Attendance Recorder using RFID Reader Module

J Component Project Report for the course

CSE2006 Microprocessor and Interfacing

by

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Submitted to

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Certificate

This is to certify that the Project work titled "Attendance Recorder using RFID Reader Module" is being submitted by ***G. Narayanee Nimeshika*** **(20BPS1111)** and ***C. Jai Ganesh*** **(20BPS1115)** for the course **Microprocessor and Interfacing**, is a record of bonafide work done under my guidance. The contents of this project work, in full or in parts, have neither been taken from any other source nor have been submitted to any other Institute or University.

Dr.D.Vydeki

Abstract

The obstacles and difficulties faced by manual attendance in schools and colleges is the key problem statement addressed in our research. Every school or college has its own method of collecting attendance from students, which entails students writing or signing in the attendance register, as well as making roll calls during lecture hours. So, the issues with these types are that students may commit or involve in malpractice by writing someone else's name and signing for them, and that some students may forget to mark their attendance, and that it takes up a lot of time for both students and faculty. This project was created with the sole purpose of relieving teachers of their burden. The authorized student is given an RFID tag in this proposed system. As a result, the information contained on this card is referred to as the person's identification or attendance. When the student presents the card in front of the RFID card reader, it scans the information and compares it to the information stored in the microcontroller (Arduino UNO). If the data is correct, the Green LED illuminates, verifying the student's entry; otherwise, the Red LED illuminates. The PLX-DAQ, which stands for Parallax microcontroller data acquisition add-on tool for Microsoft Excel, receives the status of a student's attendance immediately. Any microcontroller attached to a sensor and connected to a PC's serial connection can transfer data directly to Excel. It also uses real-time data to identify late entries, making it even more easeful. As a result, the Excel sheet can be used to retrieve information about the student's attendance record which includes Student's Name, Register Number, Date and Time. Hence, a significant amount of time is saved because all of the students' attendance is stored directly in the database. This project is based on a Radio Frequency Identification (RFID) automatic attendance system which can be used in educational institutions, with features like student registration and attendance tracking. This project replaces the human attendance system with an automated solution based on radio frequency identification (RFID) technology, which eliminates the flaws associated with it.

Keywords: PLX-DAQ, Radio Frequency Identification, Arduino UNO, LED

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List of Symbols

Symbol	Title	Page No.
Φ	-	
λ	-	
μ	-	
β	-	

List of Abbreviations

Abbreviation	Title	Page No.
RFID	Radio Frequency Identification	1-14
PLX-DAQ	Parallax microcontroller data acquisition add-on tool	1-14

Introduction:

Student's Attendance is an essential necessity for daily teaching. Making roll calls or manually signing the attendance sheet is the most primitive technique of recording attendance. Both strategies are inconvenient in a classroom with a larger number of students. In a large classroom, the roll call approach is prone to false attendance, and it also takes longer to call the names of all the students. Significant issues also occur when converting paper-based data to an electronic format for use in student electronic records in order to calculate overall attendance at various levels. The issues with these approaches range from unnecessary time waste to faulty documentation, such as students forgetting to sign the attendance list or students writing on behalf of other students who are absent from class. An automated technique is adopted using Radio Frequency Identification (RFID) technology to eliminate the flaws associated with the human attendance system. Radio Frequency Identification (RFID) is an automatic identification technique that allows you to retrieve or save data from RFID tags without having to touch them. RFID Tags, RFID Readers, Middleware, and a Backend database are the main components of an RFID system. An RFID reader can either passively activate a tag or actively transmit RF signals to the reader. When the RFID reader is in close proximity, it uses its antenna to read the information stored on the tags. The reader is designed to work at a specific frequency since its effective range is determined by its operational frequency. The reader's operating frequency is 13.56 MHz. To achieve maximum efficiency and optimum performance of the application, the RFID system is interdependent on its basic components. Hence, in the proposed system, when a student scans his or her card in the RFID reader, their name, register number, date, and time, are saved in a special form of an excel sheet called PLX – DAQ. PLX – DAQ is an excel sheet that is used to save data from sensors or readers which are connected to microcontrollers.

Objective:

The main objective of our project is to eliminate manual attendance errors while also reducing the amount of time spent doing so. Our project "Attendance Recorder Using RFID Module" will provide an effective method for resolving inaccuracy and reducing the workload for professors. The following are the objectives:

- To analyze the working of Radio Frequency Identification and Microcontroller (Arduino UNO)
- To design and build a Radio Frequency-based attendance system that overcomes the drawbacks of the manual approach.
- To test the proposed system using a few RFID tags and observe the limitations or constraints it has.

The use of RFID in student management will bring additional benefits such as increased efficiency and simplicity.

Scope:

The attendance of students is a requirement for everyday teaching. The RFID-based attendance system is intended for use in schools, universities, and institutions, but it may readily be adapted for use in other settings where attendance is required, such as industries, businesses, hospitals, and banks. The system might potentially be tailored for use in exam rooms to replace the usual technique of signing attendance during an exam. In principle, the system might be used anywhere secure and limited access to an area is required. This might also be used as a substitute for the finger print-based marking technique because it is just as effective and reliable.

Design/Implementation

2.1 Introduction:

Our project involves combining Arduino, a microcontroller and RFID reader, to create an attendance recorder. A Radio Frequency Identification Reader (RFID) is a device that uses electromagnetic fields to collect data from RFID tags. When these tags get close to an RFID reader, the device detects and scans them automatically. We developed the code to write and read RFID tags using this technique. In the tag, we wrote the student's details, such as their registration number and name. When the reader scans the tag, this information, along with the date and time, is saved in a special type of excel sheet known as PLX-DAQ. This sort of excel sheet can be used to save data from any sensors or readers attached to the microcontroller.

2.2 Design Approach

This section explains how the project's various units were designed and implemented.

The system is divided into three stages:

- Circuit design
- Algorithm
- Flow Chart

Circuit design

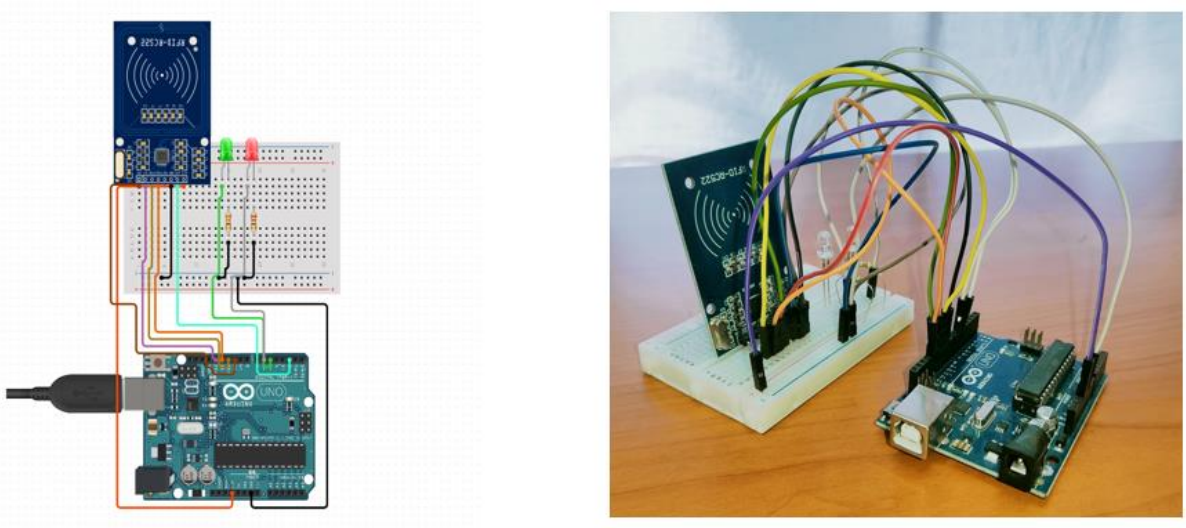

Figure 2.2 (a) and (b) Simulation and Hardware

Arduino (UNO)

The Arduino Uno is an open-source microcontroller board designed by Arduino and based on the ATmega328P microcontroller. The board has digital and analog input/output (I/O) pins that can be used to connect to other expansion boards9shields) and other circuitry. The board includes 14 digital I/O pins (six of which are capable of PWM output), 6 analog I/O pins, and is programmable through a type B USE cable with the Arduino IDE (Integrated Development Environment). It accepts voltages between 7 and 20 volts and can be powered by a USB connection or an external 9-volt battery. It's also comparable to the Arduino Nano and Leonardo microcontrollers.

RC522 RFID Reader Module Interfacing/Configuration

The low cost MFRC5222 reader module is easy to use and can be used in a wide range of applications. The MFRC522 is a highly integrated reader/writer IC for contactless communication at 13.56MHz. Features of this reader include the following:

- MFRC522 chip-based board
- Operating frequency: 13.56MHz
- Supply Voltage: 3.3V
- Current: 13-26mA
- Read Range: Approx. 3cm
- Serial Peripheral Interface
- Max Data Transfer Rate: 10Mbps
- Dimensions: 60mm x 39mm

Algorithm

The algorithm for the Attendance Recorder using Arduino and RFID recorder is written as follows:

- Start
- Student swipes the card to register attendance
- If the valid card is swiped, illuminate the green LED
- Else illuminate the red LED for an invalid card
- After class is over, IF student swipes again display the message as “Marked out” in excel and illuminate the green LED
- If student tries again even after swiping twice no data will be saved again and both the LEDs will burn
- Reiterate the process for next class
- Stop

Flowchart

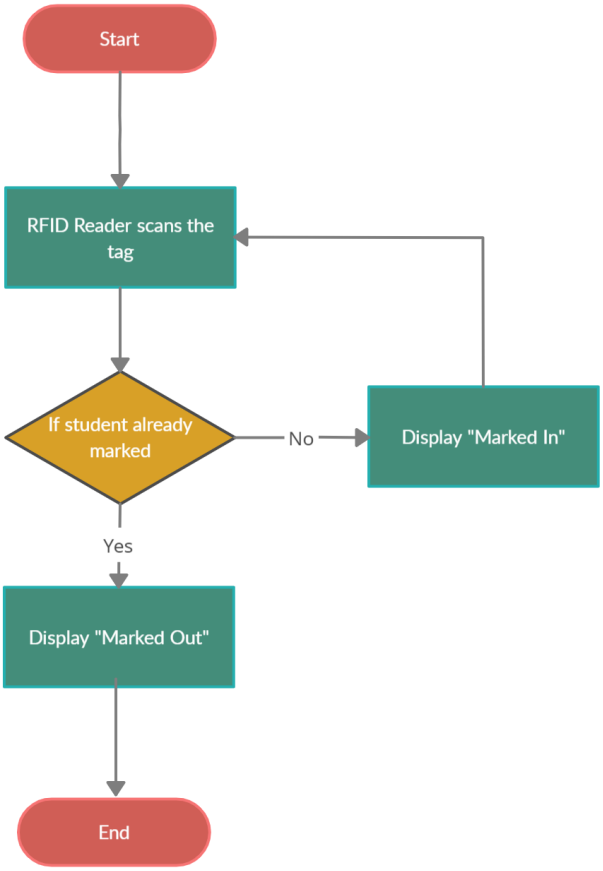

Figure 2.2 (c) Flowchart Deign

2.3 Proposed System

2.3.1 Economic Feasibility

The "ATTENDANCE RECORDER USING RFID MODULE" system has a high level of adaptability which makes it suitable for a wide range of applications, from small classrooms in schools and colleges to highly intricated workplace managements. Because of economic constraints, this idea cannot be immediately used or deployed in real-time applications, although it still has untapped potential.

2.3.2 Technical Feasibility

PLX-DAQ can be used as an attendance sheet for one class/subject if necessary. It is necessary to save data after each class so that it is not lost. However, in real-time, this may be challenging for faculty, and because this passive RFID-based lecture attendance tracking system does not have a full database, it should be limited to only a few hundred users. As a result, the design's limitations could be addressed in the future by taking into account the following key recommendations: i. By implementing a facial/biometric recognition application, the system's security against impersonation by errant pupils will be significantly enhanced. ii. Adding an online MySql database to the system, allowing it to be used by schools or businesses with a big number of students or employees.

2.3.3 Operational Feasibility

In general, operational feasibility refers to how well a proposed system solves problems and exploits possibilities found during scope definition, as well as how well it meets the criteria determined during the requirements analysis phase of system development. This proposed system abundantly reduces the workload for lecturers and greatly reduces time consumption for both students and staffs if compared to roll call or general file management system.

2.4 Overview of Software

The backend is PLX-DAQ (Parallax Data Acquisition Add-On Tool), which was created and integrated with the open-source Arduino IDE. PLX-DAQ is a Microsoft Excel add-on product that may be downloaded from the official website. The suggested framework will cover engineering components such as data collecting and aggregation, analysis, and data processing, as well as the necessary actions required and the result displayed on an excel sheet. The major reason we adopted PLX-DAQ was to improve the software's execution performance.

2.5 Hardware Specification

- Arduino Uno R3
- RFID RC522 Reader
- RFID Tags / Cards
- Jumper wires
- Breadboard
- LED – Green, Red
- Resistors

Figure 2.5 (a) Arduino-UNO

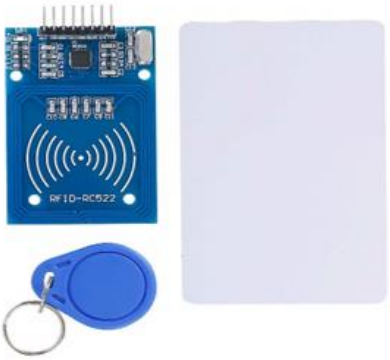

Figure 2.5 (b) RFID RC522 Reader and RFID tags

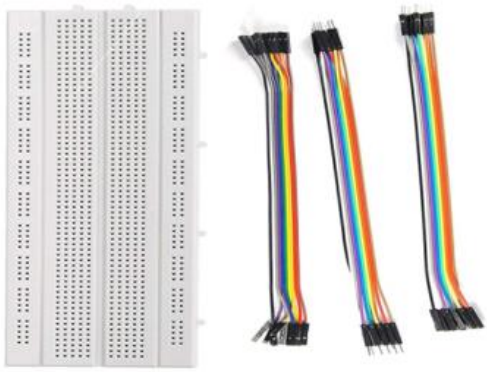

Figure 2.5 (c) Breadboard and jumper wires

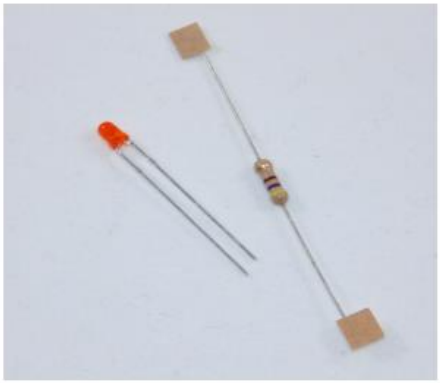

Figure 2.5 (d) LED and Resistor

2.6 Software Requirement

Arduino IDE:

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino compatible board. It can be downloaded from the official website.

PLX-DAQ Excel Sheet:

Parallax Data Acquisition tool (PLX-DAQ) software is an add-in for Microsoft Excel acquires up to 26 channels of data from any Parallax micro controllers and drops the numbers into columns as they arrive. It provides easy spreadsheet analysis of data collected in the field, laboratory analysis of sensors and real-time equipment monitoring. It is downloadable from the official website.

Summary

Our project's major goal is to eliminate manual attendance mistakes while simultaneously minimizing the amount of time it takes to do so. The "ATTENDANCE RECORDER USING RFID MODULE" project will give an effective way for correcting inaccuracies and lowering professor burden. The proposed system's key advantages are its flexibility, lack of lost time, and ease of use. The Arduino and RFID reader module were used to create this system. When a student scans their card in the RFID reader, their name, register number, date, and time are saved in the PLX – DAQ excel sheet. But still some drawbacks may arise in the later future due to technical feasibility or economical feasibility.

Result and Analysis/Testing

3.1 Read and Write from RFID Reader Module

Initially, we use jumper wires to link the Arduino board and the RFID reader module to the bread board, as shown in the table below.

RFID MODULE	ARDUINO
3.3V	PIN 3.3V
RST	PIN 9
GND	GND
NC	NO CONNECTION
MISO	PIN 12
MOSI	PIN 11
SCK	PIN 13
SDA	PIN 10

Table 3.1 (a) Connections

Circuit diagram

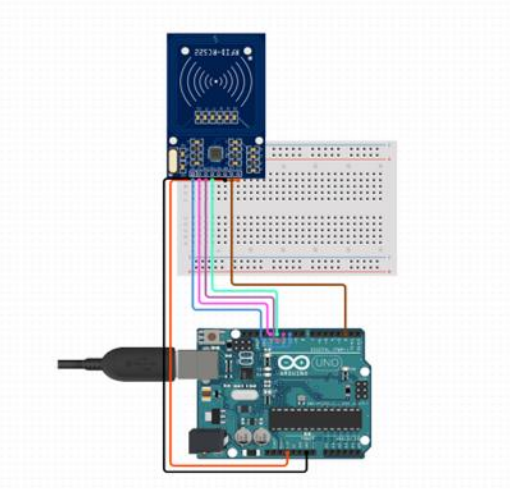

Figure 3.1 (a) Simulation

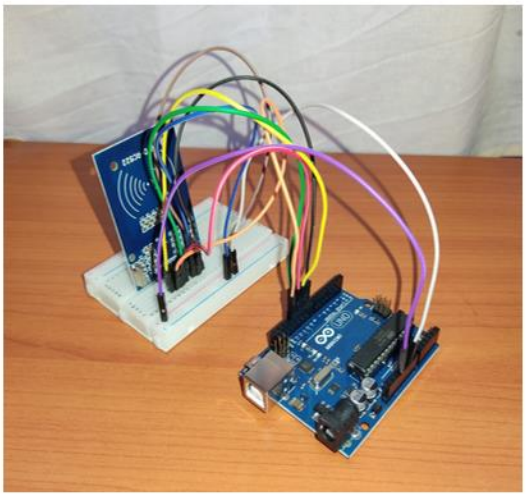

Figure 3.1 (b) Hardware

There are basic example codes in the library of Arduino IDE for reading and writing data from the RFID Reader module. We have used this preliminarily to understand the working principle.

The data is being written on the RFID tag.

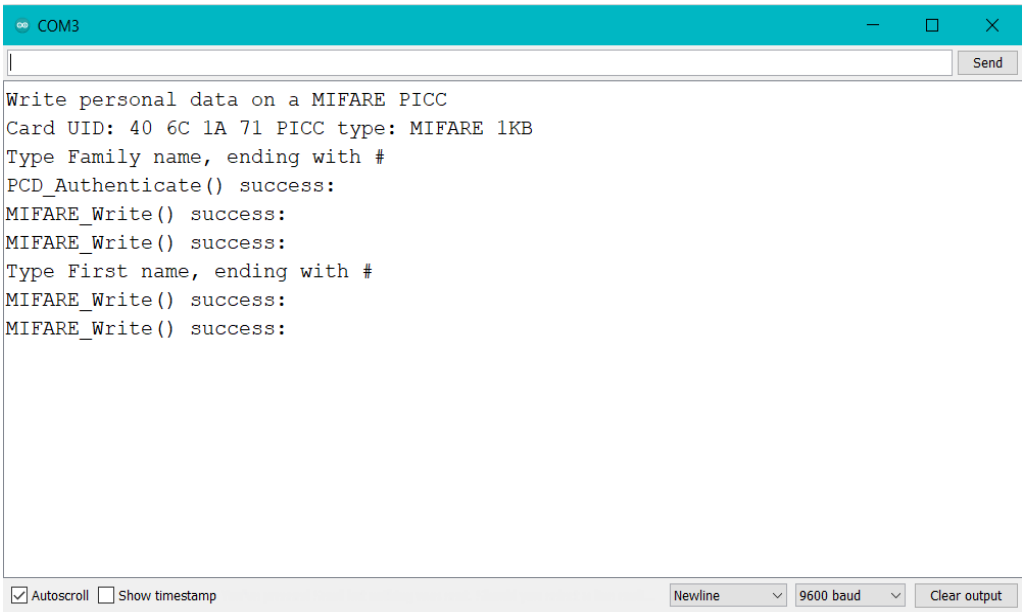

Figure 3.1 (c) Write program serial monitor

The written data is on read from the RFID tag.

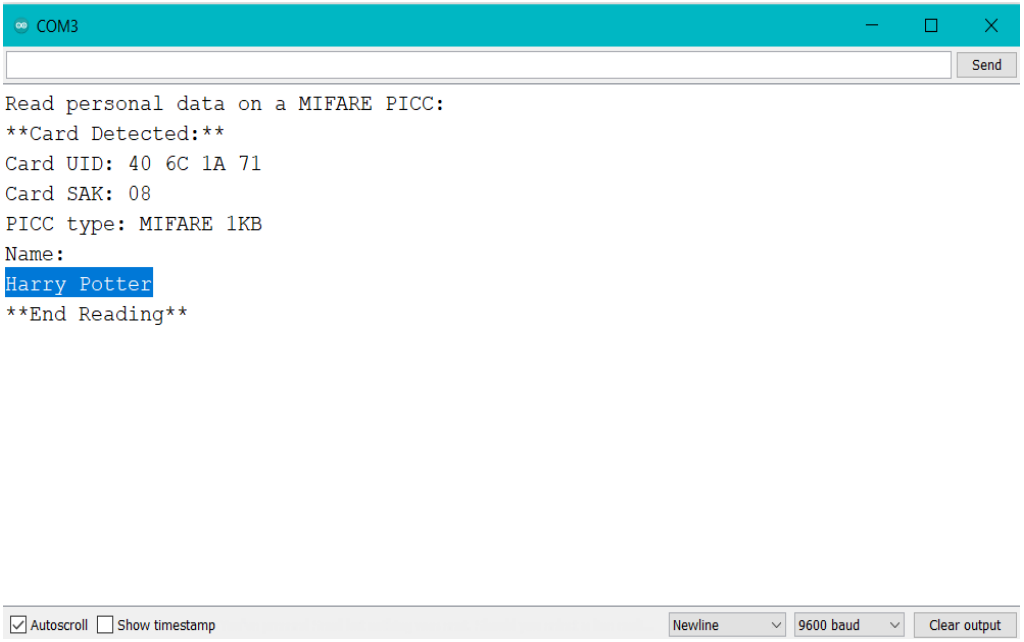

Figure 3.1 (d) Read program serial monitor

3.2 Sending the data to PLX-DAQ Sheet

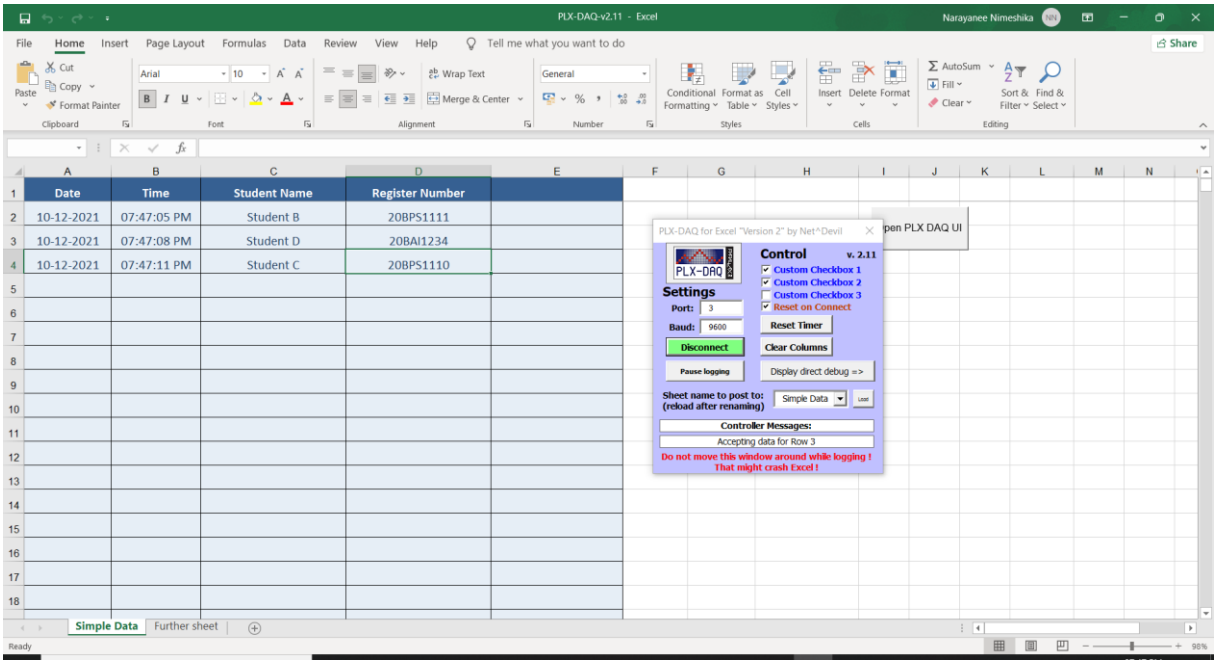

Figure 3.2(a) Student details on PLX-DAQ

We have enhanced our code in such a way that the data is being directly passed on to the excel sheet which is known as PLX-DAQ excel sheet which is a add on tool. If we take a look at the data, it is very neat and compact just like an attendance recorder table. It makes it even more comfortable because the Register number of the respective student is also being displayed.

3.3 Final test execution with LEDs

Circuit diagram:

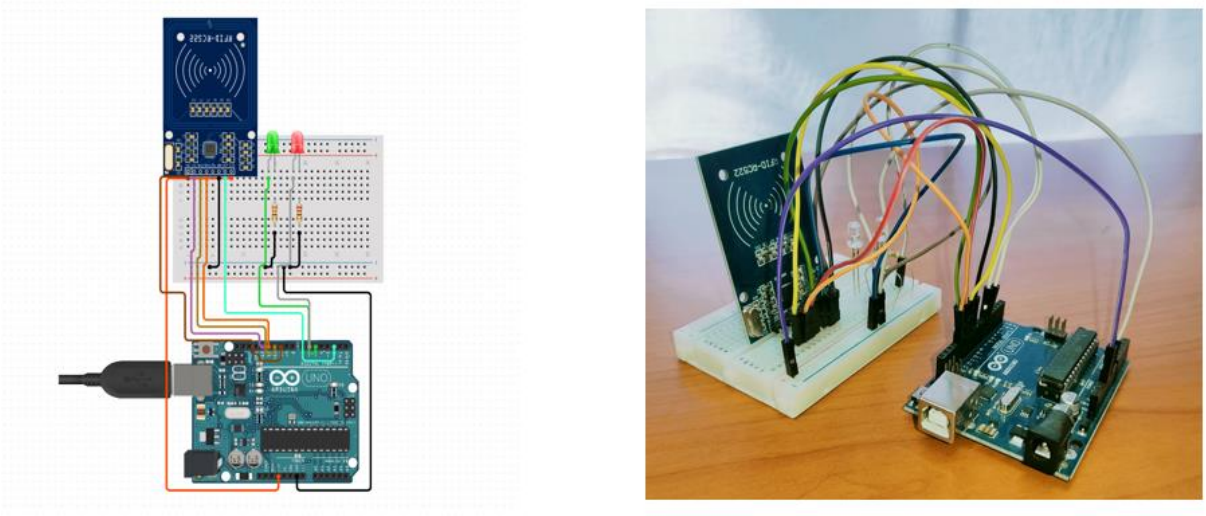

Figure 3.3 (a) and (b) Simulation and Hardware

Case(i): Student incoming

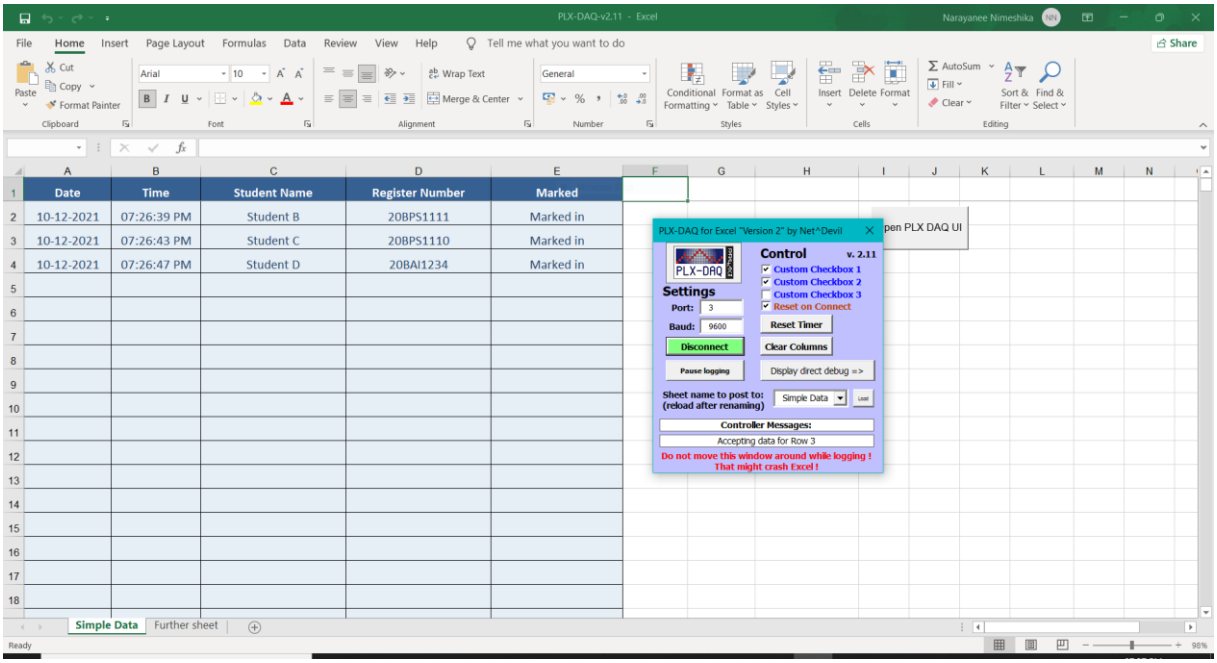

Figure 3.3 (c) Excel sheet displaying student's arrival details

The final code is uploaded and the PLX-DAQ sheet is opened and now ready for test execution. A total of 3 RFID cards data I have saved in the code and when I swipe it against the RFID Reader for the first time, the data is now being directly passed to the Excel sheet. This data being saved to the sheet is indicated to the student by the illumination of the Green LED while the Red LED goes off for about two seconds. Over here, we can analyze the stored data, which is convenient for professors as it records the time, date, name, student register number and marked details. When a student from a class have accidentally entered in the wrong class, so when that person brings his card near the sensor, the Red LED will glow for two seconds of time delay indicating an invalid card and it also ensures that no false data is being directed to the attendance excel sheet.

Case(ii): Student outgoing

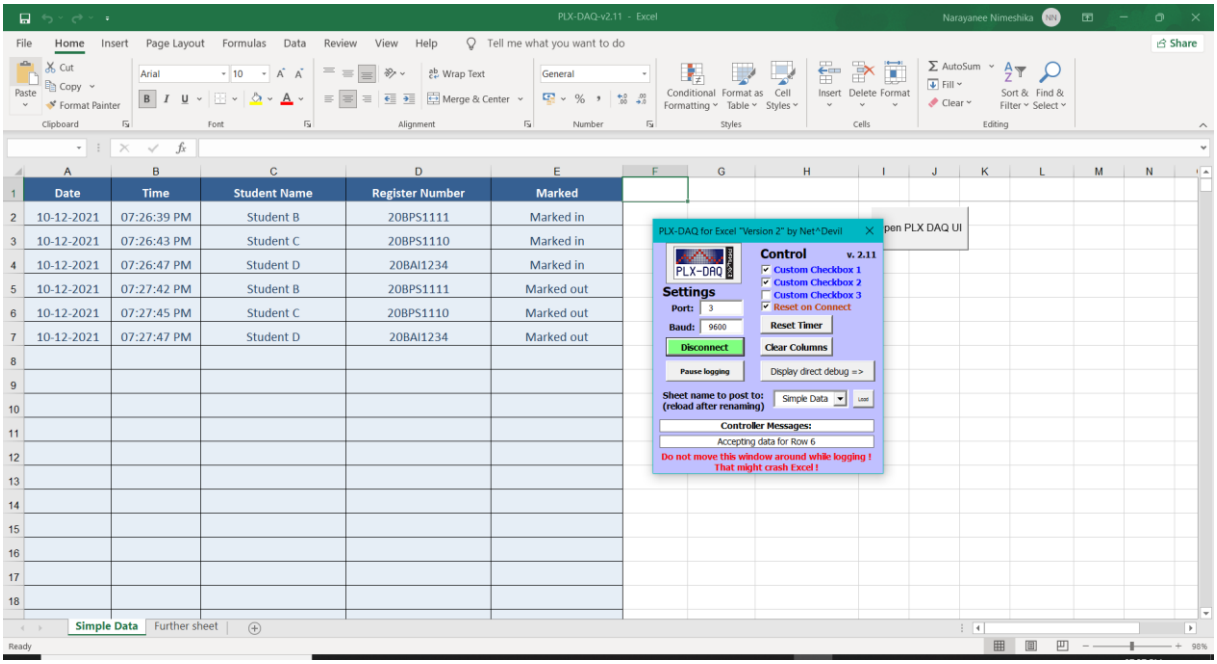

Figure 3.3 (d) Excel sheet displaying students leaving details

When the student swipes the card for the second time, which is generally after attending the whole class, the green LED burns which indicates that it is a valid card and the data is being successfully transferred to the excel sheet. This method becomes even more easeful as it records about both the arrival and outgoing time.

Summary

To begin our project testing, we connected all of the essential components and then wrote and read data from the RFID reader module. Then we discovered the PLX-DAQ sheet, which records data straight from any microcontroller with which it is in contact. As a result, we learnt more about it and began working out how to develop code that would connect to it. Furthermore, after establishing connectivity, we conducted the test, and the findings were favorable to us. Along with the name, date, and time, the excel sheet also included the register number. Despite our satisfaction, we wanted to try something new, so we included LEDs such as green and red, which glow for two seconds if the card is legitimate and burn for two seconds if it is not. We also added an extra column to the data being recorded in the excel file, which would label the first swipe as "Marked in" and the second swipe as "Marked out." This is made easier by the fact that this excel sheet serves as a good attendance recorder.

Conclusion and future enhancement

The goal and objective of this project was to design and install an RFID-based automatic attendance system, which was completed successfully. When compared to the manual system, this technology provides a more effective and convenient manner of taking attendance. This proposed method allows students to fill up their attendance cards simply by swiping or moving their ID cards across the RFID scanner situated at lecture hall entrances. This technology has the potential to change the way students manage their lecture attendance in the classroom by providing a new, more accurate, and less time-consuming method of tracking student attendance. Every good engineering design breakthrough has its own set of constraints. Because there is no true database included into this passive RFID-based lecture attendance tracking system, it should be confined only to a few hundreds of users. As a result, the design's limitations could be addressed in the future by taking into account the following key recommendations: i. By implementing a facial/biometric recognition application, the system's security against impersonation by errant pupils will be significantly enhanced. ii. Adding an online MySql database to the system, allowing it to be used by schools or businesses with a big number of students or employees.

Appendix

Code used for Project Implementation:

```
#include <SPI.h>
#include <MFRC522.h>

#define SS_PIN 10
#define RST_PIN 9

MFRC522 mfrc522(SS_PIN, RST_PIN);

byte card_ID[4];

byte s1[4] = {0x86, 0x00, 0x3D, 0x29};
byte s2[4] = {0x60, 0x73, 0x13, 0x71};
byte s3[4] = {0xC7, 0x44, 0xE3, 0xE0};
byte s4[4] = {0xC0, 0xD9, 0x71, 0xAE};
byte s5[4] = {0xE0, 0x13, 0xBD, 0xD4};

int NumbCard[5];
int j=0;

int const RedLed=6;
int const GreenLed=5;

String Name, Number;

void setup()
{
  Serial.begin(9600);
  SPI.begin();
  mfrc522.PCD_Init();

  Serial.println("CLEARSHEET");
  Serial.println("LABEL,Date,Time,Student Name,Register Number,Marked");

  pinMode(RedLed,OUTPUT);
  pinMode(GreenLed,OUTPUT);

}

void loop()
{
   if ( ! mfrc522.PICC_IsNewCardPresent())
   {
```

```
      return;
    }
 if ( ! mfrc522.PICC_ReadCardSerial())
 {
    return;
 }

 for (byte i = 0; i < mfrc522.uid.size; i++)
 {
      card_ID[1]=mfrc522.uid.uidByte[1];
      card_ID[2]=mfrc522.uid.uidByte[2];
      card_ID[3]=mfrc522.uid.uidByte[3];
      card_ID[4]=mfrc522.uid.uidByte[4];


       if(card_ID[1]==s1[1] && card_ID[2]==s1[2] && card_ID[3]==s1[3] &&
card_ID[4]==s1[4])
       {
       Name="Student A";
       Number="20BPS1115";
       j=0;

      }
      else if(card_ID[1]==s2[1] && card_ID[2]==s2[2] && card_ID[3]==s2[3] &&
card_ID[4]==s2[4])
      {
       Name="Student B";
       Number="20BPS1111";
       j=1;
      }

      else if(card_ID[1]==s3[1] && card_ID[2]==s3[2] && card_ID[3]==s3[3] &&
card_ID[4]==s3[4])
      {
       Name="Student C";
       Number="20BPS1110";
       j=2;
      }

      else if(card_ID[1]==s4[1] && card_ID[2]==s4[2] && card_ID[3]==s4[3] &&
card_ID[4]==s4[4])
      {
       Name="Student D";
       Number="20BAI1234";
       j=3;
      }
```

```
      else if(card_ID[1]==s5[1] && card_ID[2]==s5[2] && card_ID[3]==s5[3] &&
card_ID[4]==s5[4])
      {
       Name="Student E";
       Number="20BCE1135";
       j=4;
      }

      else
      {
          digitalWrite(GreenLed,LOW);
          digitalWrite(RedLed,HIGH);
          goto cont;
     }
}
      if(NumbCard[j] == 1)
      {
          NumbCard[j] = 100;
          Serial.print("DATA,DATE,TIME," + Name);
          Serial.print(",");
          Serial.println(Number + ",Marked out");
          digitalWrite(RedLed,LOW);
          digitalWrite(GreenLed,HIGH);
          delay(2000);
      }
      else if(NumbCard[j]!=1 && NumbCard[j]!=100)
      {
          NumbCard[j] = 1;
          Serial.print("DATA,DATE,TIME," + Name);
          Serial.print(",");
          Serial.println(Number + ",Marked In");
          digitalWrite(GreenLed,HIGH);
          digitalWrite(RedLed,LOW);
      }
cont:
  delay(2000);
  digitalWrite(GreenLed,LOW);
  digitalWrite(RedLed,LOW);
}
```

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