MICROPROCESSOR-BASED AUTOMATIC ATTENDANCE RECORDER USING RFID

PROJECT REPORT

Submitted by

PREM LOHIA (RA2211029010007)

CHIRANJEEV KUMAR (RA2211029010019)

KARTIKEY MISHRA (RA2211029010022)

ANITEJ MISHRA (RA2211029010023)

Under the guidance of

Dr S. Ramesh

Assistant Professor, Department of Networking and Communications

In partial satisfaction of the requirements for the degree of

BACHELOR OF TECHNOLOGY

in

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with specialization in Computer Networking

DEPARTMENT OF NETWORKING AND COMMUNICATIONS

COLLEGE OF ENGINEERING AND TECHNOLOGY

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

KATTANKULATHUR-603 203

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KATTANKULATHUR-603 203

BONAFIDE CERTIFICATE

Certified that this Project Report titled "**MICROPROCESSOR-BASED AUTOMATIC ATTENDANCE RECORDER USING RFID**" is the bonafide work done by:

PREM LOHIA (RA2211029010007)

CHIRANJEEV KUMAR (RA2211029010019)

KARTIKEY MISHRA (RA2211029010022)

ANITEJ MISHRA (RA2211029010023)

who completed the project under my supervision. Certified further, that to the best of my knowledge the work reported herein does not form part of any other work.

SIGNATURE

Dr S. Ramesh

COA-Course Faculty

Assistant Professor

Department of Networking and Communications

SRMIST

SIGNATURE

Dr Annapurani Panaiyappan

Head of the Department

Department of Networking and Communications

SRMIST

DEPARTMENT OF NETWORKING AND COMMUNICATIONS

SCHOOL OF COMPUTING

College of Engineering and Technology

SRM Institute of Science and Technology

MINI PROJECT REPORT

ODD Semester, 2023-2024

Subject Code & Name : 21CSS201T & Computer Organization and Architecture

Year & Semester : II & III

Project Title : Microprocessor-based Automatic Attendance Recorder using RFID

Lab Supervisor **: Dr S. Ramesh**

Team Members : 1. Anitej Mishra (RA2211029010023)

2. Kartikey Mishra (RA2211029010022)

3. Chiranjeev Kumar (RA2211029010019)

4. Prem Lohia (RA2211029010007)

Particulars	**Max. Marks**	**Marks Obtained**
		Name:
		Register No:
Program and Execution	20	
Demo Verification & Viva	15	
Project Report	05	
Total	**40**	

Date :

Staff Name :

Signature :

TABLE OF CONTENTS

1. OBJECTIVE AND ABSTRACT

Radio Frequency Identification (RFID) is a new technology in communication system which can be defined as a medium used to identify and track the special tag implanted into an object or a living thing by using radio frequency waves. It is a wireless medium of communication that uses electromagnetic and electrostatic coupling in radio frequency portion of the spectrum to communicate between reader and tag through a variety of modulation and encoding schemes.

Nowadays, most universities use the conventional method of taking attendance by calling names or signing on paper, which is very time consuming and inefficient.

From that, by integrating various components, namely an RFID reader, RFID card, micro-controller, and Secure Digital Card (SD Card), a portable RFID based attendance system can be set up to address this problem.

Uniquely identifying each person based on RFID tag is one of its special abilities that can make the recording attendance process faster and easier compared to the conventional methods.

OBJECTIVE: To create an automatic attendance recorder for an organization using microprocessors and RFID concepts.

2. INTRODUCTION

In an era marked by rapid technological advancements and the increasing integration of digital solutions into various aspects of our lives, the realm of education and institutional management has not remained untouched. Efficient attendance monitoring is a pivotal component of educational institutions, fostering accountability, transparency, and streamlined record-keeping. Traditional methods of manual attendance taking, often fraught with inaccuracies and time constraints, have been steadily replaced by sophisticated automated systems. One such innovative solution is the Microprocessor-Based Automatic Attendance Recorder using Radio Frequency Identification (RFID) technology.

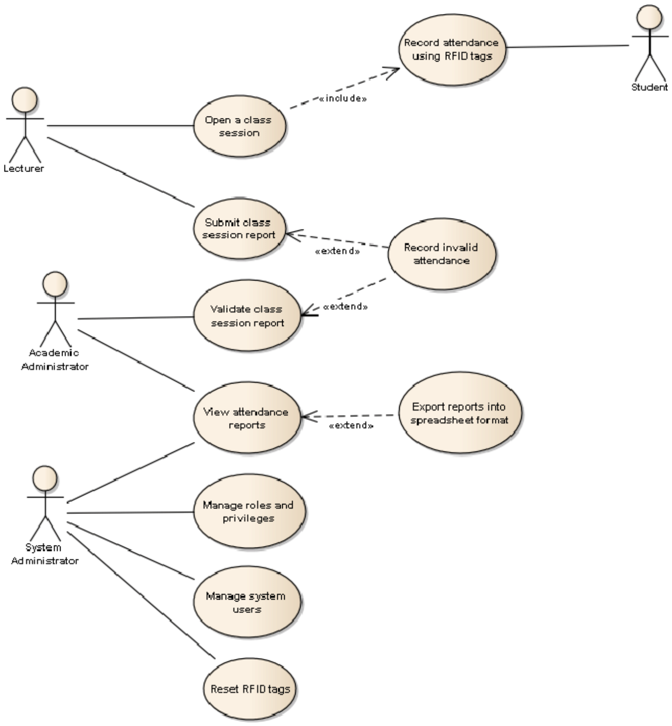
The primary goal of this project is to harness the power of microprocessors and RFID technology to create an automated attendance recording system that not only reduces the burden on educators but also enhances data accuracy and security. The integration of microprocessors, commonly used in computing devices and embedded systems, with RFID technology, which relies on radio waves to communicate with RFID tags, presents a promising avenue for transforming attendance management.

This project explores the conceptualization, design, and implementation of a microprocessor-based automatic attendance recorder system. It leverages the capabilities of RFID tags and readers to facilitate seamless attendance tracking. When a student or staff member enters a predefined zone equipped with RFID readers, their RFID tag is detected and registered by the system. The microprocessor processes this information in real-time, updating the attendance database instantly. This not only eliminates the need for manual data entry but also minimizes the scope for errors, ensuring a more reliable attendance record.

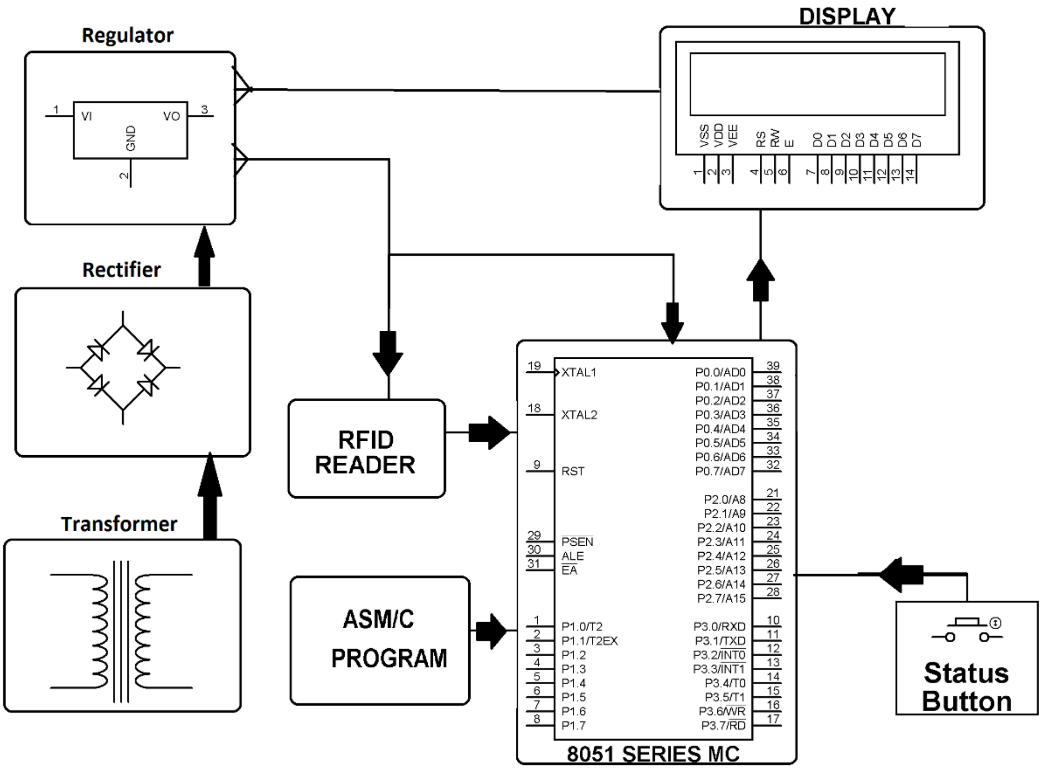
Furthermore, this report will delve into the technical intricacies of the system, detailing the hardware and software components, the choice of microprocessor, RFID technology, and data management. It will also discuss the potential benefits and challenges of implementing such a system in educational institutions. By exploring the design and implementation of a Microprocessor-Based Automatic Attendance Recorder using RFID, this project aims to contribute to the ongoing discourse surrounding the digital transformation of educational institutions, ultimately enhancing efficiency and accountability in academia.

3. DIAGRAMS

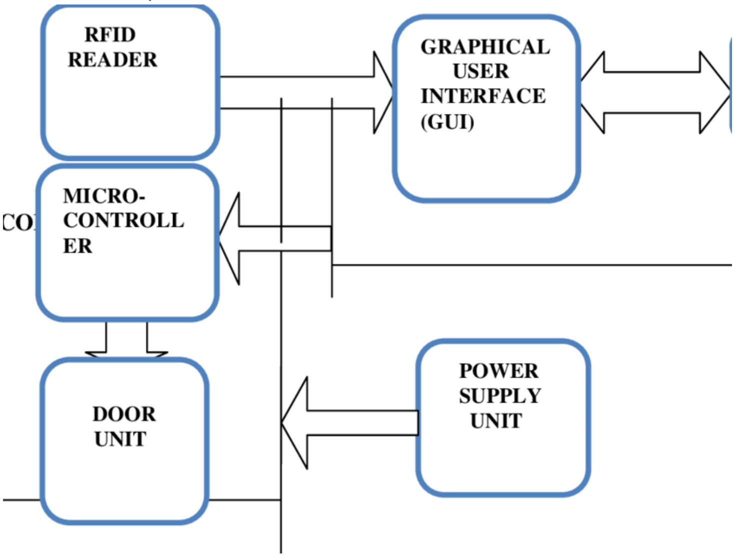
A) USE CASE DIAGRAM



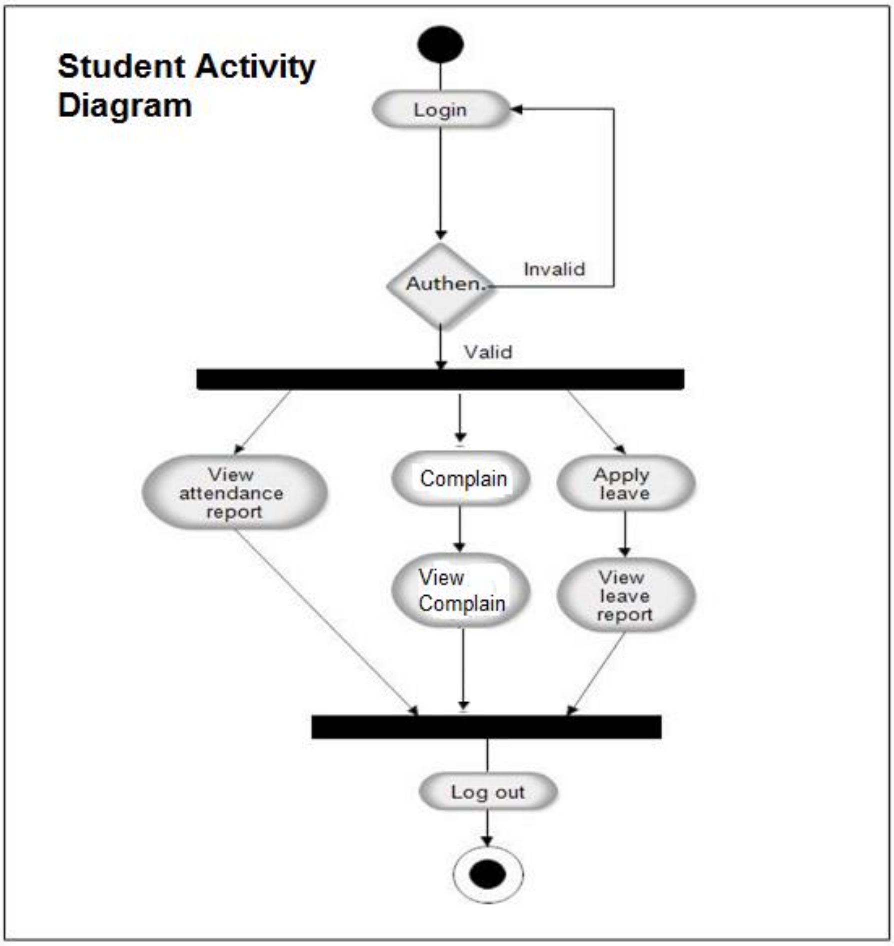
B) CLASS DIAGRAM



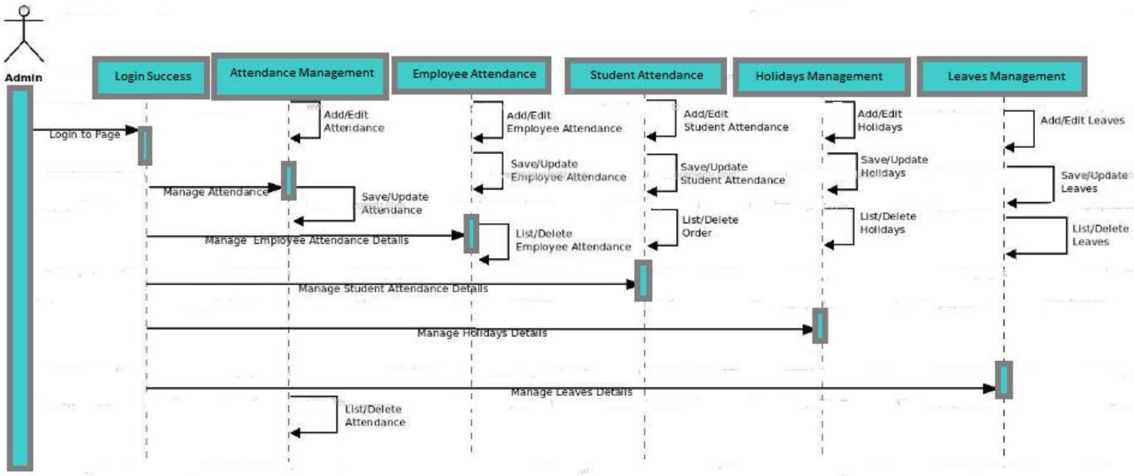
C) COMPONENT DIAGRAM



D) ACTIVITY DIAGRAM

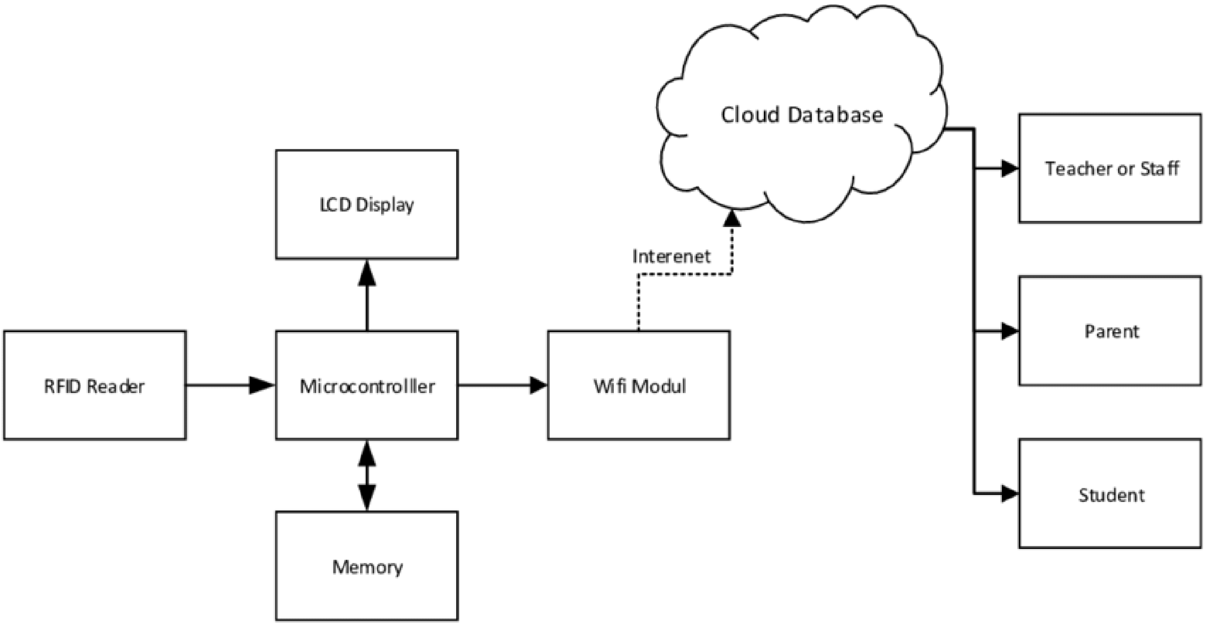


E) SEQUENCE DIAGRAM



Sequence Diagram of Attendance Management System

F) COLLABORATION DIAGRAM



4. HARDWARE AND SOFTWARE REQUIREMENTS

The following components are the **HARDWARE** requirements:

1. 8051 Series Microcontroller
2. RFID Tags for each user
3. RFID Reader
4. LCD Display
5. Transformer
6. Rectifier
7. SD Card Module
8. Arduino Uno Board
9. Jumper Wires
10. Bread Board
11. Switch
12. Integrated Circuit (IC)
13. IC Sockets

The following components are the **SOFTWARE** requirements:

1. Embedded C or Assembly Language
2. Arduino Integrated Development Environment (IDE) Software
3. Keil µVision IDE

5. CONCEPTS AND WORKING PRINCIPLE

Radio Frequency Identification (RFID) is a form of wireless communication that incorporates the use of electromagnetic or electrostatic coupling in the radio frequency portion of the electromagnetic spectrum to uniquely identify an object, an animal, or a person.

It uses radio frequency to search, identify, track, and communicate with items and people. it is a method that is used to track or identify an object by radio transmission uses over the web.

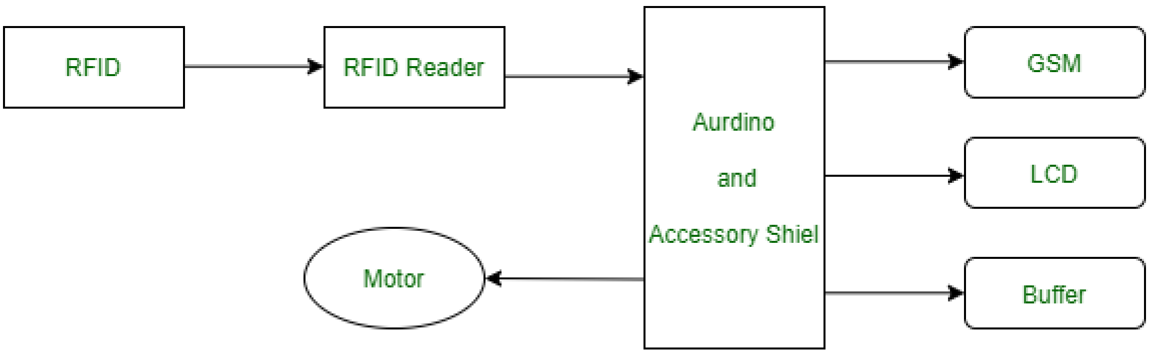
Data digitally encoded in an RFID tag which might be read by the reader. This device work as a tag or label during which data read from tags that are stored in the database through the reader as compared to traditional barcodes and QR codes. It is often read outside the road of sight either passive or active RFID.

There are two types of RFID: Active and Passive, based on whether they have their own independent power source (Active) or use the power from the reader (passive).

Working Principle of RFID

Generally, RFID uses radio waves to perform AIDC function. AIDC stands for Automatic Identification and Data Capture technology which performs object identification and collection and mapping of the data.

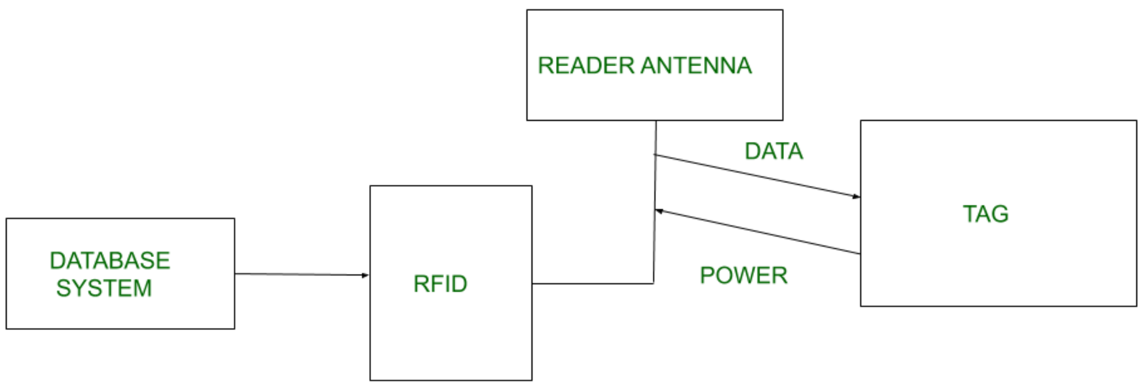
An antenna is a device which converts power into radio waves which are used for communication between reader and tag. RFID readers retrieve the information from RFID tag which detects the tag and reads or writes the data into the tag. It may include one processor, package, storage and transmitter and receiver unit.



How an RFID System works?

Every RFID system consists of three components: a scanning antenna, a trans-receiver, and a transponder. When the scanning antenna and transceiver are combined, they are referred to as an RFID reader or interrogator. There are two types of RFID readers — fixed readers and mobile readers. The RFID reader is a network-connected device that can be portable or permanently attached. It uses radio waves to transmit signals that activate the tag. Once activated, the tag sends a wave back to the antenna, where it is translated into data.

The transponder is in the RFID tag itself. The read range for RFID tags varies based on factors including the type of tag, type of reader, RFID frequency and interference in the surrounding environment or from other RFID tags and readers. Tags that have a stronger power source also have a longer read range.



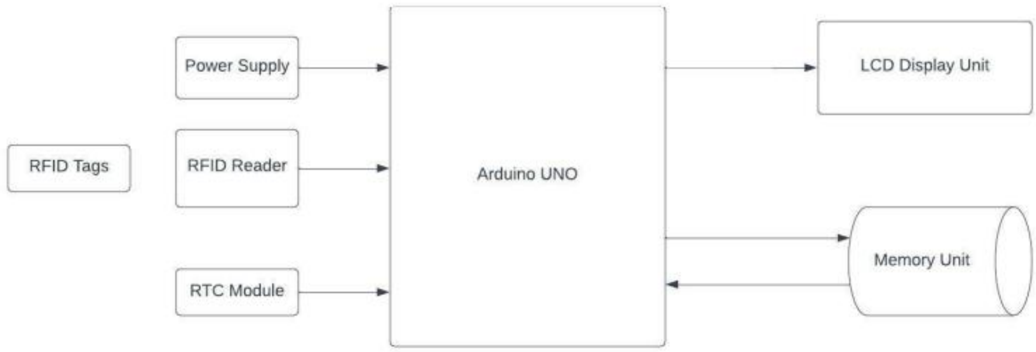
6. APPROACH, METHODOLOGY AND PROGRAMS

Methodology using Block Diagram

The block diagram shown below represents the control system in a diagrammatic form. In other words, it shows the practical representation of a control system. Each element of the control system is represented with a block and the block is the symbolic representation of the transfer function of that element. Here Arduino UNO acts as a central processor for controlling all other components as input/output unit.

The function of each block in the block diagram above is as follows:

- RFID Reader: the input block consists of an RFID reader, the tag data card that the reader detects will be sent to the microcontroller.
- Block microcontroller, data processor and central controller of the system.
- Once it is verified by the microcontroller, data is stored in the memory unit.

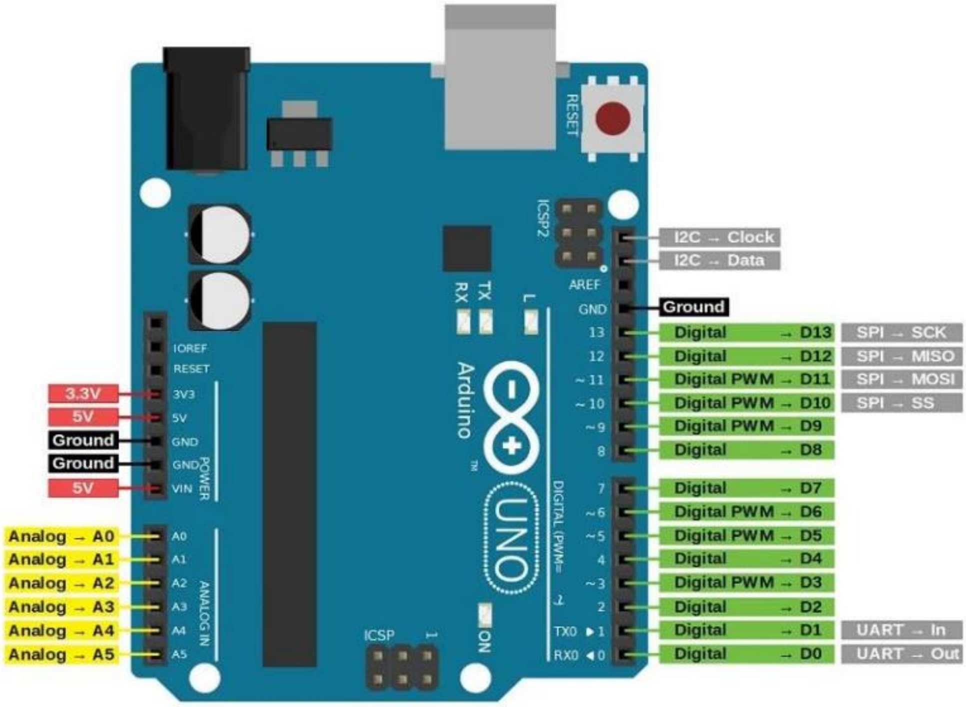


Pin Diagram

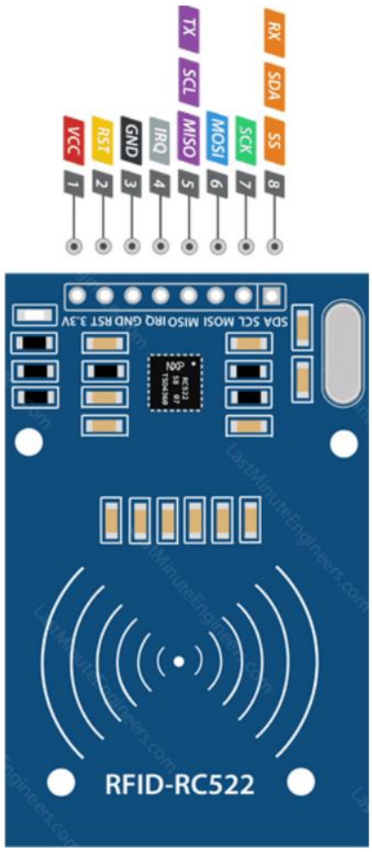
A pin out is a reference to the pins or contacts that connect an electrical device or connector. It describes the functions of transmitted signals and the circuit input/output (I/O) requirements. Each individual pin in a chip, connector or singular wire is defined in text, a table, or a diagram.

Pin Out of different modules are shown below.

- Arduino Uno Board



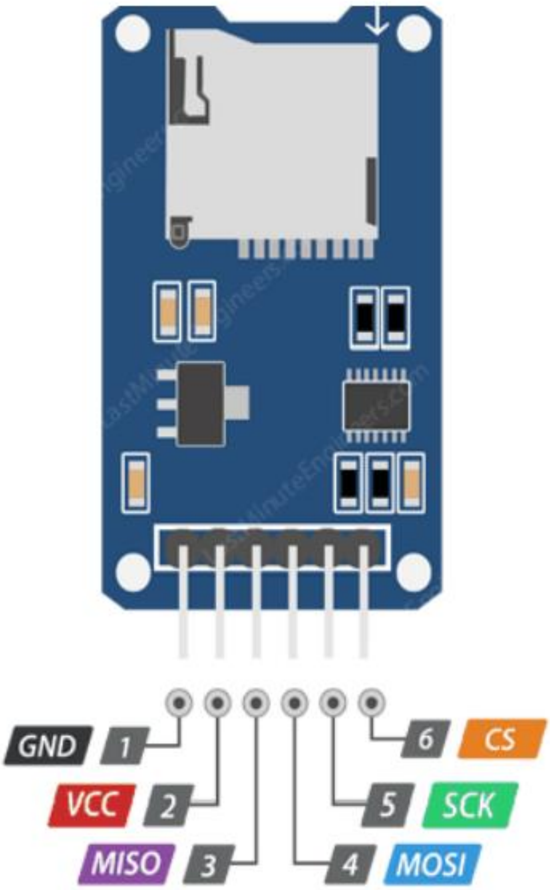
- RFID-RC522



RC522 Pin Configuration

Pin Number	Pin Name	Description
1	Vcc	Used to Power the module, typically 3.3V is used
2	RST	Reset pin – used to reset or power down the module
3	Ground	Connected to Ground of system
4	IRQ	Interrupt pin – used to wake up the module when a device comes into range
5	MISO/SCL/TX	MISO pin when used for SPI communication, acts as SCL for I2c and TX for UART.
6	MOSI	Master out slave in pin for SPI communication
7	SCK	Serial Clock pin – used to provide clock source
8	SS/SDA/Rx	Acts as Serial input (SS) for SPI communication, SDA for IIC and Rx during UART

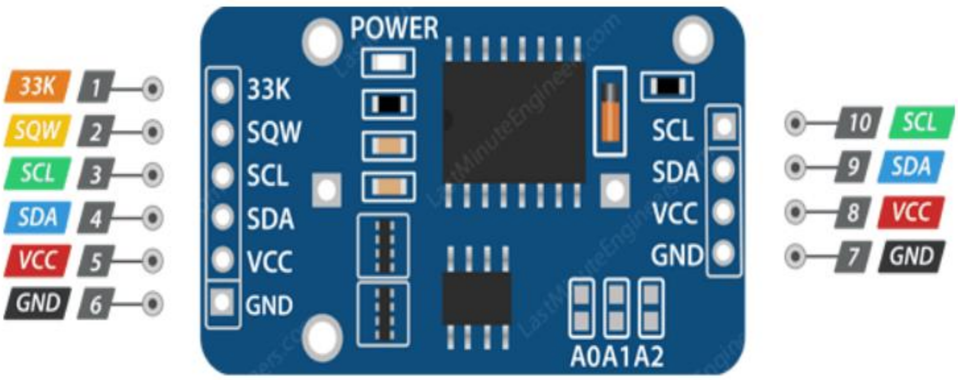
- SD Card Module



SD Card Pin Configuration

Pin Type	Pin Description
GND	Ground
VCC	Voltage Input
MISO	Master In Slave Out (SPI)
MOSI	Master Out Slave In (SPI)
SCK	Serial Clock (SPI)
CS	Chip Select (SPI)

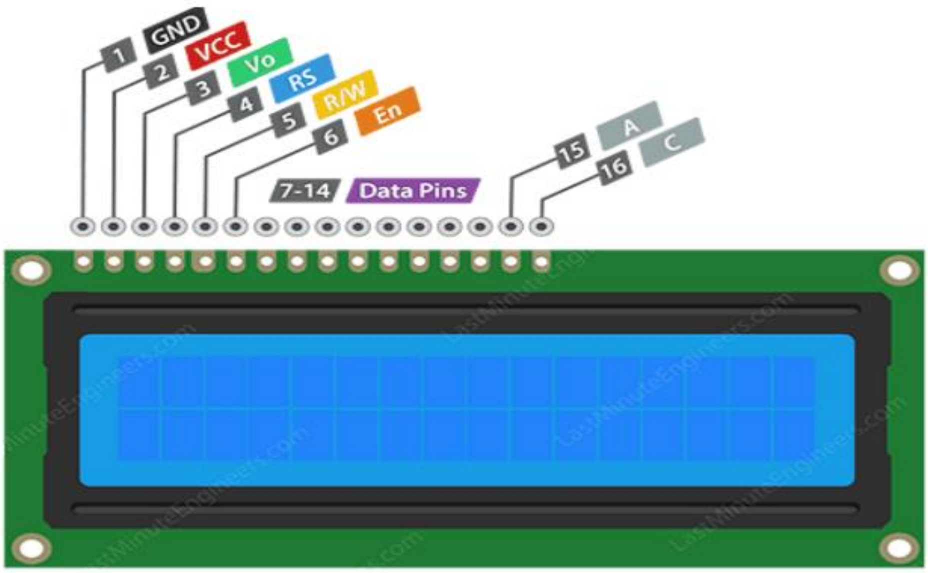
- RTC Module



RTC Module Pin Configuration

Pin Name	Description
VCC	Connected to positive of power source.
GND	Connected to ground.
SDA	Serial Data pin (I2C interface)
SCL	Serial Clock pin (I2C interface)
SQW	Square Wave output pin
32K	32K oscillator output

- LCD Display Module



Program Explanation

To program for RFID based attendance system, we first need to include header files and define input and output pin and variables.

```
#include<reg51.h>
#include<string.h>
#include<stdio.h>
```

```
sbit rs=P1^0;
sbit rw=P1^1;
sbit en=P1^2;
sbit m1=P2^4;
sbit m2=P2^5;
sbit buzzer=P2^6;
char i,rx_data[50];
char rfid[13],ch=0;
```

After this we need to create a function for delay.

```
 void delay(int itime)
{
    int i,j;
    for(i=0;i<itime;i++)
    for(j=0;j<1275;j++);
}
```

Then we make some function for LCD and initialize LCD function,

```
void lcd_init(void)
{
    lcdcmd(0x02);
    lcdcmd(0x28);
    lcdcmd(0x0e);
    lcdcmd(0x01);
}
```

Here we have some function that we have used in our program. In this we have configured 9600bps baud rate at 11.0592MHz Crystal Frequency. We are monitoring the SBUF register for receiving data.

```
void uart_init()
{
 TMOD=0x20;
 SCON=0x50;
 TH1=0xfd;
 TR1=1;
```

```
}


char rxdata()
{
  while(!RI);
    ch=SBUF;
    RI=0;
    return ch;
}
```

After this in main program, we have initialized LCD and UART and then we read the output of RFID when any one tag is on it. We will store this string in an array and then match with predefined array data.

```
        lcdcmd(1);
        lcdstring("Place Your Card:");
        lcdcmd(0xc0);
        i=0;
        for(i=0;i<12;i++)
        rfid[i]=rxdata();
        rfid[i]='\0';
        lcdcmd(1);
```

If a match occurs, then controller increases the attendance by one. Else the buzzer runs continuously, and LCD shows an invalid card error message.

```
        if(strncmp(rfid,"160066A5EC39",12)==0)
        {
            count1++;
            lcdcmd(1);
            lcdstring(" Attendance ");
            lcdcmd(0xc0);
            lcdstring(" Registered");
            delay(200);
            lcdcmd(1);
            lcdstring(" Student1 ");
            lcdcmd(0xc0);
            lcdstring("Attnd. No.: ");
```

```
            sprintf(result, "%d", count1);
            lcdstring(result);
```

Full Program

```
#include<reg51.h>
#include<string.h>
#include<stdio.h>
#define lcdport P1

sbit rs=P1^0;
sbit rw=P1^1;
sbit en=P1^2;
sbit m1=P2^4;
sbit m2=P2^5;
sbit buzzer=P2^6;
char i,rx_data[50];
char rfid[13],ch=0;
int count1, count2, count3;
unsigned char result[1];
 void delay(int itime)
{
    int i,j;
    for(i=0;i<itime;i++)
    for(j=0;j<1275;j++);
}

void daten()
{
    rs=1;
    rw=0;
    en=1;
```

```
    delay(5);
    en=0;
}
void lcddata(unsigned char ch)
{
    lcdport=ch & 0xf0;
    daten();
    lcdport=(ch<<4) & 0xf0;
    daten();
}

void cmden(void)
{
    rs=0;
    en=1;
    delay(5);
    en=0;
}
void lcdcmd(unsigned char ch)
{
    lcdport=ch & 0xf0;
    cmden();
    lcdport=(ch<<4) & 0xf0;
    cmden();
}
void lcdstring(char *str)
{
    while(*str)
    {
        lcddata(*str);
```

```
        str++;
    }
}
void lcd_init(void)
{
    lcdcmd(0x02);
    lcdcmd(0x28);
    lcdcmd(0x0e);
    lcdcmd(0x01);
}
void uart_init()
{
 TMOD=0x20;
 SCON=0x50;
 TH1=0xfd;
 TR1=1;
}
char rxdata()
{
  while(!RI);
    ch=SBUF;
    RI=0;
    return ch;
}
void main()
{
    buzzer=1;
    uart_init();
    lcd_init();
```

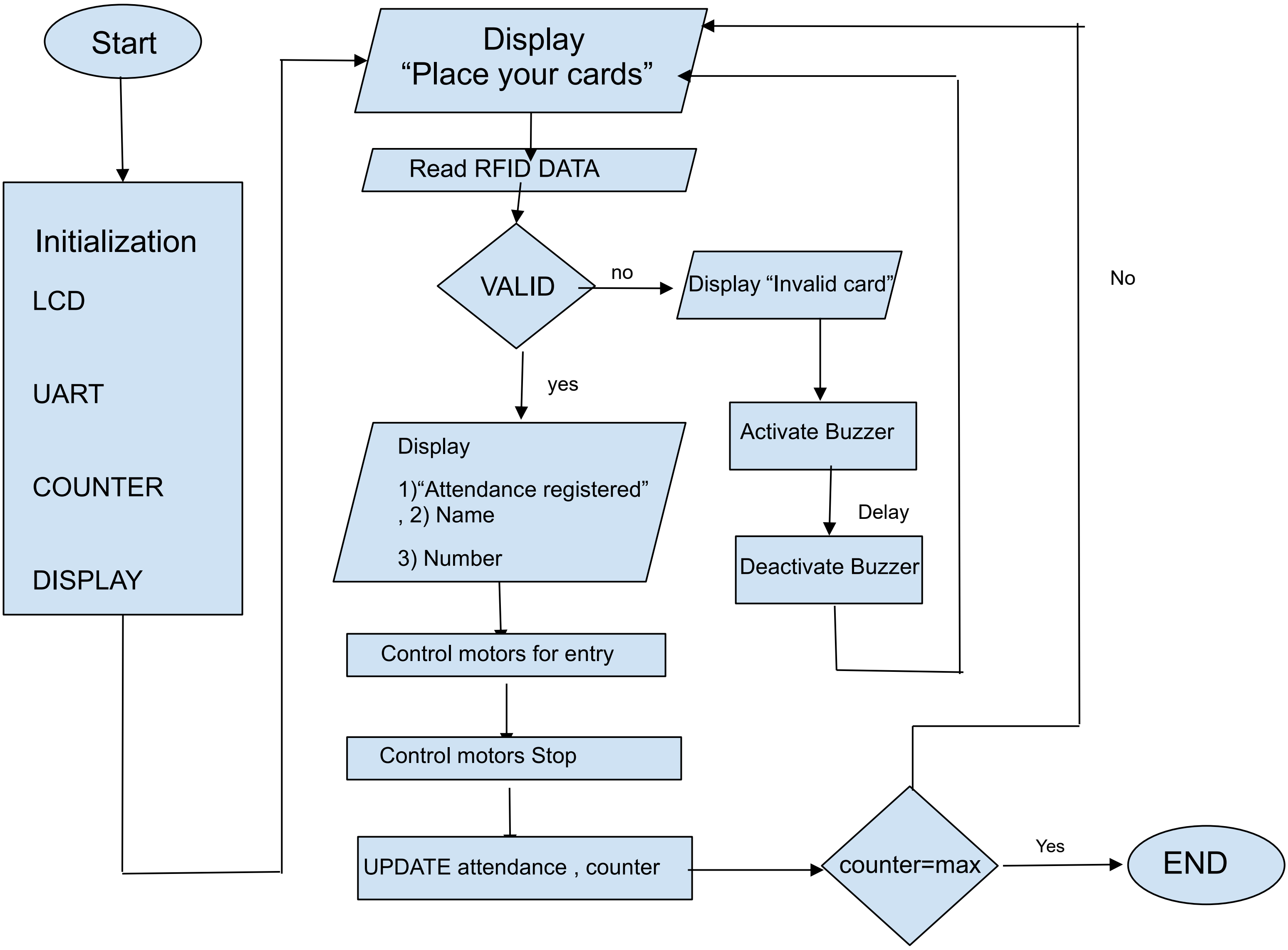
```
    lcdstring("  RFID Based    ");

    lcdcmd(0xc0);

    lcdstring("Attendance Systm");

    delay(400);

    while(1)

    {

        lcdcmd(1);

        lcdstring("Place Your Card:");

        lcdcmd(0xc0);

        i=0;

        for(i=0;i<12;i++)

        rfid[i]=rxdata();

        rfid[i]='\0';

        lcdcmd(1);

        lcdstring("Your ID No. is:");

        lcdcmd(0xc0);

        for(i=0;i<12;i++)

        lcddata(rfid[i]);

        delay(100);

        if(strncmp(rfid,"160066A5EC39",12)==0)

        {

            count1++;

            lcdcmd(1);

            lcdstring(" Attendance ");

            lcdcmd(0xc0);

            lcdstring(" Registered");

            delay(200);

            lcdcmd(1);

            lcdstring(" Student1 ");
```

```
        lcdcmd(0xc0);

        lcdstring("Attnd. No.: ");

        sprintf(result, "%d", count1);

        lcdstring(result);


        m1=1;

        m2=0;

        delay(300);

        m1=0;

        m2=0;

        delay(200);

        m1=0;

        m2=1;

        delay(300);

        m1=0;

        m2=0;

    }


    else if(strncmp(rfid,"160066BD7AB7",12)==0)

        {

        count2++;

        lcdcmd(1);

        lcdstring(" Attendance ");

        lcdcmd(0xc0);

        lcdstring(" Registered");

        delay(200);

        lcdcmd(1);

        lcdstring(" Student2 ");

        lcdcmd(0xc0);
```

```
        lcdstring("Attnd. No.: ");
        sprintf(result, "%d", count2);
        lcdstring(result);

        m1=1;
        m2=0;
        delay(300);
        m1=0;
        m2=0;
        delay(200);
        m1=0;
        m2=1;
        delay(300);
        m1=0;
        m2=0;
    }

            else if(strncmp(rfid,"160066203060",12)==0)
        {
            count3++;
        lcdcmd(1);
        lcdstring(" Attendance ");
        lcdcmd(0xc0);
        lcdstring(" Registered");
        delay(200);
        lcdcmd(1);
        lcdstring(" Student3 ");
        lcdcmd(0xc0);
        lcdstring("Attnd. No.: ");
```

```
            sprintf(result, "%d", count3);
            lcdstring(result);


            m1=1;
            m2=0;
            delay(300);
            m1=0;
            m2=0;
            delay(200);
            m1=0;
            m2=1;
            delay(300);
            m1=0;
            m2=0;
            }
        else
        {
           lcdcmd(1);
           lcdstring("Invalid Card");
           buzzer=0;
           delay(300);
           buzzer=1;
        }
  }
}
```

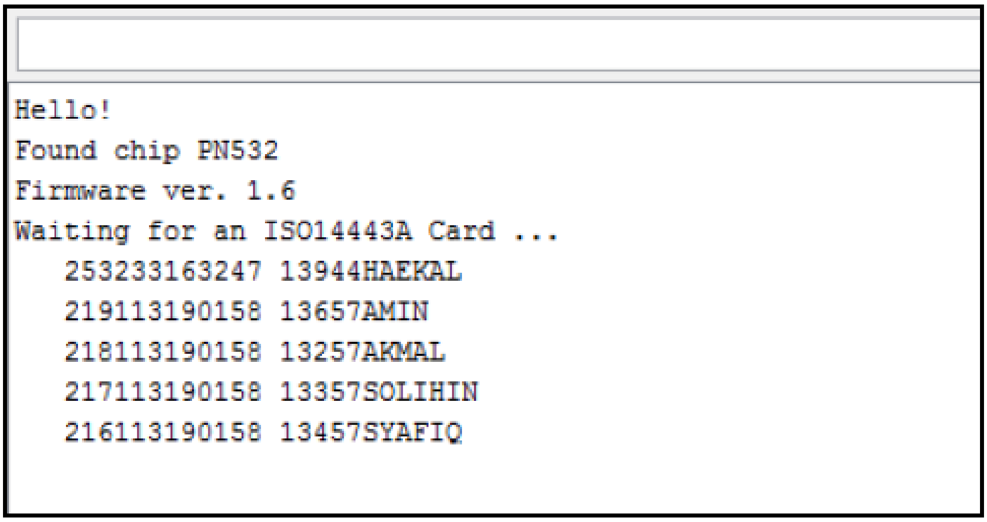
7. FLOWCHART



Start
Initialization
LCD
UART
COUNTER
DISPLAY
Display
“Place your cards”
Read RFID DATA
VALID
no
Display “Invalid card”
yes
Display
1)“Attendance registered”
, 2) Name
3) Number
Activate Buzzer
Delay
Deactivate Buzzer
Control motors for entry
Control motors Stop
UPDATE attendance , counter
counter=max
No
Yes
END

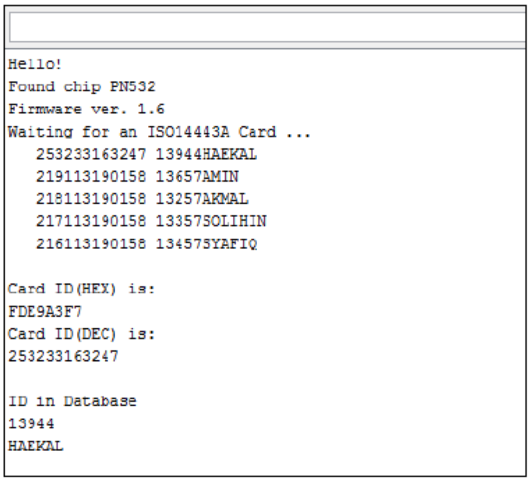
8. OUTPUT

In this phase, the communication between software and hardware is observed in serial monitor with 115200 baud. After the code is compiled, the serial monitor will list the database including the students' names and their matric numbers which is stored inside the microSD card.

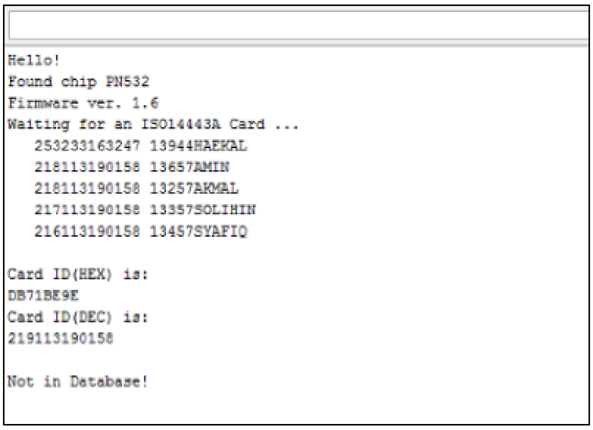


```
Hello!
Found chip PN532
Firmware ver. 1.6
Waiting for an ISO14443A Card ...
   253233163247 13944HAEKAL
   219113190158 13657AMIN
   218113190158 13257AKMAL
   217113190158 13357SOLIHIN
   216113190158 13457SYAFIQ
```

After swiping an RFID card, the serial monitor will list down a few additional things which are ID card number in hexadecimal and decimal, name together with matric number of card's owner and scanning condition. If the card is set/stored in the database, the serial monitor will show "ID in Database" as shown in the left figure but if the card is not set/stored, it will show "Not in Database" as shown in the right figure.



```
Hello!
Found chip PN532
Firmware ver. 1.6
Waiting for an ISO14443A Card ...
   253233163247 13944HAEKAL
   219113190158 13657AMIN
   218113190158 13257AKMAL
   217113190158 13357SOLIHIN
   216113190158 13457SYAFIQ

Card ID(HEX) is:
FDE9A3F7
Card ID(DEC) is:
253233163247

ID in Database
13944
HAEKAL
```



```
Hello!
Found chip PN532
Firmware ver. 1.6
Waiting for an ISO14443A Card ...
   253233163247 13944HAEKAL
   218113190158 13657AMIN
   218113190158 13257AKMAL
   217113190158 13357SOLIHIN
   216113190158 13457SYAFIQ

Card ID(HEX) is:
DB71BE9E
Card ID(DEC) is:
219113190158

Not in Database!
```

Final Phase

- After finishing the initial phase, the development of prototype will proceed to the most crucial part which is updated the database. From that, a few additional features must be added which are Real Time Clock (RTC) to save the attendance date/time, switches to change the state of the system and 2500 mAh power bank as a power source of this device. The table below shows the additional module arrangement inside the prototype.

ARDUINO		RTC		SWITCH	
GND		GND		GND	
3.3V					
5V		VCC		VCC	
SDA		SDA	I2C		
SCL		SCL	I2C		
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					SW1
50					
51					
52					
53					

- For the software part, an additional task needs to be programmed. The updated database will be created in text.csv file and save inside the microSD card.

9. CONCLUSIONS

The development of a microprocessor-based automatic attendance recorder using RFID technology represents a significant advancement in modern attendance tracking systems.

This innovative solution offers numerous benefits, including accuracy, efficiency, and security. By seamlessly integrating RFID technology with a microprocessor, this system simplifies the attendance recording process, reduces the likelihood of errors, and enhances overall data management.

The real-time data collection and automated reporting capabilities contribute to increased productivity and transparency in various educational and corporate settings.

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