Fast Tax System

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1. Abstract

The purpose of this experiment was to design and implement an RFID-based access control system using Arduino. The system employs an MFRC522 RFID module for identifying authorized cards and a servo motor to control the opening of a gate. LED indicators and a buzzer provide visual and auditory feedback. The implementation aims to enhance security and automation in restricted access areas.

2. Introduction

Access control systems are integral to secure environments, allowing only authorized personnel to enter specific areas. With advancements in RFID technology, the automation of access points has become more efficient and reliable. This project uses an MFRC522 RFID reader in conjunction with an Arduino board to authenticate users via RFID cards.

3. Objectives

1. To develop an automated access control system using RFID technology.
2. To provide visual and audio feedback for access granted or denied.
3. To use a servo motor to simulate the opening and closing of a gate.
4. To understand the use of the Arduino platform for integrating various electronic components.

4. Materials and Methods

4.1. Materials

1. Arduino Uno
2. MFRC522 RFID Module
3. Servo Motor
4. Green LED
5. Red LED
6. Buzzer
7. Resistors (220)
8. Breadboard and connecting wires
9. RFID cards and key fobs.

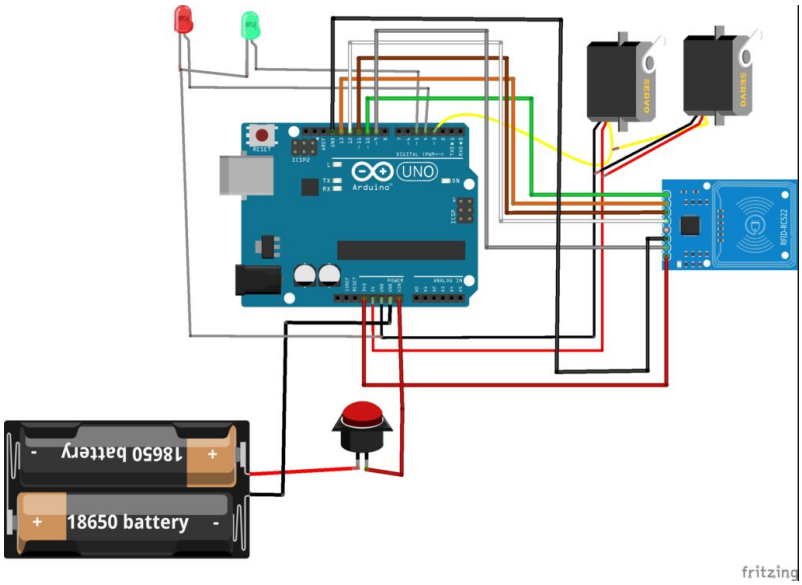
4.2. Methods

1. Connect the RFID module to the Arduino following the pin configuration described in the code.
2. Attach the servo motor to pin 3 and ensure it can move freely between the closed and open positions.
3. Connect the green and red LEDs to pins 4 and 5, respectively, using 220 resistors.
4. Connect the buzzer to pin 2.
5. Upload the Arduino code and test the system using RFID cards.

5. Experimental Setup

The experimental setup involved connecting all components to the Arduino as specified. The MFRC522 module reads the UID of the RFID card and compares it with pre-stored UIDs in the code. If a match is found, access is granted, and the servo motor opens the gate. If not, access is denied. LEDs and a buzzer provide user feedback.

5.1. Circuit Diagram



6. Code Description

```
#include <spi.h>
#include <mfrc522.h>
#include <servo.h>
#define ss_pin 10
#define rst_pin 9
#define led_g 4
#define led_r 5
#define buzzer 2
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("put your card to the reader...");
}
```

```
void loop() {
  if (!mfrc522.picc_isnewcardpresent()) return;
  if (!mfrc522.picc_readcardserial()) return;
  string content = "";
  for (byte i = 0; i < mfrc522.uid.size; i++) {
    content.concat(string(mfrc522.uid.uidbyte[i] < 0x10 ? " 0" : "
"));
    content.concat(string(mfrc522.uid.uidbyte[i], hex));
  }
  content.touppercase();
  if (content.substring(1) == "30 3e 2e 51") {
    serial.println("authorized access");
    digitalwrite(led_g, high);
    tone(buzzer, 500);
    myservo.write(90);
    delay(5000);
    myservo.write(0);
    digitalwrite(led_g, low);
    notone(buzzer);
  } else {
    serial.println("access denied");
    digitalwrite(led_r, high);
    tone(buzzer, 300);
    delay(1000);
    digitalwrite(led_r, low);
    notone(buzzer);
  }
}
```

7. Results

The system was tested with multiple RFID cards. The following observations were made:

1. Authorized Card: The green LED lit up, the buzzer emitted a sound, and the servo motor rotated to open the gate.
2. Unauthorized Card: The red LED lit up, and the buzzer emitted a different sound, indicating access denial.
3. Performance: The system successfully identified authorized and unauthorized cards with minimal delay.

8. Discussion

The RFID-based access control system demonstrated high reliability in identifying cards. The integration of visual and auditory feedback improved user experience. Potential improvements include:

1. Expanding the database of authorized UIDs for larger applications.
2. Integrating a real-time clock to log entry times.
3. Adding Wi-Fi capabilities for remote monitoring and control.

Challenges encountered included tuning the servo motor and ensuring proper communication between the Arduino and RFID module. Careful wiring and debugging resolved these issues.

9. Conclusion

This experiment successfully implemented an RFID-based access control system using Arduino. The system efficiently differentiates between authorized and unauthorized users, providing an effective solution for automated access control. Future enhancements could include increased security features and remote monitoring. The Fast Tax System is an innovative toll collection platform that modernizes toll plaza operations through advanced technologies and comprehensive digital payment support. Its emphasis on seamless transactions, including for emergency vehicles, positions it as a critical upgrade for toll management systems. By incorporating popular digital payment options like bKash, Upay, Rocket, and Nagad, the system aligns with contemporary payment trends, making toll payments easier and more accessible for all users.

10. Reference

1. Arduino Documentation: https://www.arduino.cc/reference/en/
2. MFRC522 Library Documentation: https://github.com/miguelbalboa/rfid

Project Link

https://github.com/mainul-abedin/Fast Tax System