RFID Based Attendance System Using Ardiuno

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Abstract
Over the years, registering attendance is among the important activities practised by both private and public organisations. This activity involves notifying presence at a particular place of work and specific time. Different organisations have mandated attendance registration as part of their work ethics and must be valued by employees. In Nigeria, educational institutions still use manual paper-based attendance methods for maintaining their student's attendance record. The method is inefficient, time-consuming and difficult to manage if it involves a large number of attendees. To address these challenges, this work designed and implemented Radio Frequency Interference (RFI) based attendance system using Arduino, Liquid Crystal Display (LCD), Real-Time Clock (RTC) and SD card module. The system has an RFID tag that comes with unique identification (UID). When the card is near the RIFD reader, a buzzer and led gets activated indicating their attendance has been marked. The UID is stored in the SD card with the id number, date and time of checking in. The attendance system helps to prevent proxy attendance, thus increasing the reliability of attendance records.

Keywords: Educational Institutions, Attendance System, RFID, Arduino, Integrated Circuit.

INTRODUCTION

In an educational institution, attendance records are necessary to determine and validate student eligibility during the class or examination day. The traditional attendance-monitoring scheme has a few obstructions with the development of the latest technology. For example, giving out the daily attendance sheet to a large number of students in a class is extremely hectic and may hinder the students learning in that particular class. This is considered a waste of time as well as inefficient and hence the need for an automotive method. Many types of research in this area have discovered alternative ways to improve and

replace the traditional way of using paper with advanced technology.

Radio Frequency Identification (RFID) technology is an emergent technology that is used in a wide range of applications, it is a member of the family of Automatic Identification and Data Capture which is referred to as (AIDC) technologies. It is the fastest and most reliable means and method of identifying an object or thing. RFID operates by transferring and receiving a signal using an antenna and Integrated Circuit (IC). It has two parts, the tag and the reader.

The tag contains an IC and an antenna, which is used to transmit data to the reader also known as an interrogator. The reader then converts the radio waves to a more usable form of information. The data collected from the tag is then transferred through a communications interface to a host computer system, where the information can be stored in a database and used later [1-3].

The developments in RFID technology continue to produce larger memory capacities, faster processing, and wider reading ranges. There are high tendencies that the technology can replace barcode even with the expected reduction in raw materials together with economies of scale; the integrated circuit (IC) in a radio frequency (RF) tag can never be as expensive as a bar code label. Nevertheless, RFID usage will continue to rise in areas where barcode or other optical technologies are less effective [4].

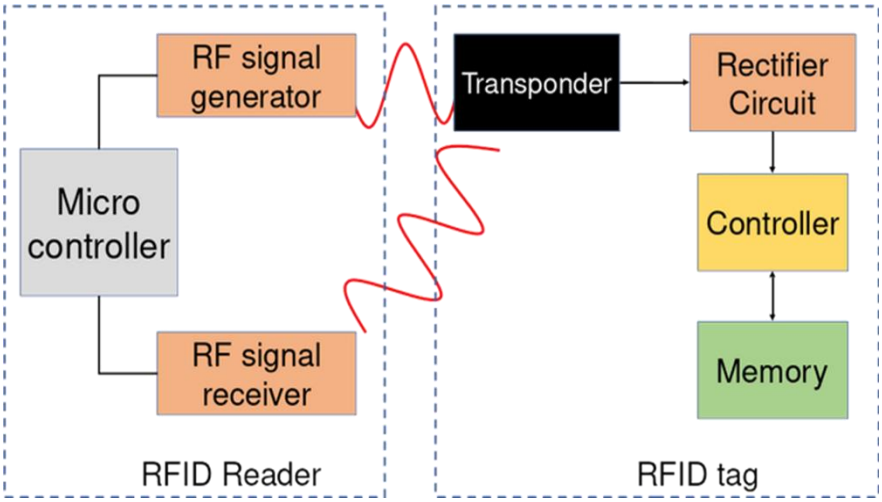

Figure 1: Scenario of the Proposed Attendance System

A study from [5] implemented a low-cost portable smart card-based attendance system. The system combines Radio Frequency Identification (RFID) with fingerprint biometric technology to enhance the safety level and integrity of the records. Bhattacharya et. al recommend having an attendance system that is based on facial recognition. They developed a portable facial recognition attendance system by integrating ubiquitous components [6].

Islam et al. developed a smart-phone attendance system with SMS enabled to keep the student's guardian informed about his child's attendance. The

system has the feature of calculating attendance percentage [7, 8]. Researchers in [9, 10] used RFID technology to implement attendance system. When the RFID reader installed at the entrance detects an RFID tag, the system captures the user's unique identifier (UID) and compares it with the stored UID for a match.

METHODOLOGY

Implementing the RFID technology-based attendance system involves two major subtasks, hardware components configuration and the development of instructions to guide the hardware components to accomplish the desired task. In this section, the hardware components configurations and the development of instructions are first discussed. Subsequently, the workflow of the integrated attendance system is presented.

Hardware Configuration

The attendance system developed in this study is formulated as an interrogator – transponder system. The interrogator usually transmits and receives the signal while the transponder is attached to the object also referred to as the tag. This tag reader generates a radio frequency interrogation, which communicates with the tags been registered in the system. The reader likewise has a receiver that captures a reply signal generated from the tags and decodes the signal. This reply signal from the tags reflects the tag's information content. To achieve that, both the interrogator and the transponder consist of several hardware components. These components are:

a. Arduino
b. MFRC522 RFID Reader + Tag
c. Micro SD Card
d. RTC Module
e. 2x LEDs (1x red + 1x green)
f. 2x 220 Ohm Resistor
g. LCD Display (20*6)
h. Breadboard
i. Jumper Wires

a. Arduino

The Arduino is the main board and brain of the system. It is the microprocessor that accept all the input data, process it and give out the result. This component can be seen in Fig. 2(a) below.

b. MFRC522 RFID Reader + Tag

The RFID reader is a two-way radio transmitter-receiver that sends a signal to the tag and reads its response, it transfers data over short distances using electromagnetic fields. It's useful in identifying people and objects by which the tag is attached to. Each tag has its own unique identification (UID). As shown below in Fig. 2 (b& c).

c. Micro SD Card

When a tag is read, its UID and time are saved on an SD card to keep track of the specific time the user check-ins. The SD card can be seen in Fig. 2(d) below.

d. RTC (Real Time Clock) Module

To keep track of time, we're using the DS3231 RTC module as shown in Figure 2(d). However, this project works just fine with the SD1307, which is very similar. One main difference between them is the accuracy. The DS3231 is much more accurate than the DS1307.

e. LEDs (1x red + 1x green)
Two different coloured light emission diodes (LED), 1 red and 1 green were used for the implementation. The red light signifies unsuccessful capture of the tag or wrong identification or duplicate. The green light is for successful capture of the attendance.

f. 2x 220 Ohm Resistor
Two 220 Ohm resistors are used to manage the current flow in the circuit.

g. LCD Display (20*6)
A liquid crystal display (LCD) screen with resolution of 20 * 6 was used for displaying information to the attendee.

h. Breadboard
Breadboard is used to hold the various hardware components wired together in the circuit.

i. Jumper Wires
Jumper wires were utilized to connect the hardware components together and establish flow of signals.

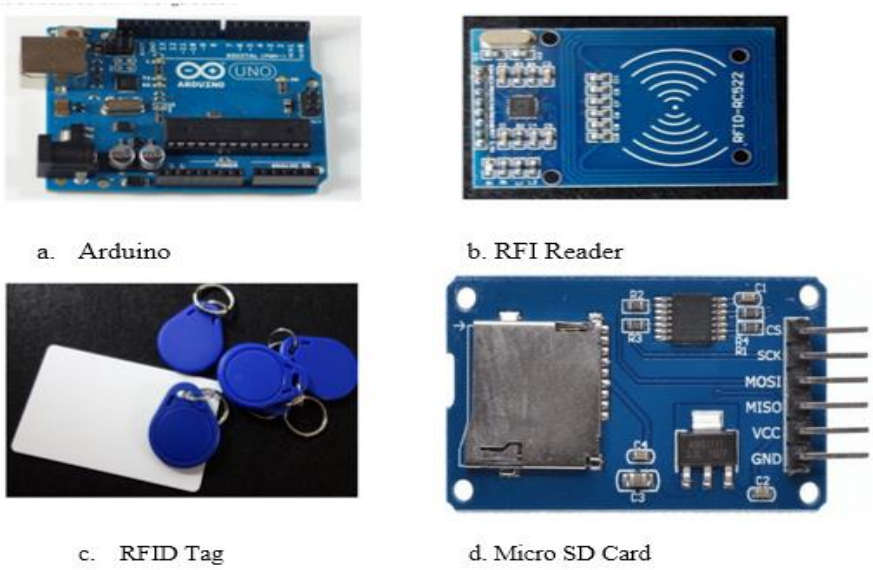

Figure 2: Hardware Components of the Attendance System

Software Development
This section described the development of the program that can be used together with the hardware components to form the complete attendance system.

Since the problem is well understood, we adopted waterfall model as our chosen model for the software development. The model has six phases as shown in Figure 3.

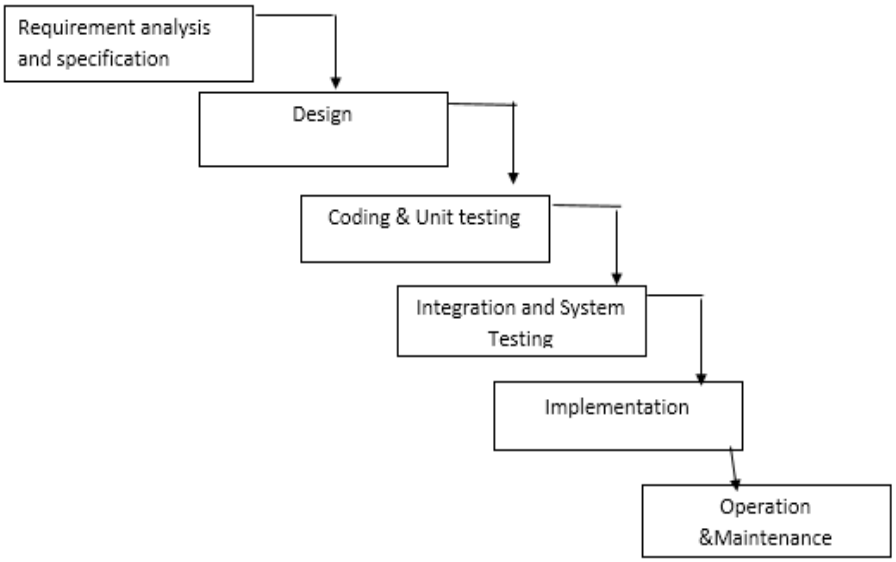

Figure 3: Waterfall Model Adopted in the Software Development.

Figure 4 demonstrate the flowchart of the proposed attendance system. A user information including his corresponding tag ID must be registered in the system first. The registered tag is to be used by the individual student to sign-in or sign-out the attendance by swiping the tag on the RFI reader. The reader authorizes the user by checking user's tag ID in its database. The corresponding user is sign-in or sign-out if the card is recognised otherwise it's reject the card and repeat the whole process.

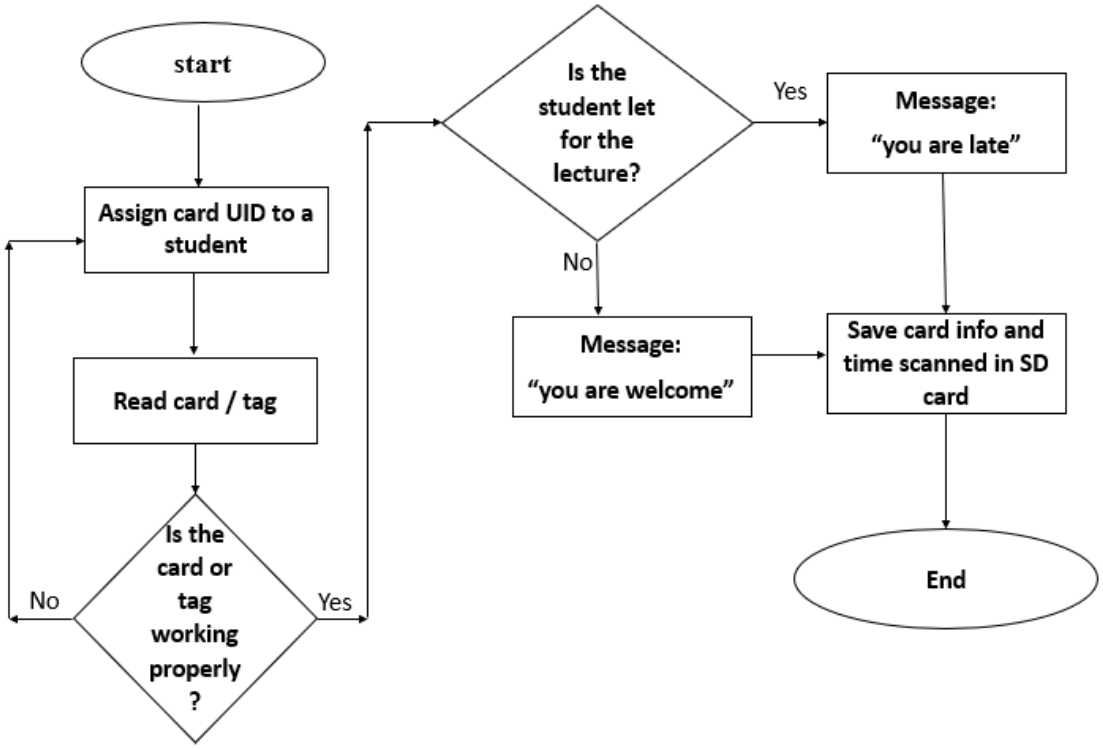

Figure 4: Flowchart of the Proposed System

SIMULATION RESULT

This section describes the applicability of the attendance system by running a real-life simulation study. The result of the simulation demonstrates the suitability of our proposed Radio Frequency Identification (RFID) technology based attendance system in educational institutions.

Registering for presence in the system requires a user to swipe the appropriate tag over the RFID module and then the module takes the tag ID. Applying the same method, all the users will be registered into the system.

Figure 5 shows the interrogator – the reader of the attendance system and the transponder – tag, after completion. When the RFID reader reads an RFID tag, it saves the current time and the user ID of the tag in an SD card. The Arduino communicates with the SD card using an SD card module. When a user is on time, a green LED lights up and welcome message displays on the liquid crystal display (LCD) as shown in Figure 7. And a red light pops up when a user is late as shown in Figure 6. The system also has a buzzer that beeps when a tag is read. A segment of the codes for the explanation above is shown in Figure 8 below.

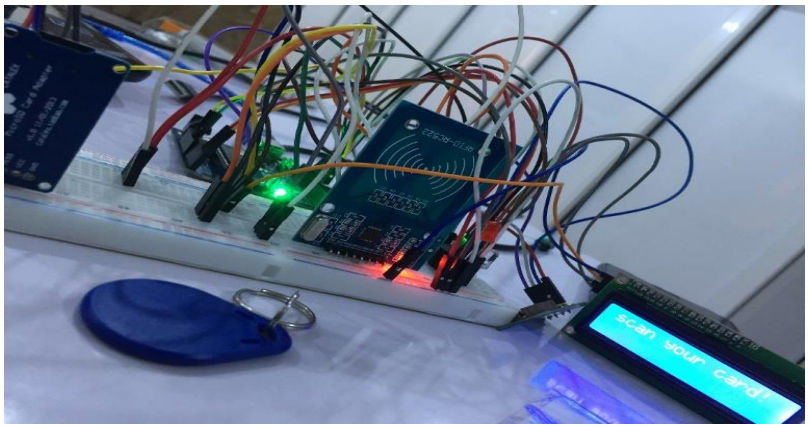

Figure 5: The RFI Reader and the Tag

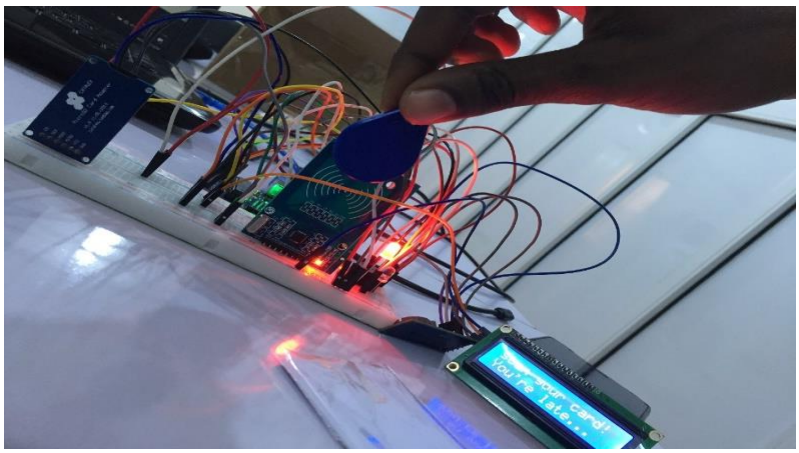

Figure 6: Simulation of Registering Attendance

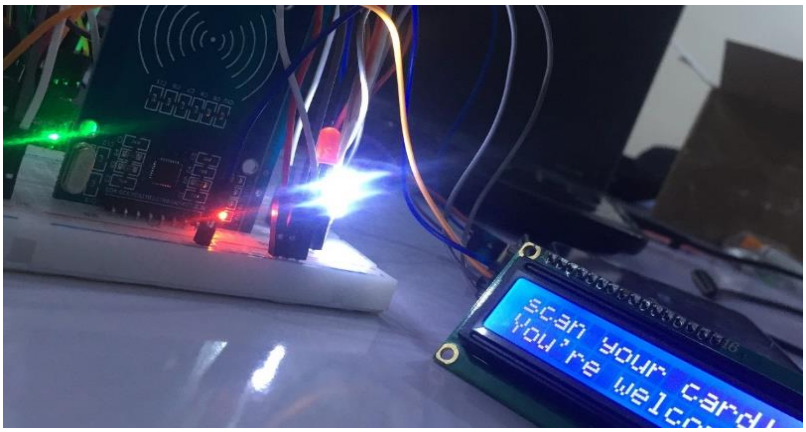

Figure 7: An acknowledgment after Registering Attendance.

```
void verifyCheckIn(){
  if((userCheckInHour < checkInHour)||((userCheckInHour==checkInHour) && (userCheckInMinute <= checkInMinute))){
    digitalWrite(greenLED, HIGH);
    delay(2000);
    digitalWrite(greenLED,LOW);
    Serial.println("You're welcome!");
    lcd.setCursor(0,1);
    lcd.print("You're welcome!");
  }
  else{
    digitalWrite(redLED, HIGH);
    delay(2000);
    digitalWrite(redLED,LOW);
    Serial.println("You are late...");
     lcd.setCursor(0,1);
    lcd.print("You're late...");
  }
}
```

Figure 8: Segment Code

The series of events taking place in the attendance system can be viewed using the monitor of the Arduino. This is also useful to the programmer as it can be used to display error message or any fault that is not set to display on the LCD screen. Figure 9 shows the relevant data that can be display on the Arduino monitor.

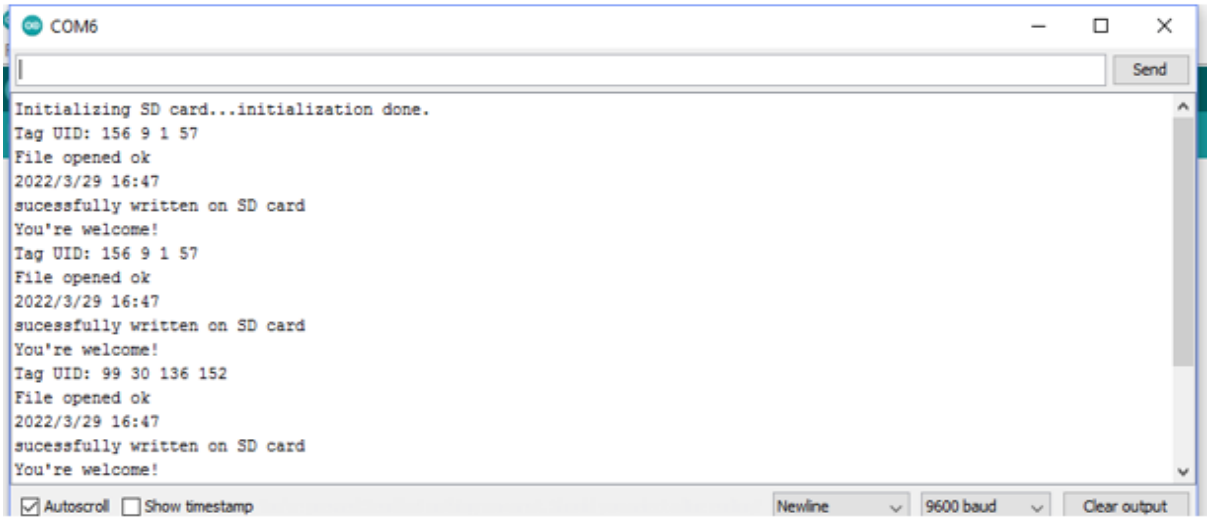

Figure 9: Display of the Login Activities in the Attendance System

The data generated during the login attendance can be exported to a file for further use. In an educational institution, these data can be used for attendance record of the students. Figure 10 show an example of the data generated been exported to a file. The data reflect the user ID, the date and exact time the user sign-in or sign-out.

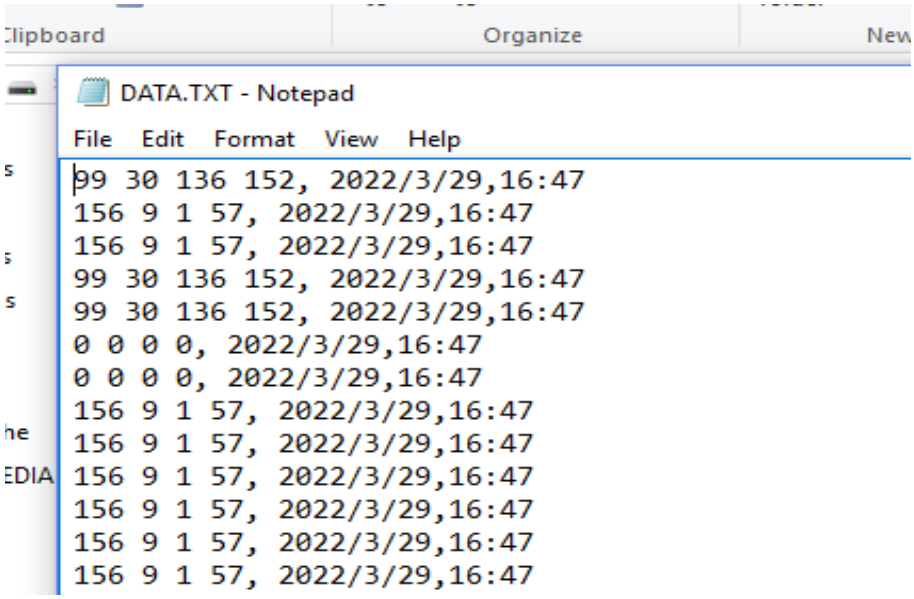

Figure 10: The Attendance Data Exported to a File.

CONCLUSION

Registering attendance is one of the important activities practised by both private and public organisations. In this work, we proposed and implemented a Radio Frequency Identification (RFID) technology-based attendance system suitable to be adopted in educational institutions in Nigeria.

The traditional process of manually taking and managing attendance is highly inefficient and time consuming. The RFID technology based attendance system has the potential to streamline the whole process. A RFID based portable attendance system proves to be highly efficient, easy to use, user friendly and secured. The cost involved in making this system is quite less, when compared to conventional attendance system. The use of SD card to store the attendance records makes all the data easy to access and retrieve.

Due to the useful nature of RFID attendance system and the knowledge obtained here we offer some recommendations for future work. They are:

i. Calculate attendance percentages of students and intimate teachers if attendance is below certain percent.
ii. Use of sim card module to let parents follow up on children lecture attendance.

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