percentage of student's attendance and the number of lectures conducted by individual lecturer, an efficient means of registering and managing students' attendance that eliminates attendance related problems such as friend signing, loss of attendance sheet, and control lecturer/ student skip lecture rate. In future, the system should be

modified such that student can know their status like barred from attending class or writing examination for particular courses. Another future work is to develop a mobile version of the system to ease the attendance process since the system at the moment can only be used on personal computer.

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