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A RFID Based Automatic Attendance System in Educational Institutions of Nigeria

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Abstract

As a result of the challenges of the manual method of taking attendance in schools and colleges in Nigeria, an automated attendance system needs to be adopted. The challenges include difficulty in keeping the attendance list over a long period of time, unnecessary time wastage during writing or signing, improper documentation, students forgetting to write or sign the attendance paper, lecturers forgetting the attendance list in the classroom, students writing or signing illegally for an absentee among others. This paper implements Radio frequency identification (RFID) automatic attendance system in Nigeria educational institutions which provides the functionalities of registering students, recording attendance, making decision on the eligibility of a student to sit for an examination in a course and other functions. This work eradicates the deficiencies associated with the manual attendance system with an automated approach implemented through Radio frequency identification (RFID) technology. The case study is Federal University of Technology, Akure, Nigeria.

Keywords*: RFID Tags, RFID Readers, Student Attendance, Course, Examination*

1. Introduction

Some students do not come to classroom due to one reason or the other and because of this they do not perform well in their examination, so there is need to monitor student attendance in the classroom to enhance their academic performance. Students are expected to attend 60 percent of the class before they are allowed to sit for the course examination. The manual method of taking attendance in schools and colleges in Nigeria over the years has become a thing of concern. In the manual method of taking attendance students are required to write down their names and sign the attendance list. The problems associated with this method vary from unnecessary time wastage to improper documentation, students forgetting to put down their names on the attendance list or students writing on behalf of other students that are absent from the class. To eradicate the deficiencies associated with the manual attendance system, an automated approach is implemented through Radio frequency identification (RFID) technology.

The RFID based automatic attendance system includes the RFID reader, RFID tags, computer system, and host system application. The RFID based automatic attendance system is used for automatically taking students' attendance and giving warning to students on cases of low attendance which could degrade the performance of student or prevent the student from taking the course examination, if the class attendance percentage is less than 60.

2. RFID Technology

Radio frequency identification (RFID) is a technology that transmits data using radio waves from an RFID tag attached to an object by the reader for tracking and identifying objects [8]. RFID system contains two main components; the reader and the tags. The tag

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is normally attached to the objects to be monitored and carries information in a microchip. The reader on the other hand detects tags that are within it frequency range and writes to or read from the tags [2].

2.1. The RFID Tag

The RFID tag is primarily is a kind of a memory device that can transmits its contents when being scanned by the reader. The memory consists of binary digits called the bits, and the transmission and receiving of data has a communication channel. The tag can be an electronic circuit with its own power supply (an active device) or a very low power integrated circuit (passive device) which taps energy from the scanner to transmit its content. In a tag, the transmission power is very low and is measured in millionths of watt i.e. microwatts [1]. Tag can be passive, semi-passive or active. It can also be categorized based on memory type and based on the transmission channel. Passive RFID tags have no internal energy source; energy supplied to the antenna by the incoming radio frequency waves induced enough energy for the CMOS integrated circuit in the tag to get activated and transmits a response. The semi passive tag is similar to passive tag, but has an addition of small power source (battery). This battery constantly powers the integrated circuit of the tag and the need for an aerial to tap energy from the incoming signal is removed [5].

Active tags have their own internal energy source which supplies energy for the integrated circuit producing the outgoing signal. They are more sophisticated and reliable due to their ability to conduct a session with the reader. As a result of their onboard energy source, they can transmit at a higher power level than passive tags, allowing them to be of more effective in RF challenged environments such as water, metal or at longer distances. They can transmit signal over a greater distance and their random access memory (RAM) gives them the ability to store up to 32,000 bytes of data. A battery can live up to 10 years and have practical ranges of hundreds of meters. Types of tags that were used in the RFID system are ISO card, clamshell card and also soft label. Tag used in this project is passive tag and the model of RFID reader is RFIDIDR-232N [2].

2.2. The RFID Reader

The RFID reader sends a pulse of radio waves to the tags and listens for its response. The tag detects this pulse and sends back a response; the tag ID number and possibly other information as well [7]. The RFID reader can be classified based on the design and technology used (read or read-write) or based on the fixation of the device [8]. The read only RFID reader only reads data from tags, usually a microcontroller based unit with a wound output coil, peak detector hardware, comparators and firmware which are designed to transmit energy to tags and read information back from them by detecting their backscattering modulation, different types for different protocols and standards existing. The read/write reader reads data from/to tags. While in stationary reader, the device is attached in a fixed way.

3. Related Works

Automatic Access Control Using Student ID Card Based on RFID Technology [2], the automatic access control system evolves to prevent illegal entry of people into a building and preventing unauthorized people from gaining access to certain organization resources. The door locking system functions in real time, the door open as soon as the user scans the tag. The system also stores the login and logout information of the user.

Inotified an SMS and RFID Based Notification System [5] enables parents to monitor the presence of their children at a specific time. The time in and out of every student is generated through scanning of their ID card at the gate followed by sending the SMS

notification of the attendance to their parents. Limitation of the system is that there is no acknowledgement between the sender and the receiver.

RFID Based Exam Hall Maintenance System [6] resolves the problem of students searching for their examination halls and seating arrangements. The card reader is provided at the entrance of the building. A student needs to swipe his tag in front of the reader at any hall and his hall and seat number would be displayed on the LCD.

Application of RFID Technology in Libraries [4], RFID based library management saves the library staff's time and energy by automating their task. Borrowing and returning of books are automated using the check-in, check-out system which is RFID based. The limitation of the system is that it is costly to implement.

Factors that motivated towards adopting of RFID based automatic attendance system in schools in Nigeria are challenges that usually occur during manually taking attendance i.e. writing and signing for students that are not physically present at the classroom by his friends, taking attendance in a large class could be cumbersome where there could be many students wanting to write and sign the attendance list at the same time, which could lead to tearing of the attendance list or some students not being able to write down their names on the attendance list before the end of the class. Also the lecturer can also misplace the attendance list. RFID technology is implemented because it is cheaper, secured and easier compared to other technologies.

4. System Architecture and Implementation

The development of the RFID based automatic attendance system is divided into two main parts; the hardware and software. The hardware part consists of the RFID reader, tags and the host computer. The software part is the host system application designed using VB.net incorporated with Microsoft access database. Administrator or lecturer can login into the system and check necessary information in the application, which keeps a log of the ID, time and date of every student that enters the lecture room for lecture. It also can register new student using the tag ID of each tag. In connecting the RFID reader to the PC, UART is incorporated by through the RS-232 (Serial Port) cable. The complete system (see Figure 1) is placed at the entrance door of the lecture room [3].

A RFID tag is given to each student in the department (which is embedded into their ID cards) and this is scanned at the entrance of the lecture room by the reader. The RFID contains a unique code that is scanned by the reader. On every scan by the student, the name, matriculation number of the student, the course to be taken and the date are displayed on the user interface if the tag number matches that which is stored in the database.

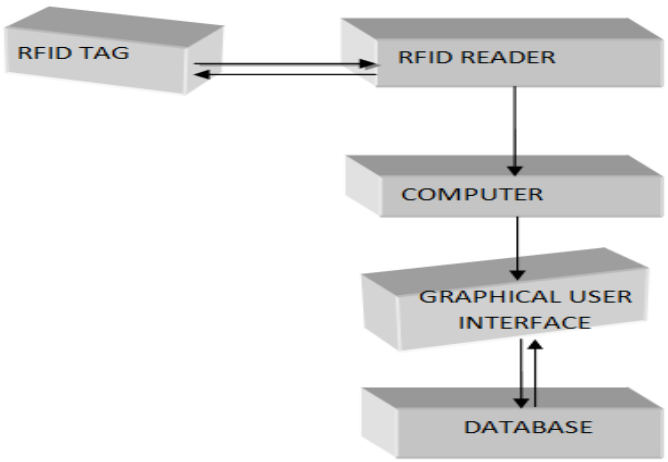

Figure 1. Overview of the Automated Attendance System

4.1. Implementation

The RFID system was successfully integrated with graphic user interface on the host system. The system consists of login form, admin form, database form, main menu form, class record form, and admin registration form and database record form interface using USB UART serial communication with the RFID reader. The system performs two main functions which are class attendance system and students' evaluation for eligibility to sit for examination.

4.1.1 Graphical User Interface

The graphical user interface is created with visual basic 2010 and it consists of the database system used to store all the student details, date and time. There are seven tables built in Microsoft Access database to store the RFID based automatic attendance system's information. There are eight frames designed in vb.net which are frame login, class record, admin, database, student evaluation, admin registration, student record and course record.

4.1.2 Login Window Form

The login window is built with tightened security which allows only authenticated person to access this system. The administrator needs to create his user name and password to log in this system. Therefore, the administrator needs to key in the correct username and password to access this system and can quit this system by clicking the exit button to turn off the system. The administrator can make selection either to login to the admin page or attendance page (See Figure 2).

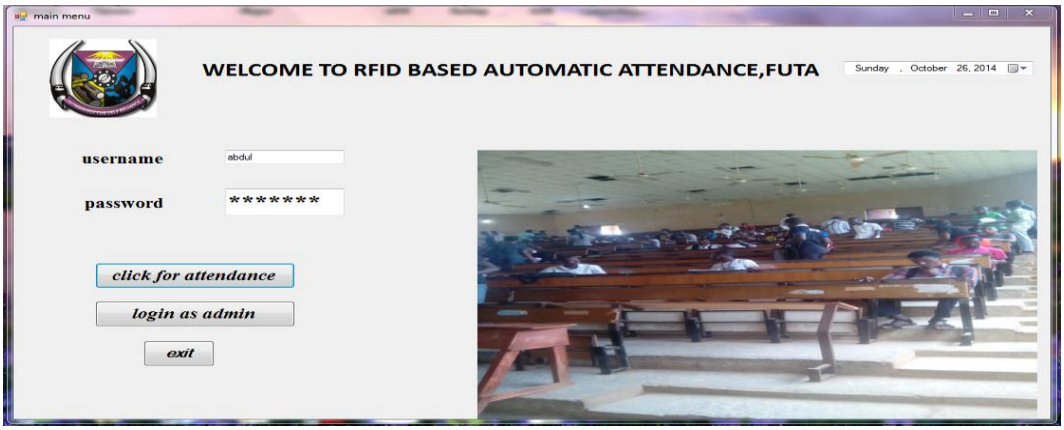

Figure 2. Login in Window Form

4.1.3 Class Record Window Form

The attendance page will pop up after the administrator successfully key in the correct username and password and click the attendance button. The attendance page consists of the grid view for displaying the student information, port button for opening the hardware port, port button for closing the port and the exit button showed in figure 3. The grid view is used to view the attendance record. This class record window is used to record the student attendance into the database system when the students attend the class. Administrators need to activate the port by clicking the port to open it so that it can receive the signal from RFID reader through USB serial communication. Administrators can easily trace the student who attends the class according to the student name, date and the time. Administrators can print the time log record of the student attendance

information. Administrators can deactivate the port by clicking the port close button which will terminate communication with the USB serial communication.

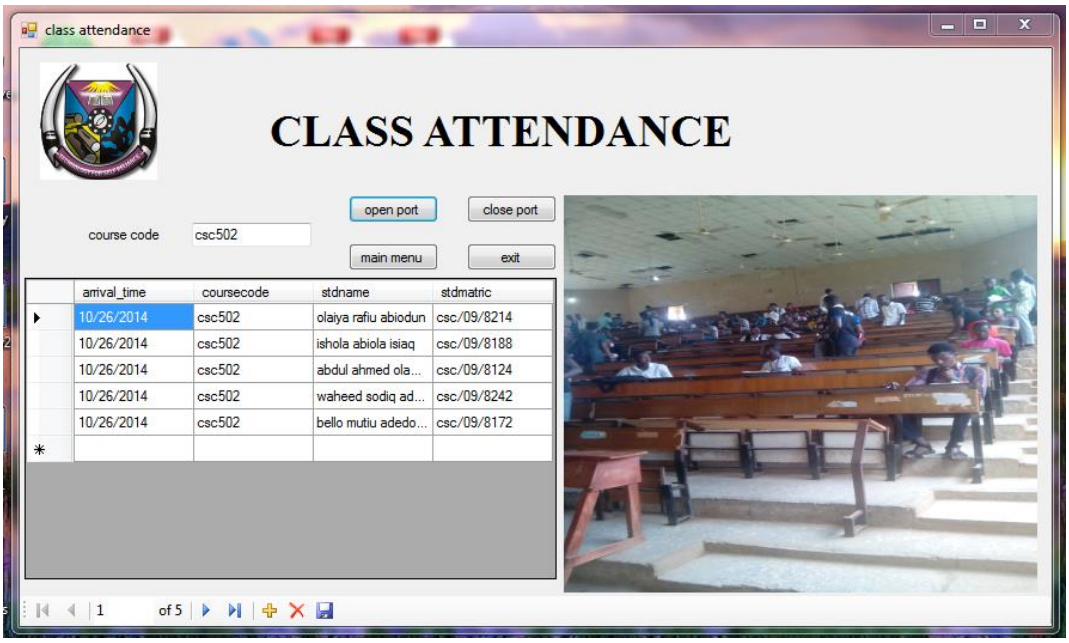

Figure 3. Class Record Window Form

4.1.4 Admin Window Form

The admin window form consists of the main menu button, evaluation button, admin registration button, database button and the exit button. The main menu button displays the login window form, the evaluation button displays the student's eligibility to sit for examination, the admin registration button displays the registration window form for the administrator and the database button displays records window form (see Figure 4).

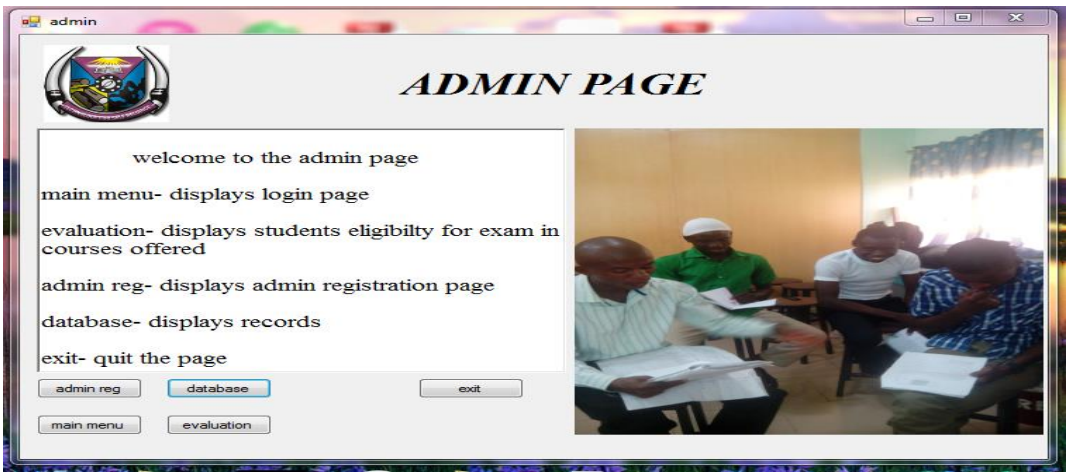

Figure 4. Admin Window Form

4.1.5 Database Window Form

This database window form consists of the course record button, student record button and the student attendance record button. The record button displays the student record, the attendance record button displays the attendance record of the students and the course record button when displays the course record (see Figure 5).

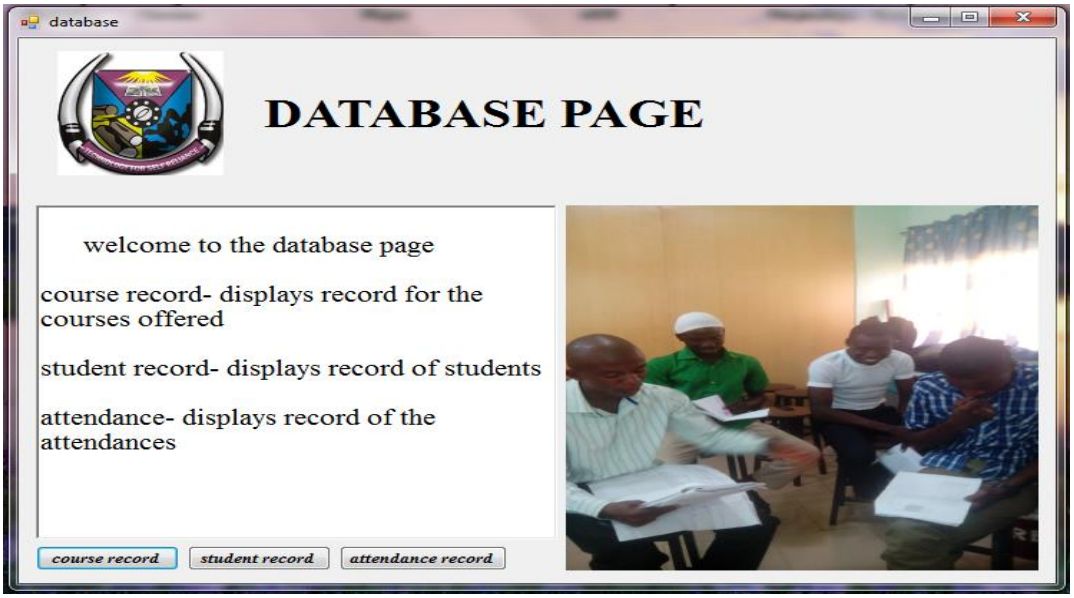

Figure 5. Database Window Form

Clicking the student record button in Figure 5 displays student information where administrators can add, delete and save students' details (see Figure 6). Clicking the attendance record button in Figure 5 displays student attendance information (see Figure 7). Clicking the course record button in Figure 5 displays course information (see Figure 8).

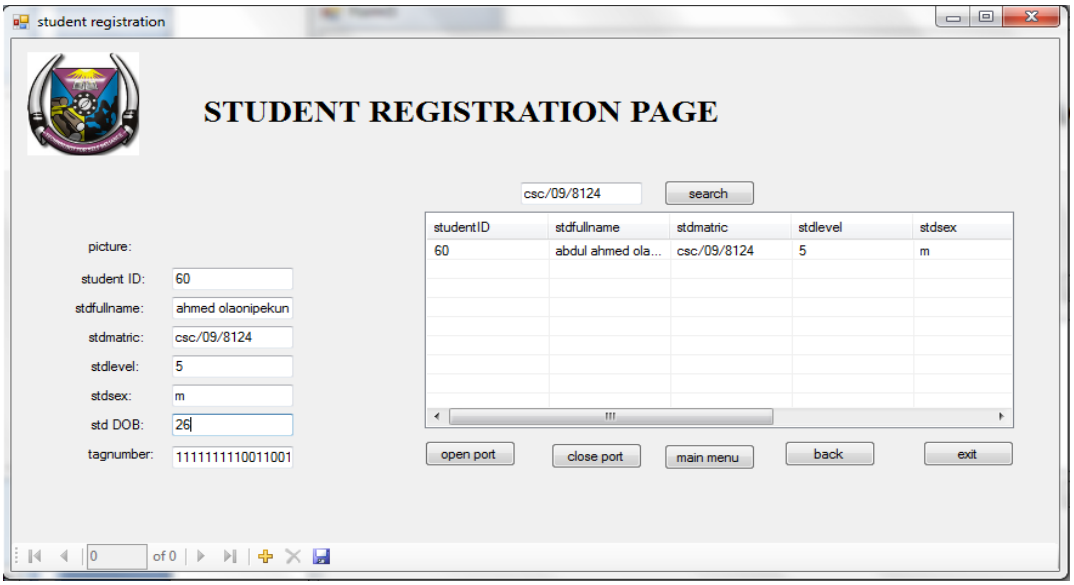

Figure 6. Student Registration Window Form

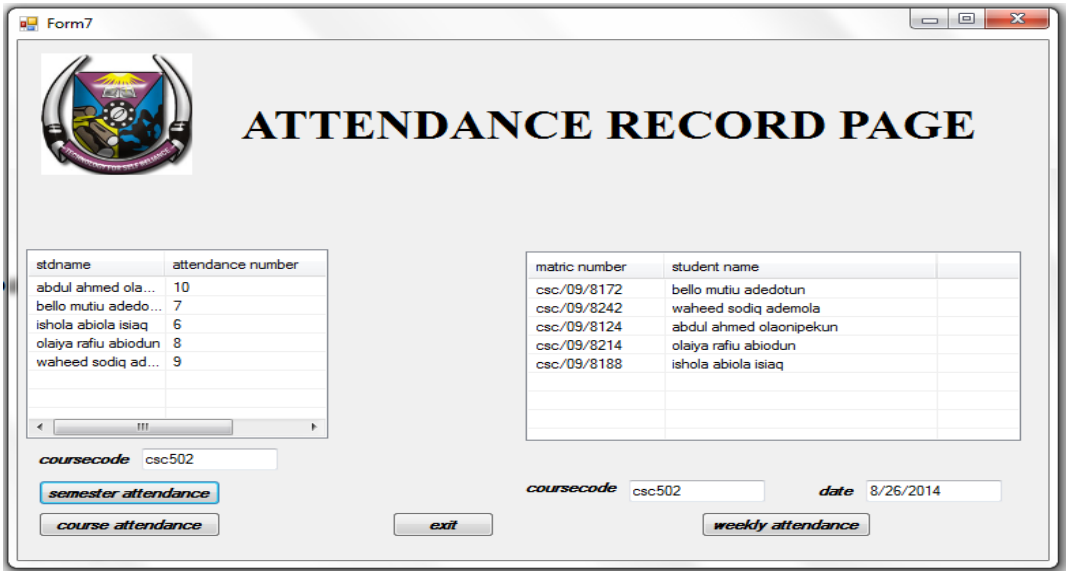

Figure 7. Attendance Record Information from Database System

Figure 8. Course Record Window Form

4.1.6. Student Evaluation Window Form

The student evaluation page consists of the eligibility button, non-eligibility button, exit button and the list view. The eligibility button displays the name of students who are eligible to sit for the examination whose course is stated in the course code label based on the assumption that a student must have at least 60 percent of attendance in that course. The non-eligibility button displays the name of students who are not eligible to sit for the exam whose course code is stated in the label based on the stated assumption (see Figure 9).

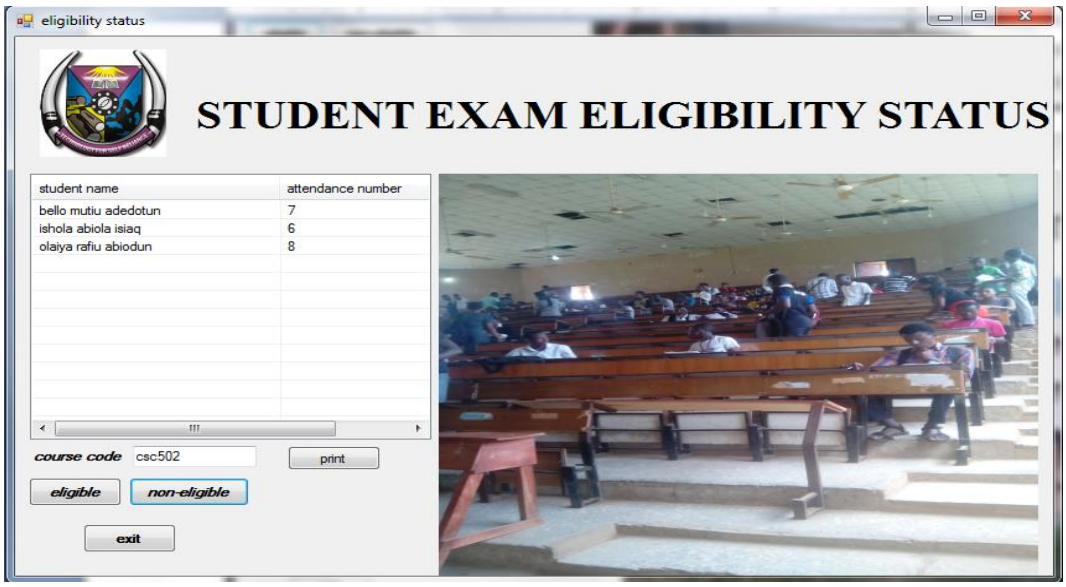

Figure 9. Student Exam Eligibility Window Form

4.1.7 Admin Registration Window Form

The admin registration for is used for registering an administrator account by providing his/her username and password and storing them in the database. Admin information can be edited and saved here also (see Figure 10).

Figure 10. Admin Registration Window Form

4.2. Limitation of Study

The limitation of this study is that a student can swipe another student's tag to register his/her attendance; this limitation will be tackled in the future work.

5. Conclusion

The design and implementation of a RFID based automatic attendance system which is the aim and objective of this paper was successfully implemented. This system provides an effective and more convenient method of taking attendance when compared to the manual system. Data are more organized, the system is user friendly, data manipulation and retrieval is done via the graphical interface. The system can be implemented in any educational institution in Nigeria. It has been implemented in Federal University of Technology, Akure, Nigeria.

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