RFID DOOR LOCK SYSTEM

Prof. Sanjeet Kumar Singh[1], Shivam Yadav[2], Jinit Patil[3], Adarsh Sharma[4]

[1] Profesr of Pravin Patil Polytechnic, Department of Information Technology, Bhayander, Thane, India – 401105.

[2] *Electronics & Tele-Communication Pravin Patil College of Diploma Engineering and Technology* Bhayandar East shivam2006december@gmail.com

[3] *Electronics & Tele-Communication Pravin Patil College of Diploma Engineering and Technology* Bhayandar East jinitpatil444@gmail.com

[4] *Electronics & Tele-Communication Pravin Patil College of Diploma Engineering and Technology* Bhayandar East adarshsharma748@gmail.com

ABSTRACT :

RFID (Radio Frequency Identification) door lock system is a new generation, contactless access control solution that increases security and ease of use. It uses RFID technology to permit access to restricted zones, with the aid of RFID tags or cards. The solution includes three main parts which are the RFID reader, the access control device (the lock) and the RFID tag or card owned by the owner.

An authorized RFID tag or card held up to or passed near the antenna-modulated reader results in the reader receiving a unique ID stored in the tag. The access control unit receives this identifier and verifies if the signal is valid against a predefined database of authorized IDs. As soon as the identifier is known and valid, the access control unit activates the locking mechanism, consequently unlocking the door. Access is denied by the system for unrecognized identifiers.

These features have led to the development and application of RFID door lock systems in a wide range of environments, including residential living, commercial, and industrial areas. They dispense with the need for old-fashioned physical keys, adding superior convenience, and they can be incorporated into more-comprehensive security systems. Additional enhancements provided include encryption, multi-factor authentication, remote management, with which additional security and ease of access would be gained when using the systems.

Key Benefits:

Security: RFID systems enable encrypted and secure communication, which stops unauthorized access to the system.

Convenience: It provides contactless operation, which makes entry faster and decreases wear on physical keys.

Scalability – systems can be scaled up to include multiple doors or even integrated with other access control solutions.

Flexibility: Security and management efficiency are also improved with features such as remote management, audit logs and customizable user access.

It describes the basic functioning and advantages of the RFID based door lock system emphasizing on its real time application in the security field.

I.Introduction :

An RFID door lock system is an electronic access control system, utilizing RFID technology, to permit or deny a person access to a door or any restricted area. Such a system is frequently applied for security reasons in offices, homes, hotels, or buildings that have been declared secure. In comparison with the old systems that work with keys, an RFID-based system is much more efficient and gives a much greater level of security by employing identification tags uniquely assigned to the people.

A typical RFID system consists of a few components working together: a reader (or scanner), an RFID tag (or card), and an electronic lock. The tag stores a unique identifier, which is detected by the reader when it is brought into range. If the system recognizes the tag as authorized, it will trigger the lock to open.

II.SYSTEM COMPONENTS :

A. RFID Reader:

The RFID reader senses the RFID tag or card and scans the unique ID contained within. It talks to the RFID tag via radio frequency signals when the tag is brought near the reader.

B. RFID Tag or Card:

The RFID card or tag contains an individual identifier sent to the reader. Tags are either passive (battery-less) or active (with battery) based on how the system is configured.

C. Access Control Unit:

This unit scans the ID picked up from the reader and matches it with an authorized list saved in advance. When the ID is valid, it sends the signal to the door to be unlocked; an invalid ID and access is barred.

D. Solenoid Lock:

The solenoid lock employs an electromagnet and a mobile plunger to lock the door. Upon granting access by the access control unit, it energizes the solenoid, freeing the plunger and opening the door.

E. Power Supply:

It supplies power to the RFID reader, access control unit, and solenoid lock. It may have backup
power sources (e.g., batteries) for uninterrupted operation.

F. Connection Components

These connections enable communication between the RFID reader, access control unit, and solenoid lock. The system can be connected via cables or wireless technology, depending on the installation.

G. Software (Database and Management System):

It handles the authorized users database, stores access logs,

III. DESIGN AND IMPLEMENTATION :

1.Circuit Design

Microcontroller to RFID Reader Interface:

Interface the MFRC522 RFID reader to the microcontroller (Arduino) via the SPI interface (MISO, MOSI, SCK, and SS pins).Microcontroller to Solenoid Lock Interface:

Interface the solenoid lock using a Relay Module. The microcontroller will provide a control signal (normally LOW for unlock) to the relay to change the state of the lock.

The relay must be wired to a 12V power source (for solenoid lock) and the Solenoid Lock.

Optional LCD or Buzzer Connection:

Wire the LCD to the microcontroller to display status messages.

Wire a Buzzer to a spare digital output pin to give audible feedback.

2. Functionality Description

Upon scanning the RFID card, the microcontroller retrieves the unique ID (UID) of the card.

The UID is then matched with a pre-loaded "allowed" UID.

If the UID is within the allowed UID:

The solenoid lock is activated (door unlocks).

The buzzer beeps for a moment.

If the UID is not matched:

Access is denied.

The buzzer makes a denial sound.

3. Testing and Debugging

Testing RFID Reading:

First, test whether the RFID reader reads the tag IDs properly.

Testing the Solenoid Lock:

Check that the relay properly triggers the solenoid lock.

Testing for Error Handling:

Check that the system properly handles erroneous RFID scans or errors.

4. Enhancements

Multiple Card Support:

You can adjust the code to support multiple users by keeping a list of allowed card IDs.

IV.RESULTS AND DISCUSSION :

The Solenoid Lock RFID Door Lock System is a secure and efficient door access control system using RFID for authentication and a solenoid lock for physical locking of the door. The key outcomes are speedy and accurate RFID authentication, where unauthorized users are denied access, and a highly reliable solenoid lock mechanism. The system is scalable, easy to use, and adds security through removal of physical keys.

Nonetheless, there are drawbacks including dependence on power supply (need for backup alternatives), susceptibility to RFID cloning (which can be remedied with encryption), and increased upfront cost in relation to conventional locks. Encryption and compatibility with other security systems or mobile devices could better strengthen security and performance in the future. As a whole, the system is best suited for residential, commercial, and vehicle access..

CONCLUSION :

An RFID door lock system with a solenoid lock provides a secure and easy access control solution. RFID enables keyless entry, and the solenoid lock provides assured physical security. The system increases safety, convenience, and scalability, and can be easily expanded to several access points. It also provides an audit trail for security surveillance. But aspects such as power supply and protection from hacking are significant for better performance.

REFERENCES :

1. Arduino Uno R3 – Arduino. (n.d.). Arduino Uno Rev3. Retrieved from https://www.arduino.cc/
2. RFID Reader Module (MFRC522) – NXP Semiconductors. (n.d.). MFRC522 RFID Reader Datasheet. Retrieved from https://www.nxp.com/
3. Solenoid Lock (12V) – Adafruit Industries. (n.d.). Solenoid Lock – 12V. Retrieved from https://www.adafruit.com/
4. 5V Relay Module – SparkFun Electronics. (n.d.). Relay Module Guide. Retrieved from https://www.sparkfun.com/
5. I2C 16x2 LCD Display – Adafruit Industries. (n.d.). I2C 16x2 LCD with Backpack. Retrieved from https://www.adafruit.com/
6. 12V Power Adapter – Mouser Electronics. (n.d.). 12V DC Power Adapter Specifications. Retrieved from https://www.mouser.com/
7. Jumper Wires & Connectors – Digikey. (n.d.). Jumper Wires & Breadboard Cables Guide. Retrieved from https://www.digikey.com/
8. RFID Tags/Cards – NXP Semiconductors. (n.d.). MIFARE RFID Cards and Tags. Retrieved from https://www.nxp.com/
9. Push Button (Override Option) – Electronics Tutorials. (n.d.). Push Button Switch Working and Applications. Retrieved from https://www.electronics-tutorials.ws/
10. Buzzer (Feedback System) – SparkFun Electronics. (n.d.). Piezo Buzzer Module Guide. Retrieved from https://www.sparkfun.com/