

# **RV College of Engineering®**

**(Autonomous Institution Affiliated to VTU, Belagavi)**



## **Modelling, simulation RFID devices, materials and engineering applications**

Experiential Report

Submitted by

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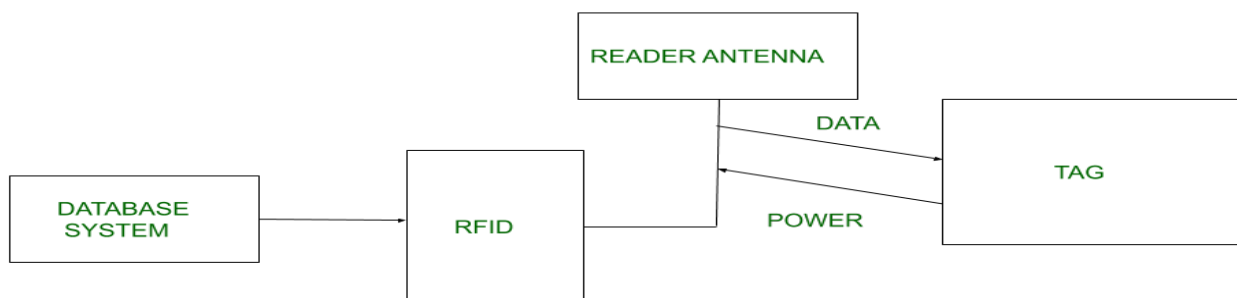
# INTRODUCTION

The term RFID refers to Radio Frequency Identification, a technology which uses radio waves to automatically identify items or people. Most commonly this involves the use of an RFID tag and a reader device. The frequency range of radio waves varies from 3kHz to 300GHz.

There are two main components in RFID systems,

- RFID reader
- RFID tag

The reader emits a field of electromagnetic waves from an antenna, which are absorbed by the tag. The absorbed energy is used to power the tag's microchip and a signal that includes the tag identification number is sent back to the reader.



# LITERATURE REVIEW

Sl No	Paper Title, Journal Name, Year	Major findings / observations
1	The RFID Technology And Its Applications: A Review Davinder Parkash, Twinkle Kundu & Preet Kaur	<p><b>Introduction to RFID technology</b> Components of RFID:-</p> <p><b>Transponder Tags :-</b> A simple silicon microchip that has an unique identification code.</p> <p><b>RFID Antenna:-</b> Used to collect information</p> <p><b>RFID Reader:-</b> Transmits and receives radio waves from the tag. Informs data processing system the presence of tag.</p> <p><b>Operating Principle of RFID:-</b> Backscattering coupling and inductive coupling are used to transmit RF signals from reader to tag and back. Backscattering coupling is transmission of RF signals through electromagnetic waves. Inductive coupling is transmission of RF signals through magnetic field.</p>
2	RFID Technology: A Review of its Applications Arun N. Nambiar	<p><b>Application of RFID on various fields are:-</b></p> <p><b>Technology:-</b> To develop a dual-function metallic RFID tag with bar codes in the steel industry. These tags proves cost effective and improve readability.</p> <p><b>Privacy and Security:-</b> The unique identification codes of each tags are very helpful in this system and it being unique and distinctive are very useful factors in this field of applications.</p> <p><b>Production Applications:-</b> RFID is used to improve production efficiencies in a integrate circuit packaging house. The RFID system when integrated with the Enterprise Resource Planning (ERP) software allows the company to keep track of each of its wafers as it travels through the packing process.</p> <p><b>Supply Chain Applications:-</b> a RFID-based location identification system to facilitate easy and quick localization of vehicles on a shipping yard of a automotive assembly plant. This improves the delivery performance through better informed decision-making.</p>

Sl No	Paper Title, Journal Name, Year	Major findings / observations
3	RFID-Based Students Attendance Management System Arulogun O. T., Olatunbosun, A., Fakolujo O. A., and Olaniyi, O. M.	<p><b>Hardware Design Considerations</b></p> <ul style="list-style-type: none"> <li>• The primary purpose of an RFID system in this application area is to detect the presence and absence of the student data to be transmitted wirelessly by mobile device, called a tag, which is read by an RFID reader and processed according to the programmed instructions on the personal computer (PC).</li> <li>• The RFID system was designed around Intersoft RFID DemoKit-1 proprietary RFID system serially interfaced to the PC.</li> <li>• The TR-R01-OEM reader board performs all the functions necessary for the RFID reading station. It continuously reads and decodes transponders that are within its reading range. When a transponder tag passes within range of the reader antenna, the RF magnetic field generated by the reader powers the tag. The data is then sent as a packet using a two wire RS232 (or TTL) interface.</li> </ul> <p><b>Software Design Considerations</b></p> <ul style="list-style-type: none"> <li>• In the development cycle of the system, decisions were made on the parts of the system to be realized in the hardware design and the parts to be implemented in software. The code of this system was typed in Microsoft Visual C#.</li> </ul> <p><b>System operation, testing and discussion</b></p> <ul style="list-style-type: none"> <li>• The tag is activated when it passes through a radio frequency (RF) field (125 kHz in this case), which is generated by the antenna embedded within the reader box. The program checks whether the tag is valid or not. If the tag is valid, it will continue to the database program and registers the student's attendance for the course.</li> <li>• Due to the reason of cost and flexibility of implementation, this RFID attendance design application uses a passive tag and thus for every class, students would have to bring their tags close to the reader (about 10 cm from the reader).</li> </ul>

## Problem Statement

- In the traditional system of libraries there were a lot of flaws and many difficulties faced in keeping the track of the books borrowed and the books available. Then there was the introduction of bar code scanner which was initially a good system but later became a drawback as the bar code would easily get erased
- During the lunch breaks or other breaks most of the students' time is spent in standing in lines for the counter to collect the tickets and again wait for the food to be prepared and collected. Then always there is no ample amount of time for the students to eat peacefully during the lunch breaks and other breaks just due to this inefficiency in the cafeteria.
- Most of the students miss their attendance because they couldn't listen to their names during the rollcall. Due to which many of the students though present in the class are marked absent. Ultimately, they end up having an attendance shortage.
- Students mostly are not able to access and make use of college facilities to their maximum benefit. This also includes the many paid software, students can use for their better learning, project work, easier understanding of the concepts etc. for free by using the college's email id.
- Students majorly face issues and also a big security threat when paying fees. Mostly these are due to the slow and unresponsive banking servers, the delay in the OTPs due to which the transaction can get failed and also some error due to which the amount would have been deducted from their account and not reflecting in the college's bank account.

# OBJECTIVES

- Students' ID cards can be used as canteen card.
- Students' ID cards can be used to issue books in libraries.
- Students' ID cards can be used to take attendance for every class.
- Students' ID cards can be used as access control in facilities.
- Students' ID cards can be used as atm/metro cards.

# METHODOLOGY

- We provide every person with a unique RFID card which has a unique number associated with it which can be read by the RFID tag reader.
- The number is then related to the user through methods of coding.
- The person with the card can access the facilities of the college, can give attendance through the card by scanning it to the reader.
- So, the students ID card can be made as an RFID card with an unique number to it which can be used for multiple purposes in college.



# HARDWARE SPECIFICATION

- **RFID TAGS**

RFID tags can be of two types :

- Passive tags
- Active tags

## **PASSIVE TAGS:**

In passive RFID systems, the reader and reader antenna sends the radio signal to the tag, this RFID tag then uses the transmitted signal to on the power, and it reflects energy back to reader.

These Passive RFID systems can work in the low frequency (LF), high frequency (HF) or ultra- high frequency (UHF) radio bands. The passive system ranges are limited by the power of the tags backscatter( radio signal reflected from tag back to reader), they are less than 10m, because passive tags do not require power source or transmitter, but only requires tag chip and an antenna, they are less in cost small in size, and easy to manufacture than active tags. Passive tags can be packed in many different ways, depending on the particular RFID application requirements. For occurrence, they may can be mounted on the substrate, or can be sandwiched between an tacky layer and a paper label to generate smart RFID labels. Passive tags may also be embedded in a variety of devices, or can be packed to make the tag resistant to utmost temperatures or harsh chemicals.

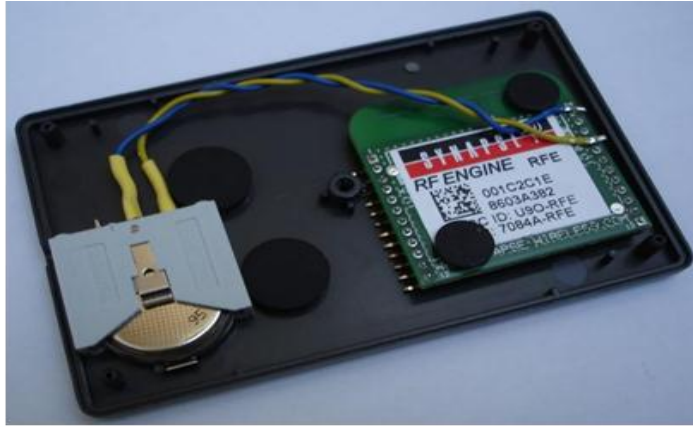
## **ACTIVE TAGS:**

In active RFID system, tags have their own transmitter and power source. The power source is a battery. Active tags transmit their own signal and to transmit the information stored on the microchips.

Active RFID systems usually operate in the ultra-high frequency (UHF) band and offer a typical range of up to 100m. In general, active tags are used for large objects, such as rail cars, big reusable containers, and other assets that need to be traced over longer distances.

There are two main types of active tags: transponders and beacons. Transponders are “woken up” when they receive a radio signal from the reader, and then the power will be on and responds by transmitting a signal back, because transponders do not actively emit radio waves until they receive the reader signal, they protect battery life.

Beacons are used in most real-time locating systems (RTLS), in order to track the exact location of an asset continuously, unlike transponders, beacons are not powered on by reader's signal, instead, they emit signals at certain intervals.



- **RFID READER:**

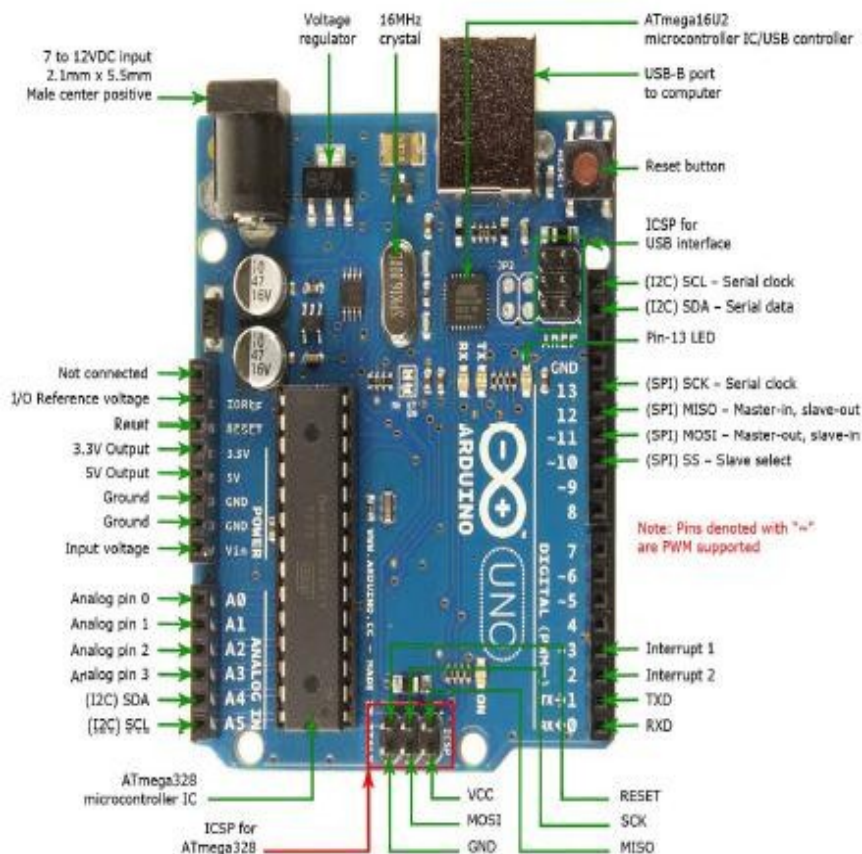
The RFID reader is the module with an RFID reader and antenna. It is small in size and can be unified with any sort of hardware design. It is used to read data stored in the RFID tags.



RFID Reader

## • ARDUINO:

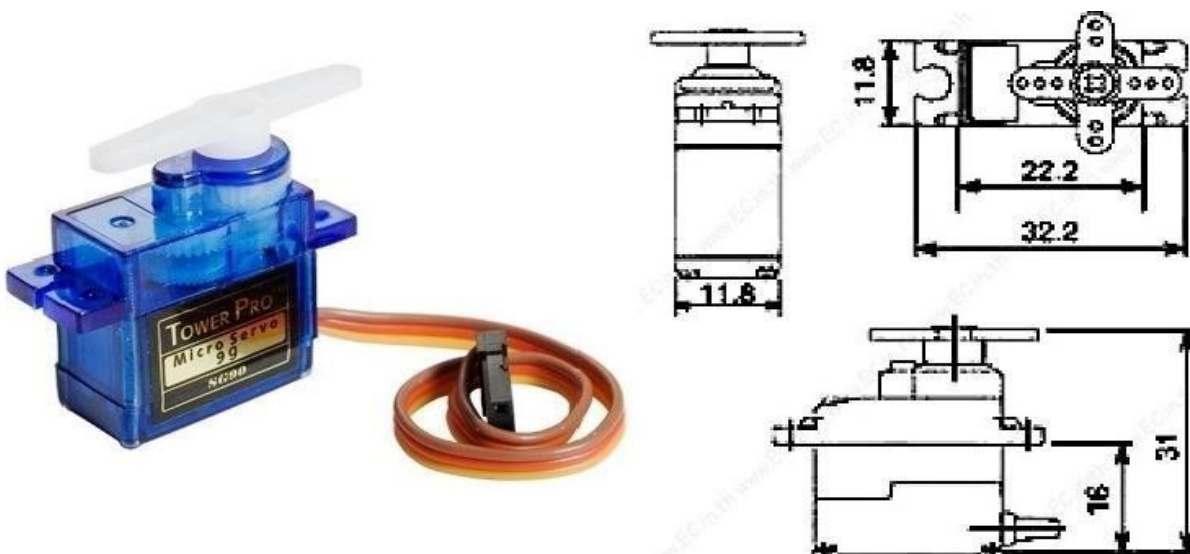
For controlling the signals from many other sensors, and merged modules, Arduino is used. Arduino is the physical computing policy for managing and handling electronics. It has an open source platform independent IDE, which ease programmer to process the electronics signal from the attached components and control them, most popular Arduino board Uno consists of 8-bit Atmel AVR microcontroller clock speed 16MHZ, also the board is not high priced and has very active developers community.



Arduino UNO

- **SERVO MOTOR:**

Scaled-down and lightweight with high output power. Servo can rotate approximately 180 degrees, and works just like the standard kinds but are smaller. We can use any of the servo code, hardware or library to control these servos. This is good for beginners who wants to make stuff move without building the motor controller with feedback and gear box, mainly since it will fit in the small places, this comes with 3 horns and hardware.



SERVO MOTOR

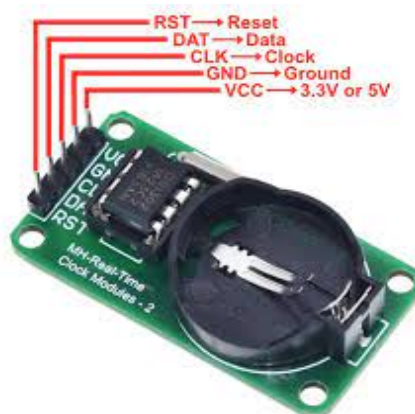
- **BUZZER:**

A beeper or buzzer is a sound flagging device which might be electro mechanical ,mechanical, or piezoelectric. Common uses of buzzers and beepers includes caution devices, timers, and confirmation of client input. The buzzer shown in the figure below gives an alarm when invalid RFID tag is scan .



## REAL TIME CLOCK(RTC):

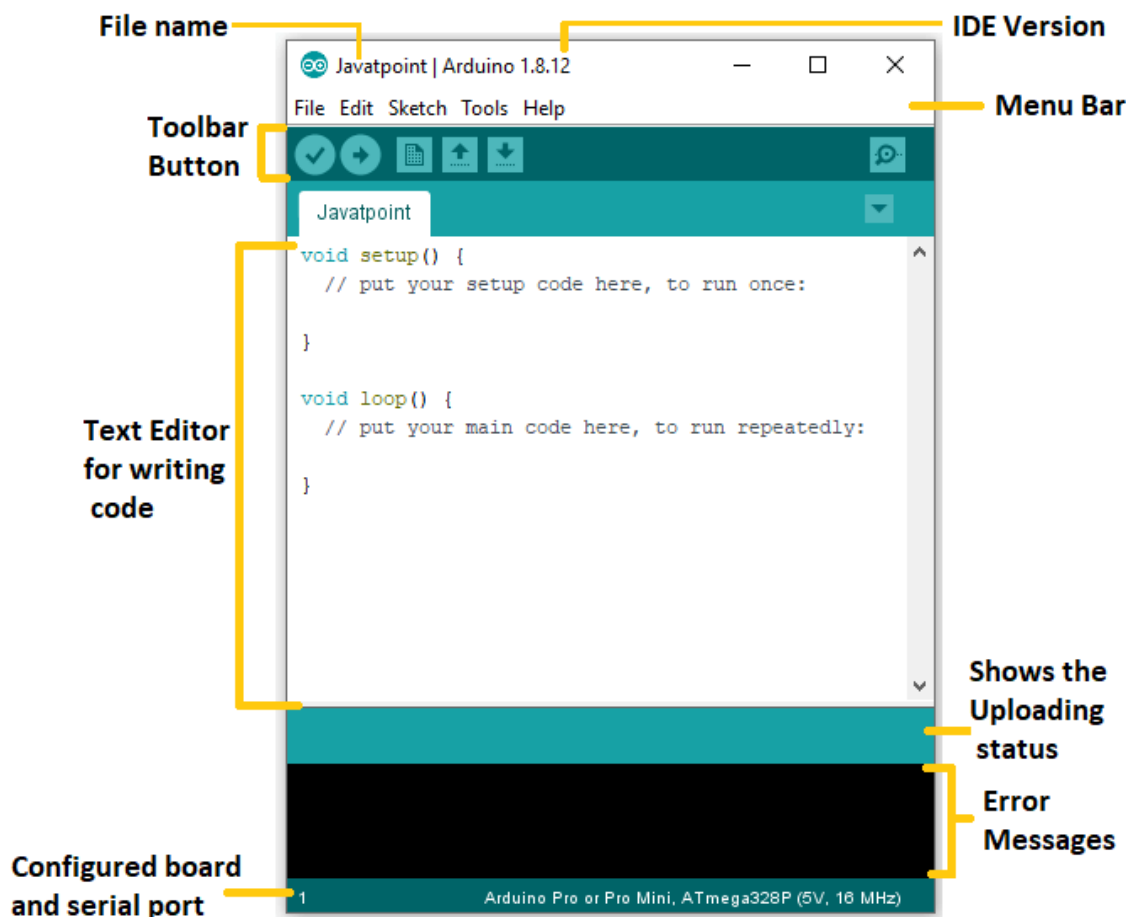
RTCs must accurately keep time, even when the device is powered off because, it is often used as a trigger for turning the device on or triggering events such as alarm clocks. RTC ICs run on an alternate power source, which allows it to continually operate under low power or even when the computer is turned off. ICs on older systems utilize lithium batteries, whereas newer systems make use of auxiliary batteries or supercapacitors. RTC ICs that use supercapacitors are rechargeable and can be soldered. But in most consumer-grade motherboards, the RTC is powered by a single battery that, when removed, resets the RTC to its starting point. RTC ICs regulate time with the use of a crystal oscillator and do not rely on clock signals like most hardware clocks. Aside from being responsible for the timing function of the system and its clock, RTC ICs ensure that all processes occurring in the system are appropriately synchronized. Although some may argue that this is a job for the system clock, the system clock is actually dependent on the RTC, making the RTC indirectly responsible for synchronization.



# SOFTWARE REQUIREMENTS

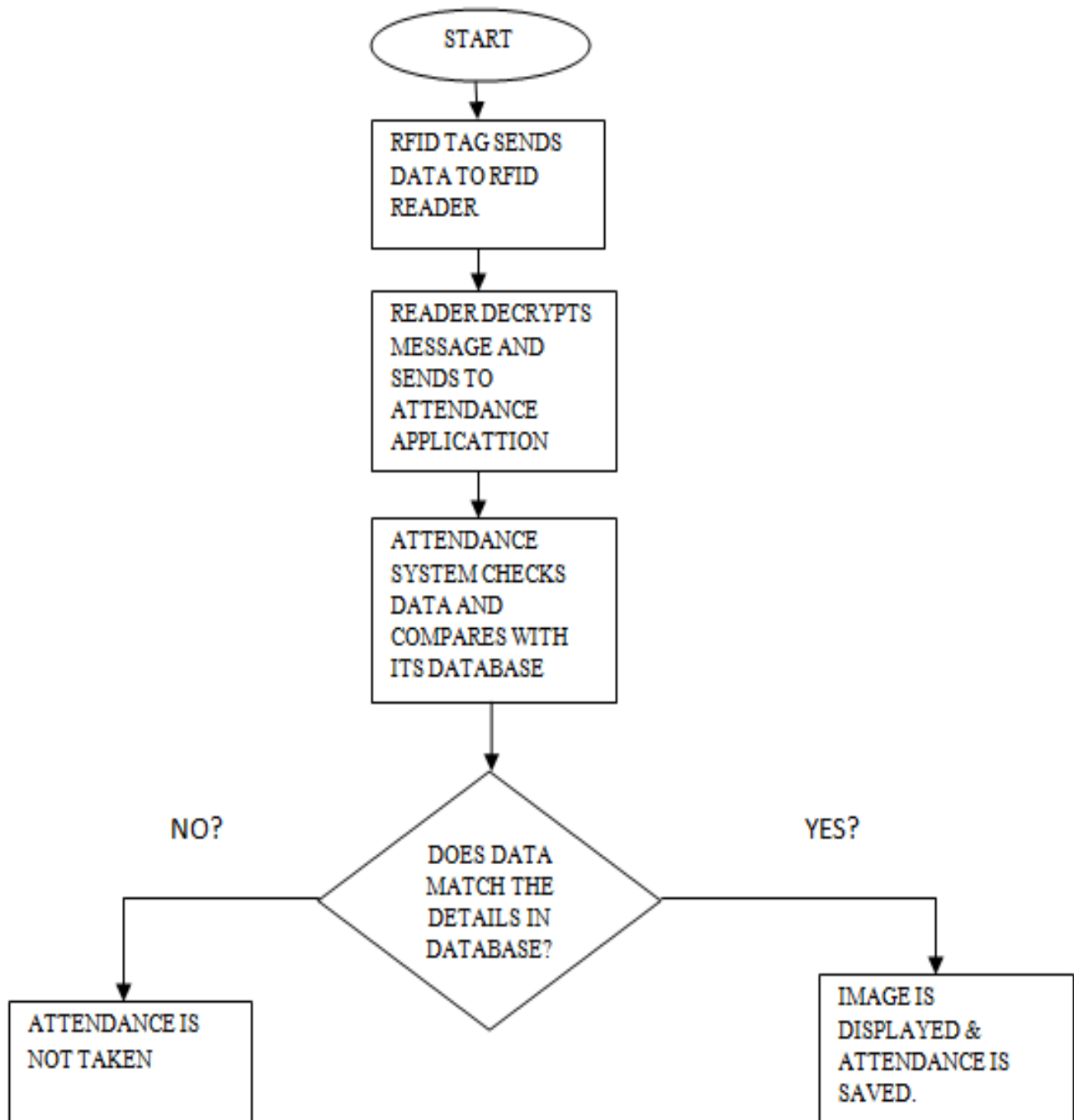
The Arduino integrated development environment (IDE) is a cross-platform application (for Microsoft Windows, macOS, and Linux) that is written in the Java programming language. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. The source code for the IDE is released under the GNU General Public License, version 2.

The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub `main()` into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program `avrdude` to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.



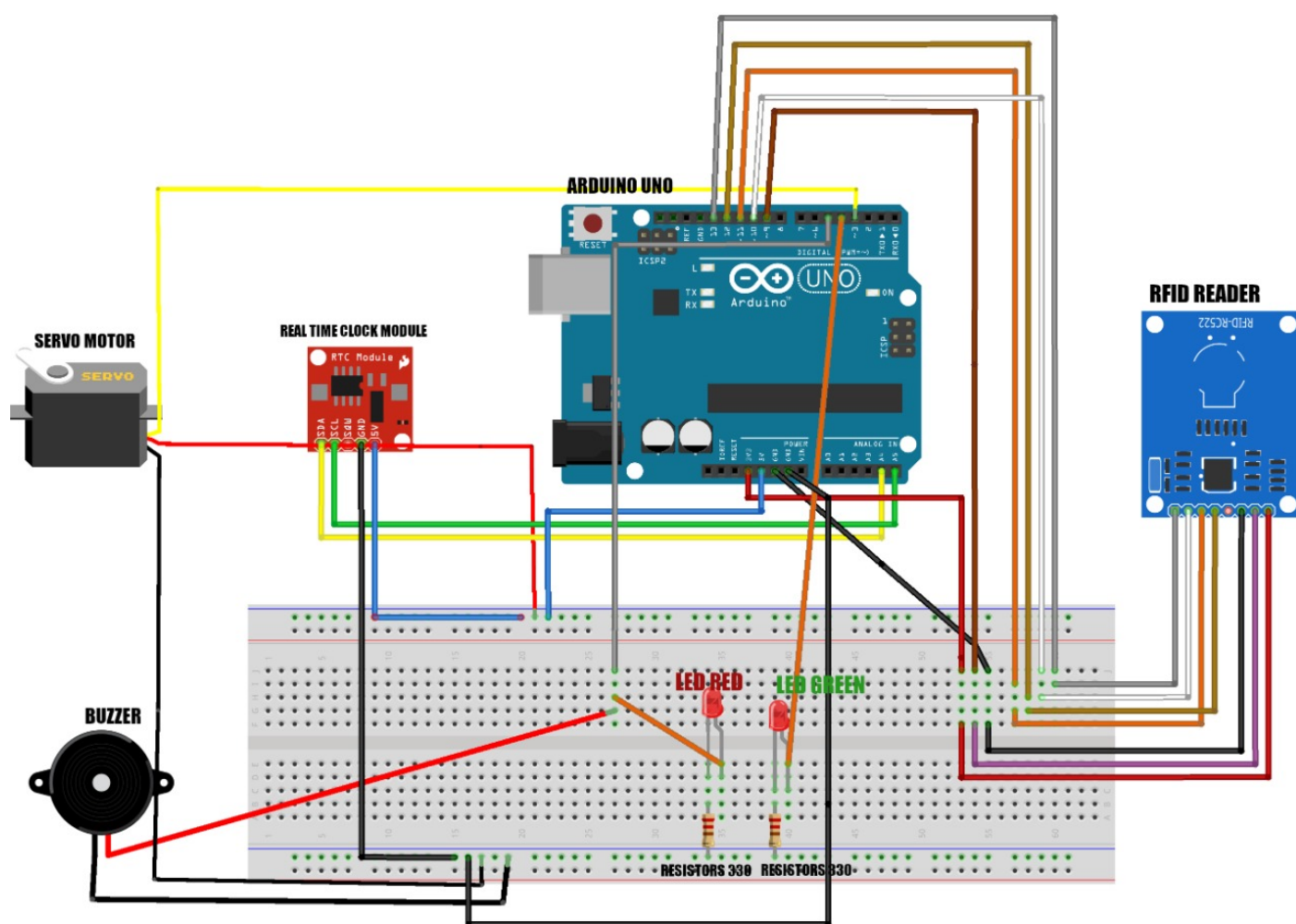


# FLOWCHART





# CIRCUIT DIAGRAM



## CODE

```
#include <SPI.h>
#include <MFRC522.h>
#include <Servo.h>
#include "RTCLib.h"
#define SS_PIN 10
#define RST_PIN 9
#define LED_G 5
#define LED_R 4
#define BUZZER 2
RTC_DS1307 rtc;
MFRC522 mfrc522(SS_PIN, RST_PIN);
Servo myServo;

void setup()
{
  Serial.begin(9600);
  SPI.begin();
  mfrc522.PCD_Init();
  myServo.attach(3);
  myServo.write(0);
  pinMode(LED_G, OUTPUT);
  pinMode(LED_R, OUTPUT);
  pinMode(BUZZER, OUTPUT);
  noTone(BUZZER);
  Serial.println("Place card/tag near reader...");
  Serial.println();
  rtc.begin();
  if (! rtc.isrunning()) {
    Serial.println("RTC is NOT running!");
    rtc.adjust(DateTime(F(_DATE), F(_TIME)));
    Serial.println("Place card/tag near reader...");
  }
}

void loop()
{
```

```

DateTime time = rtc.now();

if ( ! mfrc522.PICC_IsNewCardPresent())
{
    return;
}

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

String content= "";
byte letter;
for (byte i = 0; i < mfrc522.uid.size; i++)
{
    //Serial.print(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " ");
    //Serial.print(mfrc522.uid.uidByte[i], HEX);
    content.concat(String(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " "));
    content.concat(String(mfrc522.uid.uidByte[i], HEX));
}
Serial.println();
Serial.print("Message : ");
content.toUpperCase();
if (content.substring(1) == "DA 49 24 B0")
{
    Serial.println("Authorized access");
    Serial.println("USN: 1RV21EC099");
    Serial.println("Welcome Mohammed Asim.....");

    Serial.println(String("DateTime::TIMESTAMP_DATE:\t")+time.timestamp(DateTime::TIMESTAMP_DATE));

    Serial.println(String("DateTime::TIMESTAMP_TIME:\t")+time.timestamp(DateTime::TIMESTAMP_TIME));

    delay(3000);

    Serial.println();

```

```

    delay(500);
    digitalWrite(LED_G, HIGH);
    myServo.write(180);
    delay(5000);
    myServo.write(0);
    digitalWrite(LED_G, LOW);
    Serial.println();
    Serial.println();
    Serial.println("Place card/tag near reader...");
}
else if (content.substring(1) == "03 AD A1 A9")
{
    Serial.println("Authorized access");
    Serial.println("USN : 1RV21EC167");
    Serial.println("Welcome Sourish G.....");
    Serial.println();

    Serial.println(String("DateTime::TIMESTAMP_FULL:\t")+time.timestamp(DateTime::TIMESTAMP_FULL));

    Serial.println(String("DateTime::TIMESTAMP_DATE:\t")+time.timestamp(DateTime::TIMESTAMP_DATE));

    Serial.println(String("DateTime::TIMESTAMP_TIME:\t")+time.timestamp(DateTime::TIMESTAMP_TIME));
    delay(3000);

    delay(500);
    digitalWrite(LED_G, HIGH);
    myServo.write(180);
    delay(5000);
    myServo.write(0);
    digitalWrite(LED_G, LOW);
    Serial.println();
    Serial.println();
    Serial.println("Place card/tag near reader...");
}

else {

```

```
Serial.println(" Access denied");
```

```
Serial.println(String("DateTime::TIMESTAMP_DATE:\t")+time.timestamp(DateTime::TIMESTAMP_DATE));
```

```
Serial.println(String("DateTime::TIMESTAMP_TIME:\t")+time.timestamp(DateTime::TIMESTAMP_TIME));
```

```
    delay(500);
```

```
    digitalWrite(LED_R, HIGH);
```

```
    tone(BUZZER, 900);
```

```
    delay(4000);
```

```
    digitalWrite(LED_R, LOW);
```

```
    noTone(BUZZER);
```

```
    Serial.println();
```

```
    Serial.println();
```

```
    Serial.println("Place card/tag near reader...");
```

```
    }
```

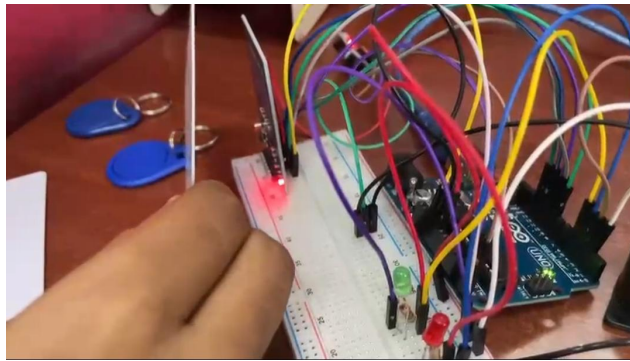
```
}
```

# WORKING OF MODEL

## 1. Result: Scanning rfid

### Analysis :

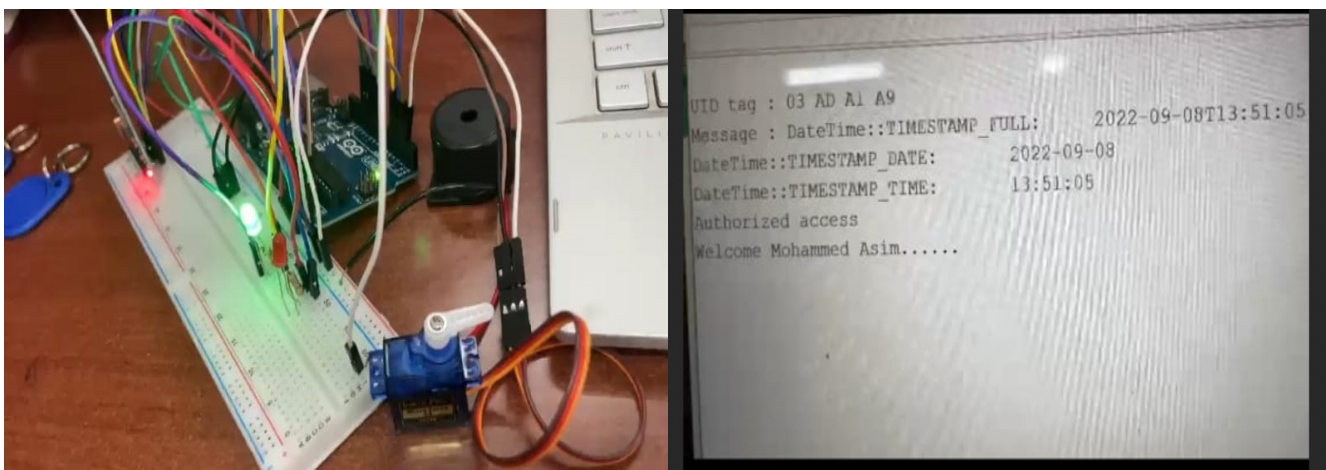
When the RFID tag is scanned, the tag's ID is verified, and it compares with the ID stored in the data of the Arduino software. The software displays the name of the person under the particular id that person holds. If it matches, access is granted or denied to that particular person through the LCD display.



## 2. Result: Granting access

### Analysis:

When the RFID tag is scanned and the result is displayed, accepted then the person is entered based on the results. When the serial monitor displays the name of the student and time of entry. Then entered through the door, the door open time limit is set in the software beforehand as 3 sec, 4 sec, and so on accordingly After the display as access, the servo rotor is rotated, which indicates that the door is open and the door is closed after the time limit has expired.



### 3. **Result:** Access denied

#### **Analysis:**

When the RFID is scanned the result is displayed on the serial monitor as access denied and a red light glows and the door is locked and the buzzer rings.



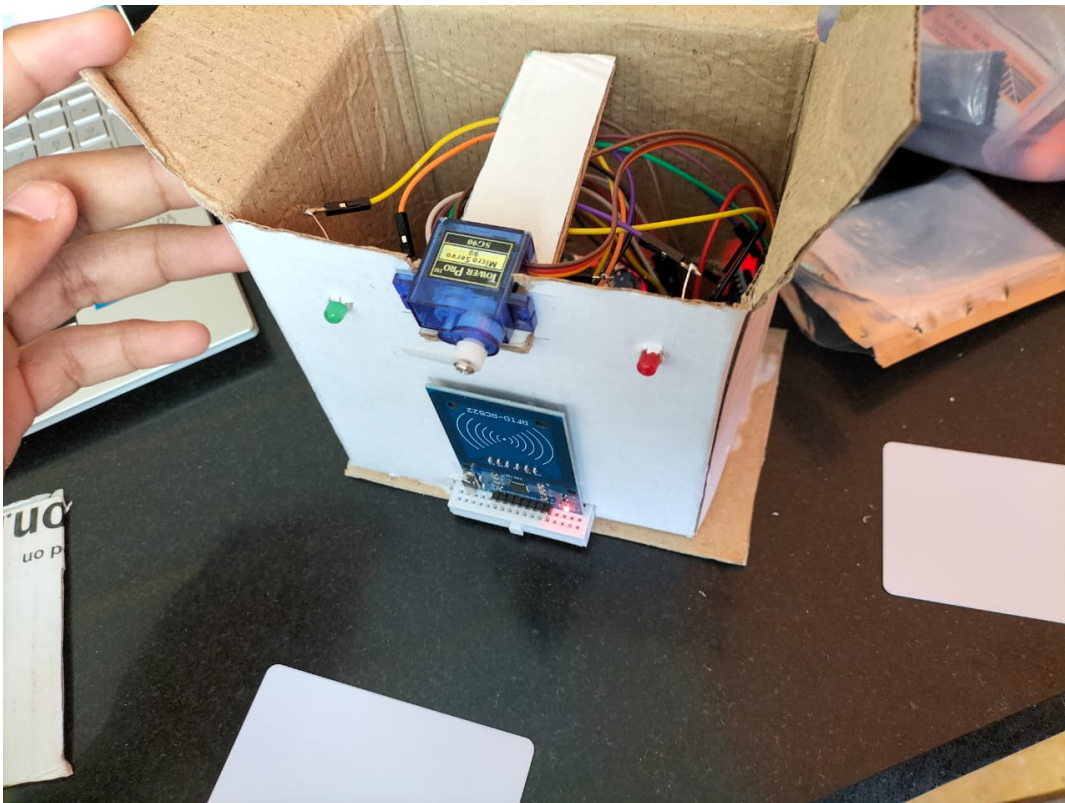


# RESULT

RFID based attendance system is an advanced attendance management system that has an RFID reader, RFID Tag, LCD display & Arduino uno unit that allows the wireless communications to establish the identity of students, faculty, or any other staff.

RFID attendance system is used to take attendance for student in school, college, and university. By placing their ID cards on the reader, students or workers can immediately verify their attendance.

RFID attendance system provides wireless identification of stakeholders when they fall in the radiofrequency range of the RFID attendance reader. To mark the attendance automatically, the students or staff need to carry the RFID tag that contains unique information about them such as name/ID number/class/section. The receiver/reader of the RFID attendance system automatically registers the attendance & saves the attendance data in the ERP system. The administrator can anytime extract the data to get a summary of student attendance history.





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