

## Exp. No:9 - RFID-based Attendance System using Arduino

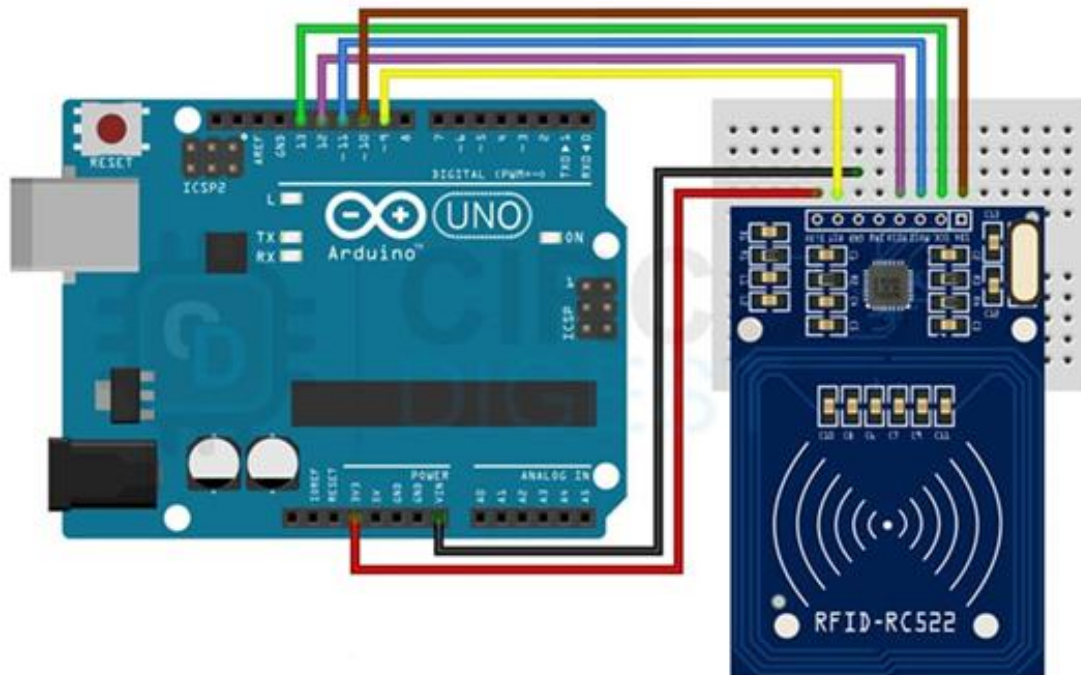
### AIM:

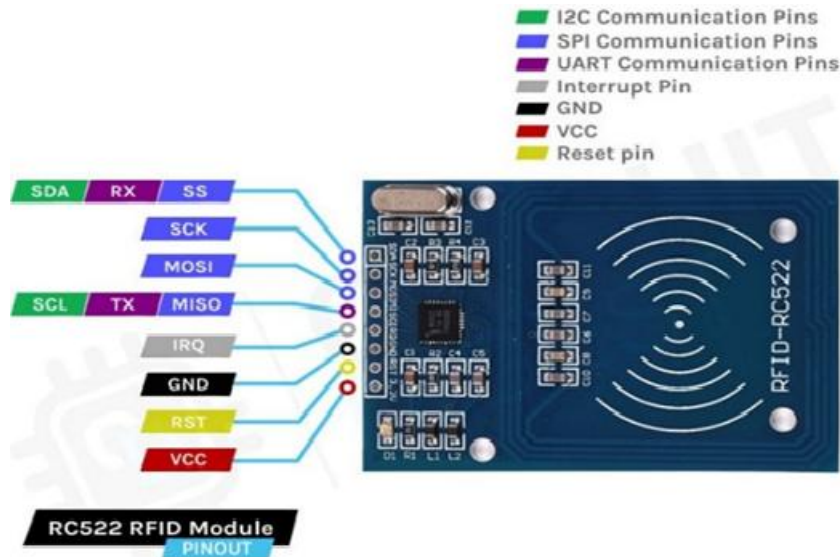
To design and implement an RFID-based attendance system using Arduino that identifies authorized cards and displays attendance status on the Serial Monitor.

### Apparatus / Materials Required

Sl. No	Component	Specification / Quantity
1	Arduino UNO	1
2	RFID RC522 Module	1
3	RFID Tags / Cards	2-5
4	Jumper Wires	As required
5	Breadboard	1
6	Buzzer / LED	Optional for indication
7	USB Cable	To connect Arduino to PC
8	Arduino IDE	Software for coding

### Circuit Connection:





### Theory:

RFID (Radio-Frequency Identification) is a technology that uses electromagnetic fields to automatically identify and track tags attached to objects. The **RC522 module** communicates with Arduino via **SPI protocol**, and each RFID card/tag has a unique UID (Unique ID). By comparing the scanned UID with a pre-stored list of authorized UIDs, the system marks attendance.

### Code:

```
#include <SPI.h>

#include <MFRC522.h>

#define SS_PIN 10

#define RST_PIN 9

MFRC522 rfid(SS_PIN, RST_PIN);

#define LED_PIN 8    // Main indicator LED/Buzzer
#define BUZZER_PIN 7 // Optional buzzer or second LED

// Authorized card UIDs
String knownIDs[] = {"A3 A1 95 98", "B4 4D 51 21"};
```

```

void setup() {
    Serial.begin(9600);
    SPI.begin();
    rfid.PCD_Init();
    Serial.println("RFID Reader Ready. Scan your card...");

    pinMode(LED_PIN, OUTPUT);
    pinMode(BUZZER_PIN, OUTPUT);
}

void loop() {
    if (!rfid.PICC_IsNewCardPresent()) return;
    if (!rfid.PICC_ReadCardSerial()) return;

    // Convert UID to string
    String uidString = "";
    for (byte i = 0; i < rfid.uid.size; i++) {
        if (rfid.uid.uidByte[i] < 0x10) uidString += "0";
        uidString += String(rfid.uid.uidByte[i], HEX);
        if (i < rfid.uid.size - 1) uidString += " ";
    }
    uidString.toUpperCase();

    Serial.print("Card UID: ");
    Serial.println(uidString);

    // Check if UID is authorized
    bool authorized = false;
    for (int i = 0; i < sizeof(knownIDs) / sizeof(knownIDs[0]); i++) {
        if (uidString == knownIDs[i]) {
            authorized = true;
            break;
        }
    }
}

```

```

    }
}

if (authorized) {
    Serial.println("✅ Authorized - Attendance Marked!");
    // Blink LED/buzzer for authorized
    for (int i = 0; i < 2; i++) {
        digitalWrite(LED_PIN, HIGH);
        digitalWrite(BUZZER_PIN, HIGH);
        delay(200);
        digitalWrite(BUZZER_PIN, LOW);
        delay(200);
    }
    digitalWrite(LED_PIN, LOW);
} else {
    Serial.println("❌ Unauthorized Card!");
    digitalWrite(LED_PIN, HIGH);
    digitalWrite(BUZZER_PIN, HIGH);
    delay(2000); // long alert for unauthorized
    digitalWrite(LED_PIN, LOW);
    digitalWrite(BUZZER_PIN, LOW);
}

delay(2000); // Small delay before next read
}

```

## Procedure:

### 1. Hardware Setup

- Connect the **RFID RC522 module** to Arduino as follows:

#### **RC522 Pin Arduino Pin**

VCC      3.3V

## RC522 Pin Arduino Pin

GND	GND
SDA (SS)	D10
SCK	D13
MOSI	D11
MISO	D12
RST	D9

- Connect **LED** to pin 8 (optional) and **Buzzer** to pin 7 (optional).

## 2. Software Setup

- Install **Arduino IDE** and the required libraries:
  - MFRC522
  - SPI (built-in)

## 3. Programming

- Open Arduino IDE and upload the **RFID attendance code** (provided earlier).
- Store the **authorized card UUIDs** in the code.

## 4. Operation

- Open the **Serial Monitor** at 9600 baud rate.
- Scan an RFID card/tag near the reader.
- The Serial Monitor will display:
  - **UID of the card**
  - **Attendance status** (Authorized/Unauthorized)
- Optional: LED/Buzzer will indicate authorization status.

## 5. Recording Attendance

- Manually note the attendance from the Serial Monitor, or log it to a PC if needed.

## Observations / Results

Card UID	Status
A3 A1 95 98	✓ Authorized
B4 4D 51 21	✓ Authorized

Card UID	Status
12 34 56 78	✗ Unauthorized

- When an **authorized card** is scanned:
  - Serial Monitor displays “Authorized – Attendance Marked”.
  - LED/buzzer blinks shortly.
- When an **unauthorized card** is scanned:
  - Serial Monitor displays “Unauthorized Card”.
  - LED/buzzer stays ON longer to indicate rejection.

**Result:**

The system successfully identifies authorized RFID cards, marks attendance, and provides visual/audio feedback using LED/Buzzer. Unauthorized cards are rejected.