



A FINGERPRINT BASED STUDENTS ATTENDANCE MANAGEMENT SYSTEM FOR OLABISI ONABANJO UNIVERSITY

*Olasupo A. O, Ademiluyi O. S, Usman M. A, Abdullah K.-K. A, Olubanwo O. O, Ayo F. E, Ojumadu U. H, Salami E.O, Ibrinke T. E.

Department of Mathematical Sciences, Olabisi Onabanjo University, Ago-Iwoye, Ogun State

*Corresponding authors' email: ahmed.olasupo@oouagoiwove.edu.ng

ABSTRACT

The development of attendance was motivated by the necessity to keep track of who was there in a certain location at any given moment for future reference. Attendance is defined as the awareness of persons present at a specific location at a specific time for a previously scheduled event. Keeping and managing attendance records efficiently is critical for student evaluation. All formal institutions of learning place a high value on class attendance, which is so important that students who do not reach the class attendance threshold are not allowed to appear for exams. Traditional attendance marking techniques are prone to human error and time demanding for both students and lecturers during class. The old attendance system has various drawbacks, including lost attendance sheets, impersonation, time waste, insecurity, and lack of precision. As a result, by utilizing the unique qualities of fingerprint technology, a smart solution to the challenges connected with the traditional attendance system is required. As a result, the article devised, designed, and deployed a fingerprint-based attendance management system for students. The system's development model was the Software Development Life Cycle (SDLC). To record and verify students' fingerprints, a digital persona fingerprint scanner was utilized, and the Graphical User Interface (GUI) was created using the window forms application of the Visual Studio Integrated Development Environment (IDE). The back-end design was created using the C# programming language and the Structure Query Language (SQL) server. The system's logic was implemented in C#, and the SQL server was utilized as the system's database for storing and retrieving data. The system was able to provide smart solutions to the problems with the existing traditional attendance system by providing a system that is secure, free of impersonation, accurate, processes faster, efficiently, and reliably, economical by avoiding the use of paper and pen, saves time during attendance capture, and also helps to eliminate attendance loss.

Keywords: Fingerprint, Attendance, Software Development Life Cycle (SDLC)

INTRODUCTION

The needs for record keeping of people present in a particular place at any given time for future references brings about the introduction of attendance. Attendance is the awareness of people, individually or collectively as a group, present at a particular location at any given time for a previously planned occasion (Franklin *et al.*, 2008). It's a record of a person's presence in an event or gathering. Different organizations or institutions utilize attendance for a variety of reasons. Taking and retaining attendance is a major problem for many organizations and institutions, who rely on the data gathered from attendance to assess the efficacy of their efforts and prepare for future efforts. Attendance is one of the most important indicators of a person's eligibility, timeliness, and devotion to an institution or group (Kabir *et al.*, 2021). Keeping and managing the attendance records efficiently is cogent for the assessment of students. All formal institutions of learning put a great deal on class attendance and it is so crucial that students who do not meet the benchmark assigned to class attendance are not authorized to sit for examination (Okokpujie *et al.*, 2017)

In today's world, the traditional attendance marking system which is paper-based attendance system is used in most educational institutes where the teacher/lecturer calls out students roll/matriculation numbers or where the students write down their names and roll/matriculation numbers on a paper, which is then submitted as the attendance sheet.

Furthermore, in most schools and colleges, teachers take the student's attendance in an attendance register manually and subsequently entered into a computer and the total percentage of students' attendance is calculated (Sunehra *et al.*, 2016) In Olabisi Onabanjo University, Ago-Iwoye, Ogun State, Nigeria; the traditional attendance system is been used for recording the presence of students during classes. The class representative passes paper across to all students present in the class, then the student writes down their names and matric number with their signature. At the end of the class, the class representative submits the attendance paper to the lecturer, the lecturer then keeps the paper for record purposes. The traditional processes of attendance marking are inclined to many human errors and time consuming for both the students and lecturer during classes. There are several problems associated with the traditional attendance system such as; loss of attendance sheet, impersonation, time wastage, not secure and lack of accuracy. Therefore, there is a need to provide smart solution to the problems associated with the traditional attendance system by employing the use of the unique properties of the fingerprint technology. A fingerprint is an effect or lines of an impression from the friction ridges, from the floor of a fingertip of a person's finger. A friction ridge is a raised part of the epidermis on the fingers and includes one or extra linked ridge units of friction ridge skin (Kwok 2009). Fingerprints are considered to be the most secure and fastest

means for biometric identification. Since individual fingerprint is unique and do not change in one's lifetime. Besides these, implementation of fingerprint recognition system is economical, accurate, durable, mobile and efficient (Hong 2008). Fingerprint recognition has been widely used in both forensic and many attendance applications. Compared with other biometrics features, fingerprint-based biometrics has been proved as the most efficient method and has the largest market shares (Mary 2008).

(Akinduyite *et al.*, 2013) developed an attendance management system using fingerprint technology in a university environment. The fingerprint unique features were collected using crossing number method, the method detected unique identifiers from skeleton image by examining the images in image pixels using a 3X3 window. The system was developed using C# programming language and Structured Query Language (SQL) was used as the database for storage and retrieval of records. The result shows that the system is secured, efficient and save time in taking of attendance.

Over the years, different researchers have used various techniques to proposed, design and implement attendance management systems. Some of the techniques include; internet systems such as web-based system, mobile-based attendance system and hardware technology like fingerprint-based attendance system, iris-based attendance system, face recognition-based attendance system, RFID (Radio Frequency Identification) based attendance system, and others.

(Rufai *et al.*, 2012) developed a biometric approach for attendance monitoring and examination screening in Yaba College of Technology, Nigeria. The technique ensures that impersonation does not occur during examinations. It was further stated that the invented biometric devices decreased impersonation rate and student cannot forge, steal or misuse the other student's biometric identity. A record was designed in the database that consists of timely mannered information of the tag's "Exit or Enter". From the record, the complete Stay-In time of students in each class is computed. If the calculated time is identical to the expected time with the criteria stated by the administration the student will be marked "Present" or else marked "Absent".

(Lakshmi *et al.*, 2014) developed an attendance system by invented a camera of "plug and play" fixed at the entrance of every class, whereby students entering into the class will be captured by the camera, the image captured will be compared with the image stored in the database, if it matches, the student will be counted as present in the class. By the means of local binary outline of the camera, the face will be recognized and the sums of the absentees are then calculated. All students with their respective faces were stored in the raspberry pi. Using max232, the details of the absentee will be transferred via the mobile device to the concerned parents and the Departments.

(Dutta *et al.*, 2020) proposed and developed a fingerprint-based attendance system using Arduino microcontroller based on ATmega1280. The fingerprint scanner ZFM20 is used alone with its own processor and memory. A user-friendly

interface named TFT touch screen is used to display reports, storage device card is used for storage of student's records. To extract attendance date and time a real time clock is used. Caesar Cipher cryptographic technique was employed for the encryption and decryption of data, so that data cannot be accessed or modified by illegitimate person.

(Nasir *et al.*, 2012) proposed a web-based attendance system employing Near Field Communication (NFC) technology, and named it "Touch In System". In this system, Peer to Peer approach (similar to an android beam) and Reader/Writer approach (similar to a smart poster) are utilized. Each class consists of NFC reader linked with the lecturers' computers associated with the institution's network. The student phone by connecting to the institution network using the reader/writer approach will be enable to mark attendance during the class.

(Shoewu *et al.*, 2011) proposed and developed an embedded computer-based lecture attendance management system where a single-chip computer-based subsystems an improvised electronic card and the card reader were interfaced serially to the serial port of the digital computer. The electronic card is a model of a smart card containing the student identity (ID-Name, Matriculation Number and five pin encrypted code). The student ID is authenticated by the card reader which compares the entrance code with the encrypted code on the card swiped through the card reader. The student is granted and/or denies specific lecture attendance based on the result of the comparison by the system to which the card reader is serially interfaced. The system provided a simplified, low-cost embedded computer-based system solution to the management of lecture attendance problem in developing countries but does not eliminate the risk of impersonation.

MATERIALS AND METHODS

The design methodology utilized for this system is the Software Development Life Cycle (SDLC) method. The method is utilized in building, designing and preserving information on industrial systems and computer software. It is the common and the oldest software development architecture. It involves series of phases in which the output of one phase provides the input to the next phase. The attendance management system is a fingerprint system. Digital persona fingerprint scanner was used to capture students' fingerprints, the Graphical User Interface (GUI) was designed using window forms application of visual studio Integrated Development Environment (IDE). C# programming language and Structure Query Language (SQL) server were utilized as the back-end design. C# was employed to implement the logic of the system, which the SQL server was used as the database of the system for storing and retrieving of data. Figure 1; shows the architecture of the Fingerprint-Based Attendance Management System (FAMS). The architecture is the conceptual model that defines the structure and behavior of the system (Jaakkola and Thalheim 2011).

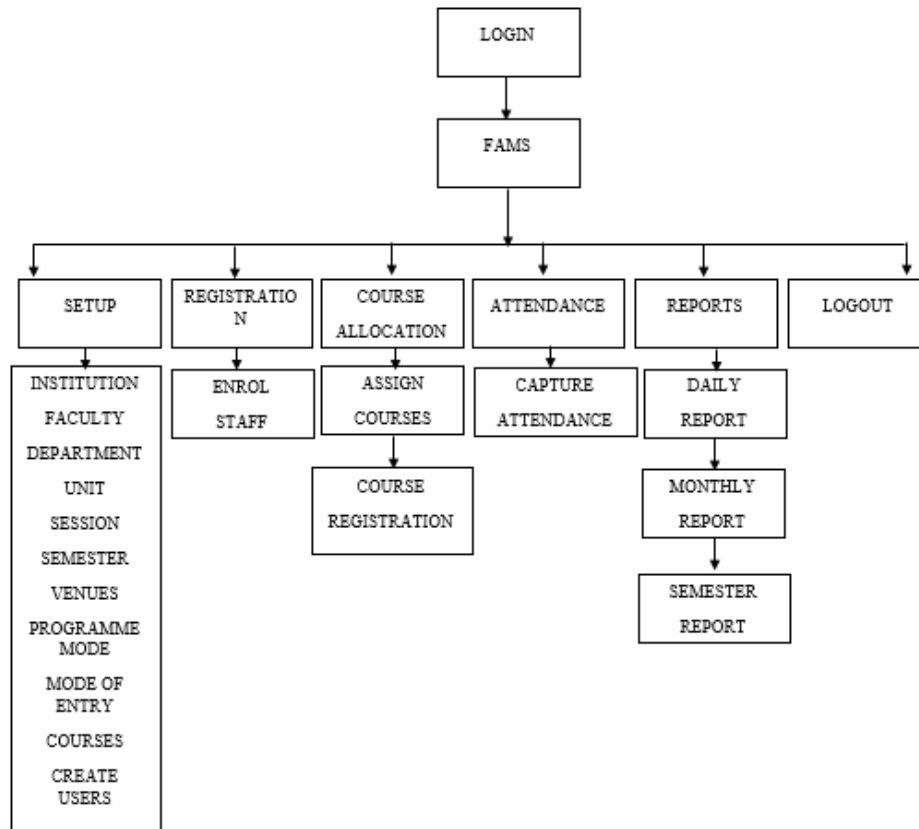


Figure 1: Architecture of the FAMS

RESULTS AND DISCUSSION

FAMS was implemented by installing the software on the lecturer’s Personal Computer (PC) and the database was hosted on a window server, the PC and the window server are on the same networks. Figure 2 to Figure 19, shows all the forms in the system.

Figure 2 shows the login form of the FAMS, the system users (the administrator, which is the Head of the Department and lecturer’s) provide their login details and which is validated against the login data in the database to verify if user’s is an authenticated user.



Figure 2: Login Form

Figure 3 shows the homepage form of the FAMS, the homepage consists of the various menus available in the system.



Figure 3: Homepage Form

Figure 4 shows the institution setup form of the FAMS. The system administrator setup the institution by inputting and saving all the required data about the institutions. This form is only available to the system administrator.

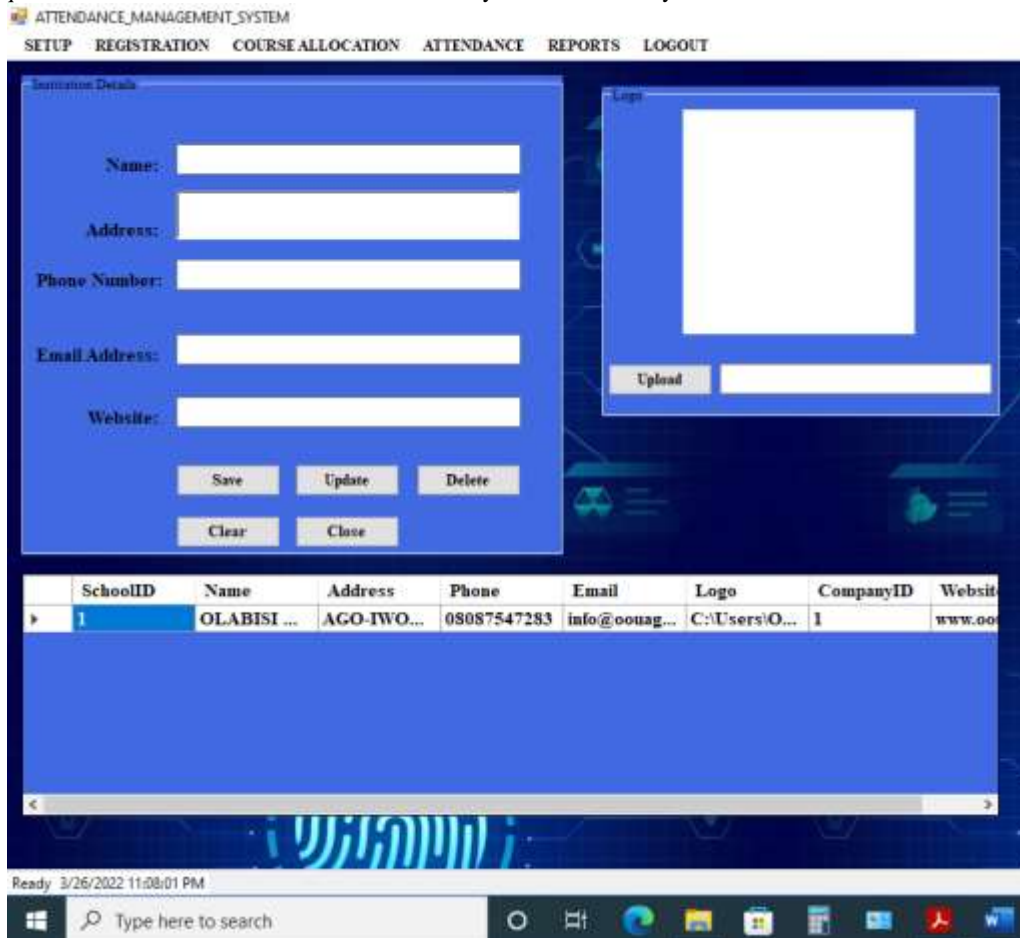


Figure 4: Institution Setup Form

Figure 5 shows the faculty setup form of the FAMS. The system administrator setup the faculties in the institution by inputting and saving all the required data about the faculty. This form is only available to the system administrator.

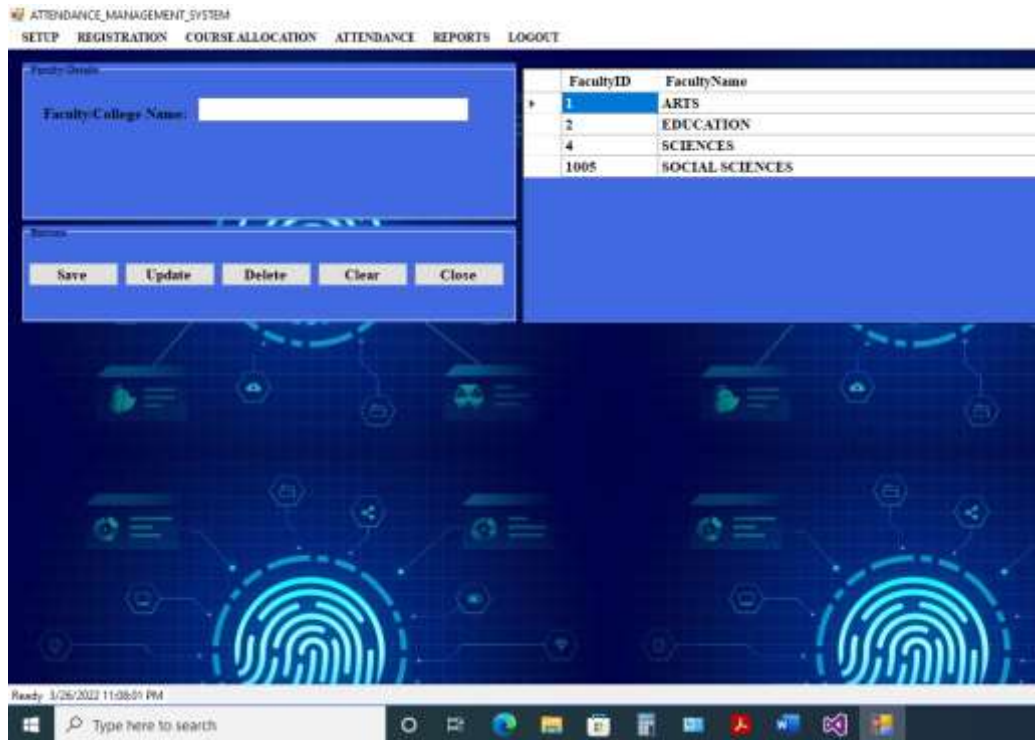


Figure 5: Faculty Setup Form

Figure 6 shows the department setup form of the FAMS. The system administrator setup the departments available in the faculty of the institution by inputting and saving all the required data about the departments. This form is only available to the system administrator.

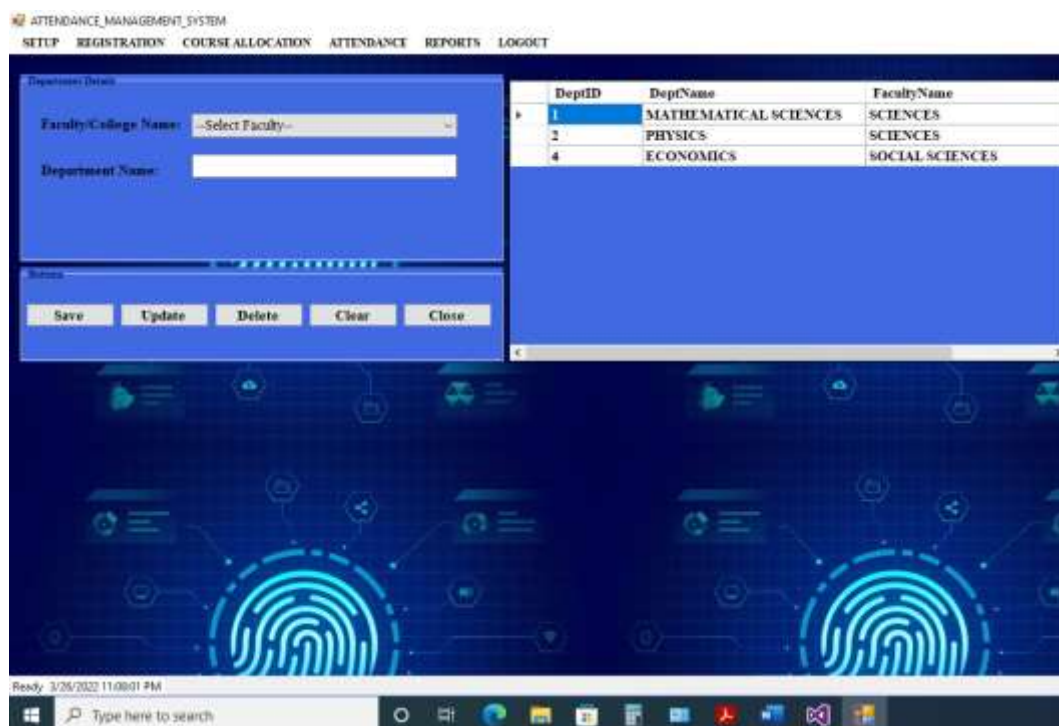


Figure 6: Department Setup Form

Figure 7 shows the unit setup form of the FAMS. The system administrator setup the units available in the department of the faculty by inputting and saving all the required data about the units. This form is only available to the system administrator.

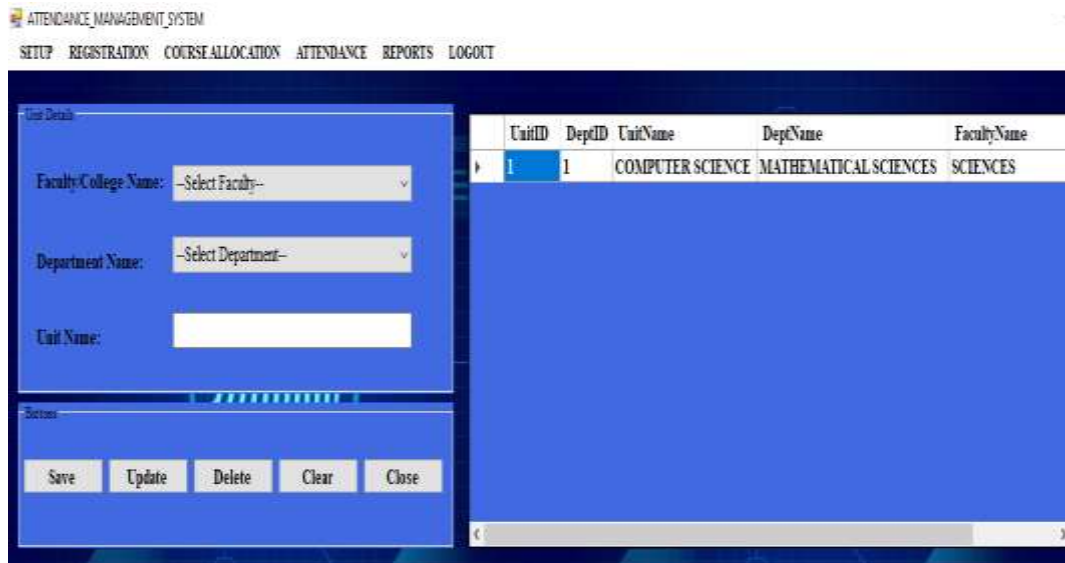


Figure 7: Unit Setup Form

Figure 8 shows the session setup form of the FAMS. The system administrator setup the session at the beginning of a new academic calendar year. This form is only available to the system administrator.

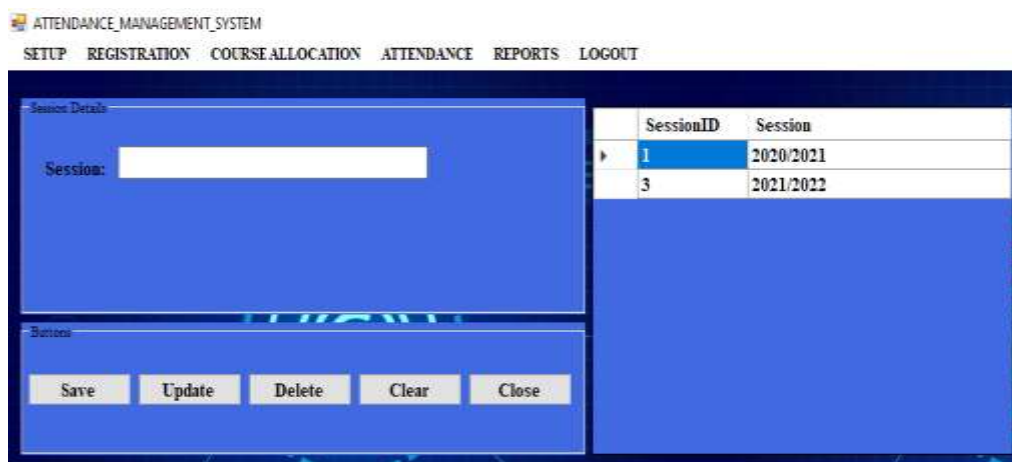


Figure 8: Session Setup Form

Figure 9 shows the semester setup form of the FAMS. The system administrator setup the semester. This form is only available to the system administrator.

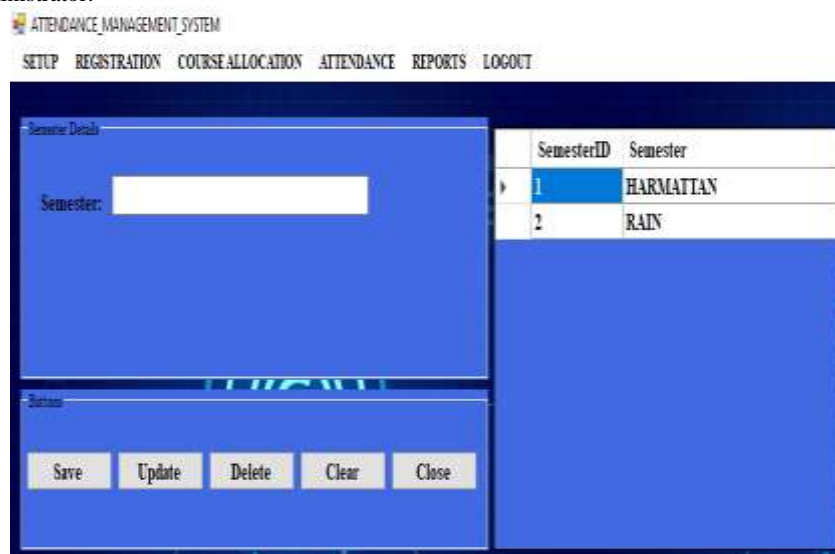


Figure 9: Semester Setup Form

Figure 10 shows the lecture venues setup form of the FAMS. The system administrator setup the venues available for lecture in the faculty by inputting and saving all the required data about the venues. This form is only available to the system administrator.

VenueID	Venue	Dept	Faculty
1	COMPUTER LAB	MATHEMATICAL SCIENCES	SCIENCES
3	LI III	MATHEMATICAL SCIENCES	SCIENCES

Figure 10: Lecture Venues Setup Form

Figure 11 shows the programme mode setup form of the FAMS. The system administrator setup all the available programme in the faculty, such as Pre-Degree, Diploma, Undergraduate, etc. This form is only available to the system administrator.

ProgrammeM	Programme
1	PRE-DEGREE
2	REGULAR

Figure 11: Programme Mode Setup Form

Figure 12 shows the mode of entry setup form of the FAMS. The system administrator setup all the available mode of entry into the institution. This form is only available to the system administrator.

ProgrammeM	Programme
1	PRE-DEGREE
2	REGULAR

Figure 12: Mode of Entry Setup Form

Figure 13 shows the course setup form of the FAMS. The system administrator setup all the available courses in the department. This form is only available to the system administrator.

seID	CourseCode	CourseTitle	CourseStatus	CourseUnit	Semester	Dept	Faculty
1	CMP102	INTRODU...	Compulsory	3	RAIN	MATHEM.	SCIENCES

Figure 13: Course Setup Form

Figure 14 shows the create user's setup form of the FAMS. The system administrator setup all the course lecturer's login details. This form is only available to the system administrator.

ATTENDANCE_MANAGEMENT_SYSTEM
 SETUP REGISTRATION COURSE ALLOCATION ATTENDANCE REPORTS LOGOUT

User Details

First Name:

Last Name:

Email Address:

Password:

User Role:

Buttons: Save, Update, Delete, Clear, Close

AdminID	FirstName	LastName	EmailAddress	UserRole	InstitutionName
1	OLUWADA...	ADEMILUYI	SuperAdmi...	Administrator	OLABISI ONABANJ...
1002	EMMANU...	SALAMI	salamieum...	Administrator	OLABISI ONABANJ...
1003	TOLUPE	IBIRONKE	ibironkectol...	Administrator	OLABISI ONABANJ...

Figure 14: Create User Setup Form

Figure 15 shows the Enroll Staff's form of the FAMS. The system administrator adds all the lecturers in the department by inputting and saving all the required data about the lecturers.

ATTENDANCE_MANAGEMENT_SYSTEM
 SETUP REGISTRATION COURSE ALLOCATION ATTENDANCE REPORTS LOGOUT

Staff Details

Title:

Staff Number:

First Name:

Middle Name:

Last Name:

Gender:

Email Address:

Phone No.:

Faculty:

Dept:

Unit:

Areas of Specialization:

Buttons: Save, Update, Delete, Clear, Close

StaffNumber	FirstName	MiddleName	LastName	PhoneNumber	EmailAddress	Faculty	Dept	Unit	AreasofSpecialization
100UACA...	AHMED	AMAZEM...	OLASUPO	8076543213	amozem...	SCIENCES	MATHEM...	COMPUTE...	ARTIFICIAL INTELL...

Ready 3/26/2022 11:54:17 PM

Figure 15: Enroll Staff Form

Figure 16 shows the Assign Courses form of the FAMS. The system administrator assigns courses to various lecturers in the department with the lecture venues for the course.

Course	CourseStatus	Venue	LecturerI	LecturerII	LecturerIII	Semester	Session	Faculty	Dept
2 CMP102-INTROD...	Compulsory	COMPUTER L...	AHMED A...	AHMED A...	AHMED A...	RAIN	2020/2021	SCIENCES	MATHEMATICAL SCIENCES

Figure 16: Assign Courses Form

Figure 17 shows the Courses Registration form of the FAMS. The student's enrolled for all courses to be taken in the semester of each academic session. In this form, the fingerprint scanner is connected to the system. Courses enrollment is done by collecting student's unique fingerprint with the aid of the fingerprint scanner, the courses selected are stored along with the unique digital fingerprint template taken by the fingerprint scanner in the database.

Figure 17: Course Registration Form

Figure 18 shows the Capture Attendance form of the FAMS. Here the student attendance is been captured with the help of the fingerprint scanner. The student placed their fingers on the fingerprint scanner, the scanner collects the student unique fingerprint and then verify it against the stored fingerprint in the database, if match is yes, it then marks the student as present, but if match is no, it displays no record found which means the students didn't register for the course.

Figure 18: Capture Attendance Form

Figure 19 shows the Daily Attendance report of the FAMS. Here the report displays students that were present in the class during a particular course lecture.


 OLABISI ONABANJO UNIVERSITY Ago-Iwoye, Ogun State, Nigeria (+2348050987864) info@oouagoiwoye.edu.ng			
Course Information			
Course Code	CMP102		
Course Title	INTRODUCTION TO C PROGRAMMING LANGUAGE		
Department	MATHEMATICAL SCIENCES		
Lecturer-In-Charge	Dr. K.K. Abdullah and Olasupo Ahmed		
Date	Sunday, March 27, 2022		
Attendance Information			
S/N	Matric Number	Name	Status
1	SCI/20/21/0001	OLADELE SAMUEL	PRESENT
2	SCI/20/21/0002	SOWUNMI IBRAHIM	PRESENT
3	SCI/20/21/0003	SOYOMBO ABIODUN	PRESENT
4	SCI/20/21/0004	KAZEEM JUMOKE	PRESENT
5	SCI/20/21/0005	RITA CLETUS	PRESENT
6	SCI/20/21/0006	ABOSEDE SOFOLABO	PRESENT
7	SCI/20/21/0007	ADETUTU ABIGAEL	PRESENT
8	SCI/20/21/0008	BENJAMIN ADEKUNLE	PRESENT
9	SCI/20/21/0009	OSUNRANTI KHADUAT	PRESENT
10	SCI/20/21/0010	SALUSI ABIODUN	PRESENT
11	SCI/20/21/0011	OBASAN KEJI	PRESENT
12	SCI/20/21/0012	ODULE TAWO	PRESENT
13	SCI/20/21/0013	FATOYE KOLAWOLE	PRESENT
14	SCI/20/21/0014	ADEKOYA JAMAL	PRESENT
15	SCI/20/21/0015	IFAYE IBUKUN	PRESENT
16	SCI/20/21/0016	OGUNWOBI DAMILOLA	PRESENT
17	SCI/20/21/0017	AYODEJI CHARLES	PRESENT
18	SCI/20/21/0018	OLANBIWOHINJU LAWRENCE	PRESENT
19	SCI/20/21/0019	LASISI OLUWASELMI	PRESENT
Attendance Information			
S/N	Matric Number	Name	Status
20	SCI/20/21/0020	ADAMU RIDWAN	PRESENT

Figure 19: Daily Attendance Report

The developed system was tested to check if the system was able to solve the problems associated with the existing traditional method of taking attendances. Those that participated in the system evaluation testing are students and lecturers in the department of mathematical sciences, Olubisi Onabanjo University, Ago-Iwoye, Ogun State, Nigeria. The lecturers carried out the test, by first enrolling students for courses and take attendance during classes using the fingerprint scanner. The reports collected from the lecturers indicated that the developed system was accurate, secure, fast and efficient in capturing attendances. The students agreed that the system helps to prevent impersonation, saves times and reveal the actual number of times they were present in a class. The lecturers found the system useful and supportive in capturing and saving attendance.

CONCLUSION

In this study a Fingerprint-Based Attendance Management System was designed and implemented. The system

developed has many features which include; managing of courses, academic staffs, course registration by students, capturing attendance, printing of reports, etc. The system was able to provide smart solutions to the problems with the existing traditional attendance system by providing a system which is secured void of impersonation, accurate, process faster, efficient, reliable, economical by saving paper and pen, saves time during capturing of attendance and also helps to eliminate loss of attendance sheet. The future enhancement of the system is implementing it as a web-based application.

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