ARDUINO BASED ATTENDANCE SYSTEM USING RFID

PROJECT REPORT

Submitted by

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in partial fulfilment for the award of the degree

of

BACHELOR OF ENGINEERING

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ELECTRICAL AND ELECTRONICS ENGINEERING

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Faculty Guide	**Head of the Department**

Certified that the candidate was examined in the viva-voce examination held on _____.

…….....	…….....
(Internal Examiner)	(External Examiner)

ACKNOWLEDGEMENT

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OBJECTIVE

Main objective of RFID based Attendance System project is to propose a digital way of attendance of students or employees. Microcontroller does the task of storing the attendance of the respective person in the database The existing attendance system is manual and it is taken on paper and it consumes lot of time. The proposed system does this work in a more efficient way.

ABSTRACT

The security system is basically an embedded one. Embedded stands for hardware controller by software. Here a software using microcontroller controls all the hardware components. The microcontroller plays an important role in the system. The main objective of the system is to uniquely identify and to make security for a person. This requires a unique product, which has the capability of distinguishing different person. This is possible by the new technology called RFID. The main parts of the RFID system are RFID tag and RFID reader. In this system the RFID reader and RFID tag used are operating at 125 KHz. Database like excel and google sheets are used for storing the details. This report provides a clear picture of hardware and software used in the system. It also provides an overall view with detailed discussion of the operation of the system. Main concept behind radio frequency based attendance system is to take the attendance. RFID card has to be show in front of RFID reader, and then the attendance of the person is noted down in the database. RFID based attendance system is one of the solutions to address the problem of student security by increasing the system efficiency instead of photo ID card, it also helps to take the attendance of the workers at their work place. its ability to uniquely identify each person based on their RFID tag type of id card make the process of allowing security access easier, faster and secure as compared to traditional method. The card holder only needs to place their card on the reader and they will be allowed to enter.

CHAPTER 1 – INTRODUCTION

Radio-frequency identification (RFID) is a technology that uses radio waves to transfer data from an electronic tag, called RFID tag or label, connected to an object, via a reader for the cause of identifying and monitoring the object. Radio frequency identification (RFID) is a matured technological knowhow that accommodates the use of electromagnetic or electrostatic coupling in the radio frequency portion of the electromagnetic spectrum to uniquely become aware of an object, animal, or person. RFID chips include a radio transmitter that emits a coded identification number when queried through a reader device. Some RFID tags can be examined from various meters away and beyond the line of sight of the reader. The utility of bulk reading allows an almost-parallel analysing of tags. This small type is incorporated in client products, and even implanted in pets, for identification. The tag's facts are stored electronically. The RFID tag includes a small RF transmitter which transmits an encoded radio sign to interrogate the tag, and receiver which receives the message and responds with its identification information. Some RFID tags do not use a battery. Instead, the tag makes use of the radio power transmitted by way of the reader as its strength source. The RFID machine plan consists of an approach of discriminating countless tags that might be within the range of the RFID reader. RFID can be used in many applications. A tag can be affixed to any object and used to track and manage inventory, assets, people, etc. For example, it can be affixed to cars, laptop equipment, books, cellular phones, etc. The RFID attendance device is an automated embedded system used in taking attendance of registered individuals in a specific organization. The RFID attendance gadget presents an organization, the efficiency and comfort-related with RFID technological know-how at a low cost. This approach is fast as properly as simple. Each employee makes use of an RFID card and the reader records the information when the employee enters or exits. RFID devices and software

ought to be supported through a state-of-the-art software structure that enables the collection and distribution of region-based data in close to real time. A whole picture of the RFID attendance device combines the RFID Tags and readers with getting the right of entry to the international standardized database, ensuring actual time get right of entry to up to date data on the card. The card consists of a unique identification wide variety known as an electronic product code .

CHAPTER 2 - LITERATURE SURVEY

The designed system significantly improves the productivity and reduces wastage of human and material resources . The immense potential of RFID based systems has been identified and explained in literature earlier .It will open the door to applications which were unthought of a few years ago . Also the evolution of the technology and role of individual components has been explained in detail . The use of object counters in RFID based systems has also been shown. Such a system significantly improves the current manual process of taking attendance in the University Environment . It also promotes a fully automated approach in monitoring the students in the Campus.

These problems can be listed in several formats as per below:

Energy loss of professors: Each professor should check attendance of about 25 to 30 students per session and thus his energy is wasted.

Loss of time useful for teaching: Students attendance is naturally associated with the time and spending this time leads to a waste of time that is useful for teaching.

CHAPTER 3 - COMPONENT DESCRIPTION

A. ARDUINO UNO

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. Each of the 14 digital pins and 6 Analog pins on the Uno can be used as an input or output, using pinMode(),digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller.The

Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). Serial Pins 0 (Rx) and 1 (Tx): Rx and Tx pins are used to receive and transmit TTL serial data. They are connected with the corresponding ATmega328P USB to TTL serial chip. PWM Pins 3, 5, 6, 9 and 11: These pins provide an 8-bit PWM output by using analogWrite() function. SPI Pins 10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK): These pins are used for SPI communication.

Fig.3.1. Arduino UNO

B. RFID TAG AND READER:

Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically-stored information. Passive tags collect energy from a nearby RFID reader's interrogating radio waves. Active tags have a local power source (such as a battery) and may operate hundreds of meters from the RFID reader . RFID belongs to a group of technologies referred to as Automatic Identification and Data Capture (AIDC). AIDC methods automatically identify objects, collect data about them, and enter those data directly into computer systems with little or no human intervention. RFID methods utilize radio waves to accomplish this. At a simple level, RFID systems consist of three components: an RFID tag or smart label, an RFID reader, and an antenna.

RFID tags contain an integrated circuit and an antenna, which are used to transmit data to the RFID reader (also called an interrogator). The reader then converts the radio waves to a more usable form of data. Information collected from the tags is then transferred through a communications interface to a host computer system, where the data can be stored in a database and analysed at a later time. There are two types of RFID systems. (1) Active RFID system: These are systems where the tag has its own power source like any external power supply unit or a battery. The only constraint being the life time of the power devices. These systems can be used for larger distances and to track high value goods like vehicles. (2) Passive RFID system: These are systems where the tag gets power through the transfer of power from a reader antenna to the tag antenna. They are used for short range transmission.

Fig.3.2. RFID reader and tag kit

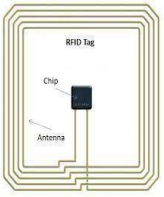

Fig.3.3. RFID tag

FEATURES OF RFID READER

a. Low cost solution for reading passive RFID transponder tags.

b. Industrial grade casing for better outlook and protection.

c. Integrated RFID reader, antenna, LED, power cable and data cable.

d. Every reader has been tested before is being shipped.

e. 9600 baud RS232 serial interface (output only) to PC.

f. Fully operation with 5VDC power supply.

g. Buzzer as sound indication of activity.

h. Bi-colour LED for visual indication of activity.

i. Standard RS232 serial cable (female) ready to plug to desktop PC or Laptop. j. 2m reading range.

k. 0.1s response time.

l. Operating frequency: 125KHz

C.ESP8266 01 Wi-Fi MODULE:

The ESP-01 ESP8266 Serial WIFI Wireless Transceiver Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre programmed with an AT command set firmware, meaning, you can simply connect this to your Arduino device and get about as much WiFi-ability as a WiFi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost-effective board with a huge, and ever growing, community.

This module has a powerful enough onboard processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with

minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existing interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions and requires no external RF parts.

Setup of ESP01:

Step 1: Materials

These are the components that you will need:

- ESP8266 Wi-Fi Module ESP-01
- Male/female jumper wires
- Breadboard
- Arduino UNO

Step 2: ESP-01 Setup

When you buy the **ESP8266 ESP-01**, it comes with a pre-installed **AT firmware**. It is possible to program the chip with another firmware such as **NodeMCU**, for example. However, AT firmware is compatible with the **Arduino IDE**, so we are going to use this firmware.

Step 3: ESP-01 Setup Continued

Upload the **Bare Minimum** example to ensure that no previous programs are running and using the serial communication channel. Next, open the serial monitor and type the following command:

```
AT
```

You should get an “OK” response. This means that the module is working and that you are good to go. Now we are ready to test a two-way communication between the module and another device.

Step 4: Basic AT Commands

The ESP8266 ESP-01 module has three operation modes:

1. **Access Point (AP)**
2. **Station (STA)**
3. **Both**

In **AP** the Wi-Fi module acts as a Wi-Fi network, or access point (hence the name), allowing other devices to connect to it. This does not mean that you will be able to check your Facebook from your device while the ESP-01 module is operating in the AP mode. It simply establishes a two way communication between the ESP8266 and the device that is connected to it via Wi-Fi.

In **STA** mode, the ESP-01 can connect to an AP such as the Wi-Fi network from your house. This allows any device connected to that network to communicate with the module.

The third mode of operation permits the module to act as both an AP and a STA.

Step 5: Basic AT Commands - STA Mode

In this tutorial, we are going to set the module to operate in **STA** mode by typing the following command:

```
AT+CWMODE=1
```

The corresponding number for each mode of operation is as follows:

- STA = 1
- AP = 2
- Both = 3

Step 6: Basic AT Commands - Check Mode

If you want to check what mode your **Wi-Fi module** is in, you can simply type the following command:

```
AT+CWMODE?
```

This will display a number (1, 2, or 3) associated with the corresponding mode of operation.

Step 6: Basic AT Commands - Check Mode

If you want to check what mode your **Wi-Fi module** is in, you can simply type the following command:

```
AT+CWMODE?
```

This will display a number (1, 2, or 3) associated with the corresponding mode of operation.

Fig3.4. ESP 01 Wi-Fi module

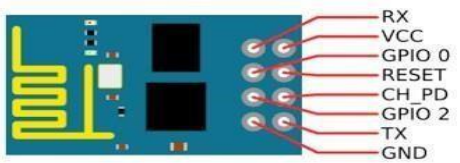

Fig.3.5. ESP 01 Wi-Fi module pin out diagram

D.IDENTIFICATION DEVICES:

For identification of status of result (whether the attendance is marked or not, i.e., whether the RFID tag is authorized or not) this system uses basic devices such as green LED, red

LED and buzzer

Fig 3.6. Indication devices (Red LED, Green LED, Buzzer)

A **light-emitting diode** (**LED**) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The colour of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor.[5] White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device

Piezo buzzers are simple devices that can generate basic beeps and tones. They work by using a piezo crystal, a special material that changes shape when voltage is applied to it. If the crystal pushes against a diaphragm, like a tiny speaker cone, it can generate a pressure wave which the human ear picks up as sound.

CHAPTER 4 - BLOCK DIAGRAM

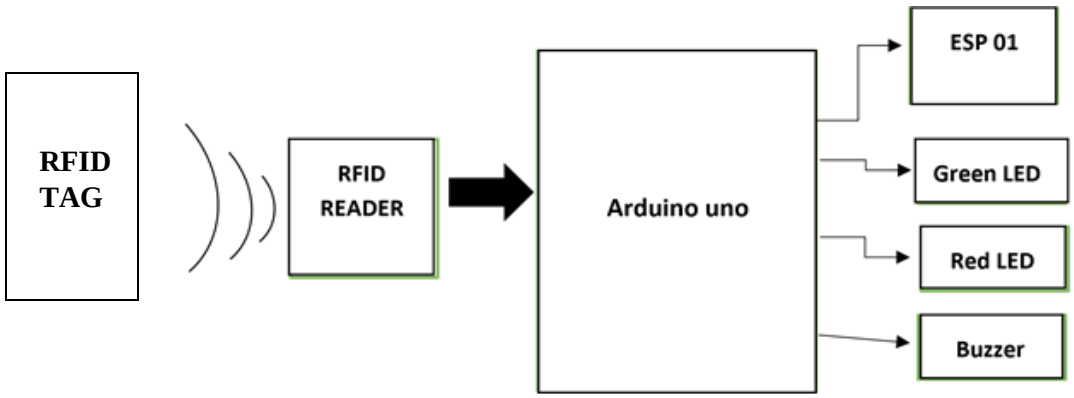

Fig 4.1. Block Diagram

This is the **block diagram** of our **project ARDUINO Based Attendance System using RFID**, ESP01 & indicators. Here Arduino UNO acts as a central processor for controlling all other components as input/output unit. We have used the 5-volt power supply to power all the components used in this project. **RFID Reader module** is interfaced with Arduino to read the data from the RFID card/tag. **ESP 01** wi-fi module is used to connect the Arduino UNO to internet**.** Red & Green LED is used for the indication of marked attendance and error in marking attendance. Similarly, the buzzer produces sound whenever the interrupt is detected.

CHAPTER 5 - CIRCUIT DIAGRAM

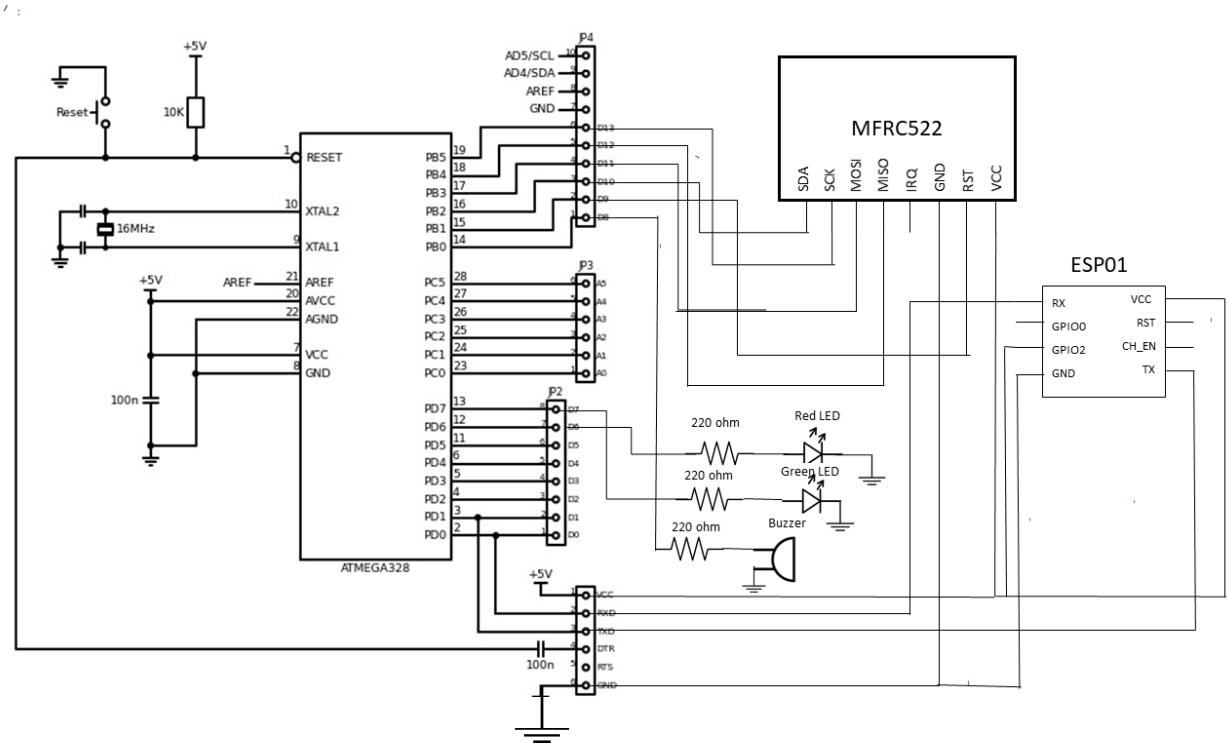

Fig.5.1. Circuit Diagram

CHAPTER 6 – WORKING

READING THE DATA FROM THE TAG

After having the circuit ready, go to File > Examples > MFRC522 > Dump Info and upload the code. This code will be available in your Arduino IDE (after installing the RFID library).

You will see something like this Now put the RFID tag on the reader.

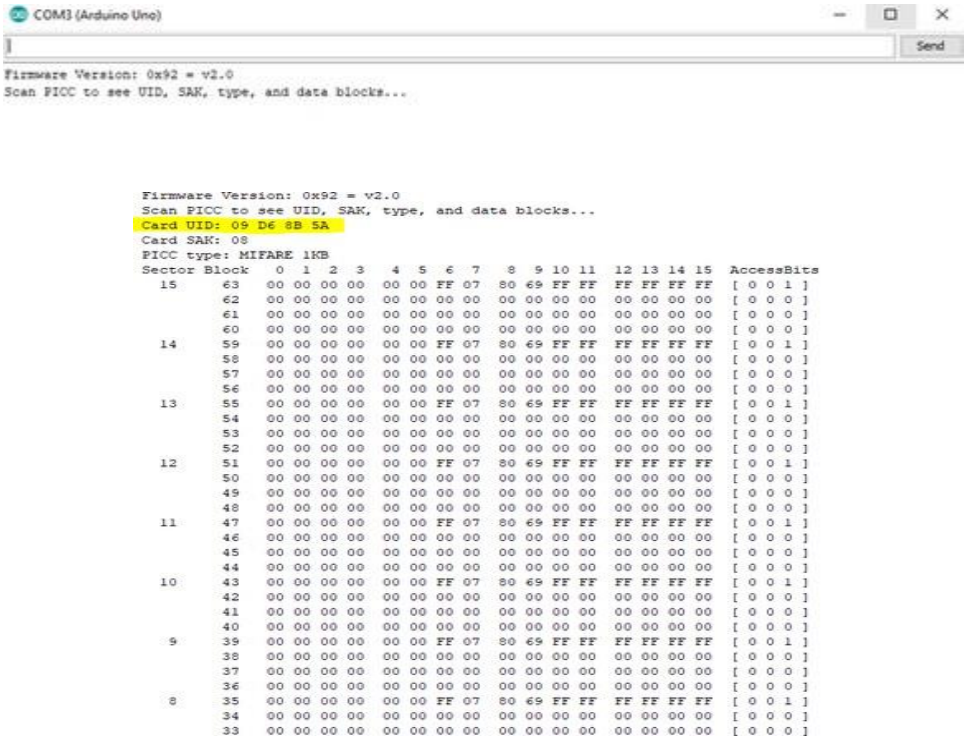

Fig.6.1 Reading the data from tag

The keys highlighted in yellow are card Unique ID. Write it down as it will be used in the program. This is the information that you can read from the card, including the card UID that is highlighted in yellow. The information is stored in the memory that is divided into segments and blocks as you can see in the previous picture. You have 1024 bytes of data storage divided into 16 sectors and each sector is protected by two different keys, A and B.

Arduino and Excel with PLX-DAQ

We know that Arduino allows to acquire data in the analog input. We can use Excel to store data in a sheet and display it in a graph using an application available on the network called PLX-DAQ (Parallax Data Acquisition), but this software doesn't work under Windows 10 and is no longer supported. So we can found a new version of PLX-DAQ re-written by Net Devil, an Arduino forum's member, to be able to be run on modern systems.

We want to measure the voltage variations from a **trimmer**. We take a device of any ohmic value and connect its two external pins respectively to 5V and GND pins supplied by Arduino. We pick up the voltage signal offered by the central pin, which varies according to the resistive divider that is formed while we turn its knob.

To collect data from our experiment, we can open the **PLX-DAQ-v2.11.xlsm** worksheet which contains a macro that allows us to save the data from the USB in Excel. To do this, we need to open PLX DAQ clicking on the respectively button and in the popup that the software opens we choose the USB **Port** to which Arduino is connected. Before clicking on the **Connect** button, we have to open Arduino IDE and use the sketch that is reported below, or use that is provided with PLX-DAQ software distribution.

Fig.6.2PLX-DAQ software

Arduino Uno and ESP01 with Google sheets:

Let's first try to understand what really happens when we try to send data to Google's end. We will obviously be sending data using a GET request over an URL which has a pattern of **https://script.google.com/**….. When you enter this URL in a web browser, the Google's server responds back asking the browser to redirect to another URL with domain **script.googleusercontent.com** with a new GET request. For a web browser, the URL redirection is a very common thing and it works without any problem. However, for ESP8266, this is not straight forward. The ESP8266 needs to correctly decode the header information received from the first server to extract the redirect URL and make a second GET request to the new server. The use of **HTTPSRedirect** library makes the task much simpler by avoiding the need of any third-party service. So, the first thing you need to do is to copy the HTTPSRedirect library files from GitHub and install into your Arduino libraries folder.

Create Google Sheets

Create a Google spreadsheet in your Google Drive and name it something like **DataCollector**. Rename the current/active sheet to **Summary** and add a second sheet, call it **DataLogger**. From the URL address bar of the sheet, copy the string between d/ and /edit and save it somewhere. This is your spreadsheet's unique sharing key, which will be needed in the Google Apps scripts later.

Google Apps Scripts

To create a Google App Scripts, go to **Tools > Script Editor** from the Google Sheets. In the code section, paste the code below. The code or script can be saved under any name.

Deploy the contents as Web app

Next step is to publish the script so that it is accessible through an URL. In order to do that, **Publish > Deploy as Web App**.

Note: Whenever you modify your code, you have to create a "New" Project version and publish it otherwise you will still be hitting the same old code.

Copy the **Current web app URL** and save it somewhere as we will need it for extracting the **GScriptID**.

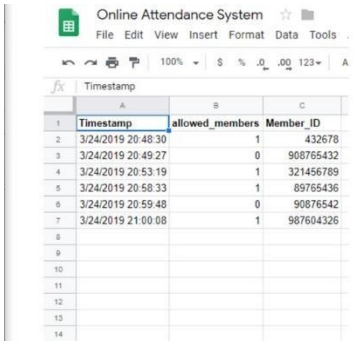

Fig.6.3.Sample Google attendance log

Project Code:

```
#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 Name1[4]={0x2C,0x94,0xC4,0x5B};
byte Name2[4]={0x2C,0x94,0xC4,0x5C};
int NumbCard[2];
int j=0;
int const RedLed=6;
int const GreenLed=7;
int const Buzzer=8;
String Name;
long Number;
int n ;
void setup() {
  Serial.begin(9600);
  SPI.begin();
```

```
 mfrc522.PCD_Init();
 Serial.println("LABEL,Date,Time,Name,Number");
 pinMode(RedLed,OUTPUT);
 pinMode(GreenLed,OUTPUT);
 pinMode(Buzzer,OUTPUT);
  }
void loop() {
  if ( ! mfrc522.PICC_IsNewCardPresent()) {
 return;
 }
 if ( ! mfrc522.PICC_ReadCardSerial()) {
 return;
 }

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

      if(card_ID[i]==Name1[i]){
      Name="TN32AV2761";
      Number=1234456;
      j=0;
     }
     else if(card_ID[i]==Name2[i]){
      Name="TN32AV2771";
      Number=12456;
      j=1;
     }
     else{
        digitalWrite(GreenLed,LOW);
        digitalWrite(RedLed,HIGH);
        delay(60);
        digitalWrite(RedLed,LOW);
         digitalWrite(Buzzer,HIGH);
     delay(60);
     digitalWrite(Buzzer,LOW);
        goto cont;
    }
}
     if(NumbCard[j] == 1){
     }
     else{
     NumbCard[j] = 1;
     n++;
     Serial.print("DATA,DATE,TIME," + Name);
     Serial.print(",");
     Serial.println(Number);
```

```
      digitalWrite(GreenLed,HIGH);
       delay(60);
       digitalWrite(GreenLed,LOW);

      digitalWrite(RedLed,LOW);
      digitalWrite(Buzzer,HIGH);
      delay(60);
      digitalWrite(Buzzer,LOW);
      delay(60);
       digitalWrite(Buzzer,HIGH);
      delay(60);
      digitalWrite(Buzzer,LOW);
      Serial.println("end");
      }
      delay(1000);
cont:
delay(2000);
digitalWrite(GreenLed,LOW);
digitalWrite(RedLed,LOW);
}
```

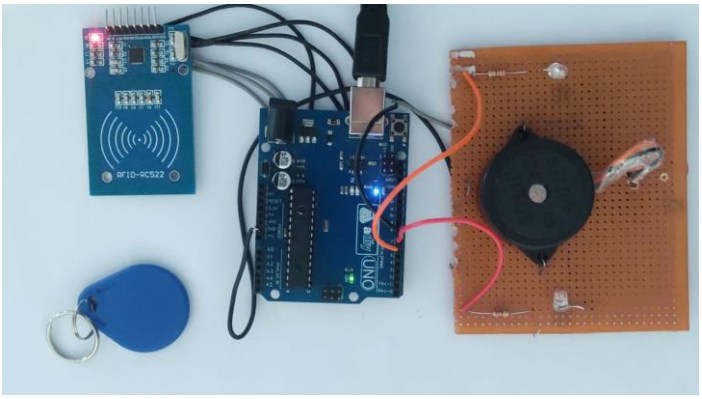

Fig.6.4.Project image

Output Image:

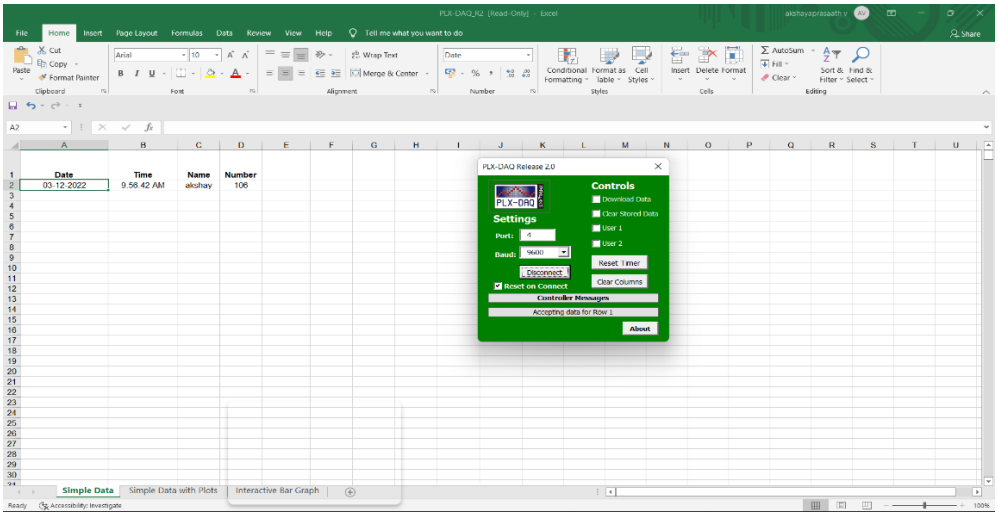

Fig.6.5.Output image

CHAPTER 7 - ADVANTAGES

1. Convenience and Accuracy

The RFID attendance management system eliminates all the drawbacks of the manual attendance process while making the process hassle-free.

2. Security

It immediately notifies the concerned person about the concerned person's whereabouts. This is a great benefit to students in schools where it is a matter of student protection.

3. Easy Tracking

The RFID tags were designed in such a way that the user can track persons while they are in school or the workplace. The history is also stored in the system, which is helpful for future references.

4. Real-Time Access

Attendance data can be easily accessed at any time and from anywhere when linked to the cloud server.

5. Automatic Process

No compromise on efficiency, because attendance calculations are quickly automated by this system.

CHAPTER 8 – CONCLUSION

This RFID attendance system can replace the manual system that it process and transfers information without a hitch. This system proposes a super efficient and easy method of marking attendance which is low cost and time saving. This system is user friendly as data manipulation and retrieval can be done through the interface , making it universal attendance system. Thus it can be implemented in both educational institutions and other organizations.

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