

SYCS – IOT PROJECT SYNOPSIS STRUCTURE

(For Project Approval & R&D Planning)

Cover Page

Title of the Project: Smart Door Lock using RFID

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1. Introduction

A Smart Door Lock System using RFID is an automated security solution designed to control door access with minimal human intervention. The system uses RFID (Radio Frequency Identification) cards or tags, where each authorized user is assigned a unique identification number. When an RFID card is scanned using an RFID reader connected to a microcontroller such as Arduino UNO, the system verifies the user instantly.

By integrating IoT and embedded system concepts, the door locking mechanism operates automatically based on authentication results. If the scanned card is authorized, the door unlocks using a

servo motor and the access status is displayed on an LCD. If the card is unauthorized, access is denied, ensuring improved security.

Compared to traditional key-based locking systems, the RFID-based smart door lock reduces the risk of unauthorized access, improves convenience, and enhances overall security. This system can be effectively used in homes, offices, laboratories, hostels, and other restricted areas, making it a reliable and scalable solution for modern access control.

2. Problem Statement

1. Traditional door locking systems based on physical keys are prone to loss, duplication, and unauthorized access.
2. Manual access control systems do not provide proper tracking or monitoring of authorized and unauthorized entries.
3. Conventional locks lack automation and require human intervention for locking and unlocking.
4. Existing security systems are often costly and complex to implement for small-scale applications.
5. There is a need for a low-cost, automated, and secure door access system that uses RFID and IoT concepts to improve security and convenience.

Limitations of RFID-Based Smart Door Lock System

1. Unauthorized access is possible if an RFID card is lost or misused by another person.
2. Damage or loss of RFID cards can prevent authorized users from accessing the door.
3. The RFID reader has a limited reading range, requiring the card to be scanned at close proximity.

4. Basic RFID systems may be vulnerable to card cloning without advanced encryption.
 5. The system requires a continuous power supply to operate effectively.
 6. Initial hardware setup and maintenance may increase overall cost.
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3. Project Objectives

- To design and develop an **RFID-based smart door lock system** using IoT concepts
 - To automate the process of door access control
 - To allow entry only to authorized users using RFID authentication
 - To improve security by reducing unauthorized access
 - To display system status such as access granted or denied on an LCD
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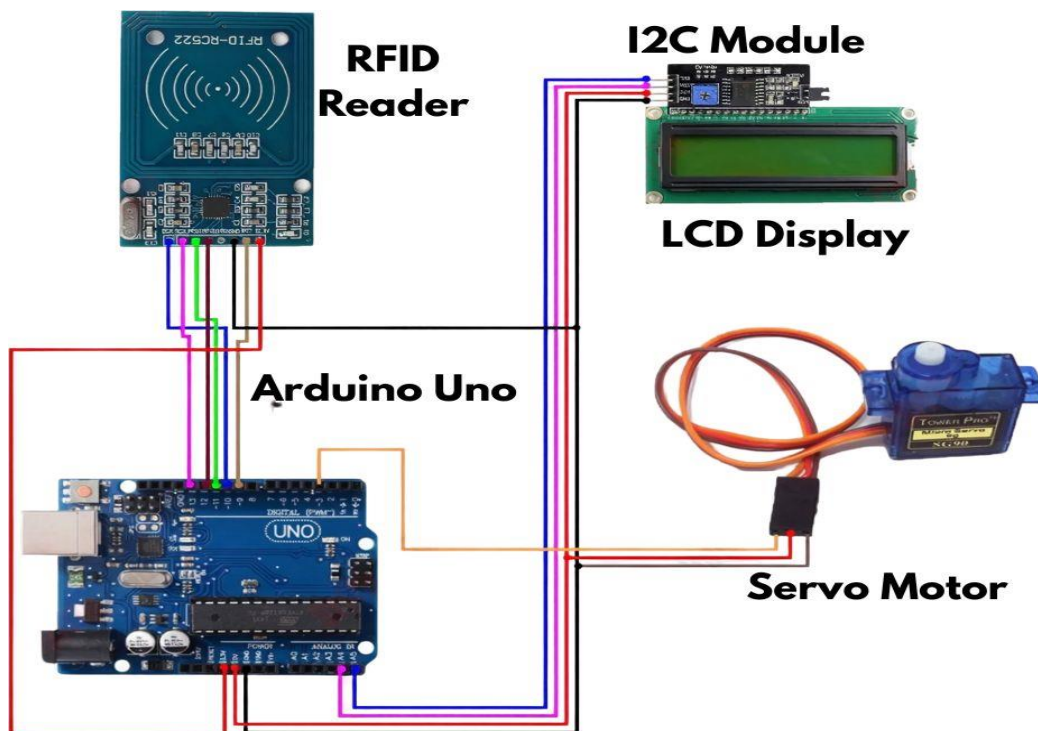
4. Project Description

This system works on **Radio Frequency Identification (RFID)** technology. Each authorized user is provided with an RFID card containing a unique identification number stored in the system memory. When the system is powered on, it continuously prompts the user to scan the RFID card using the RFID reader module.

When an RFID card is scanned, the reader reads the card details and sends the information to the microcontroller for verification. If the scanned card information is valid, the servo motor unlocks the door, and the 16×2 LCD with I2C module displays the message “Access Granted”.

If an unauthorized or unregistered RFID card is scanned, the door remains locked and the LCD displays “Unauthorized Access”. This project provides a secure and automated door locking mechanism using RFID technology with minimal human intervention.

6. System Block Diagram Description



Main Blocks & Their Functions

1. RFID Reader

- Used to scan the RFID card or tag
- Reads the unique identification number of the card
- Sends the scanned data to the Arduino UNO

2. Arduino UNO

- Acts as the main controller of the system
- Compares scanned RFID data with authorized card details

- Controls the servo motor and LCD display based on verification

3. LCD Display with I2C Module

- Displays system messages such as “Access Granted” and “Unauthorized Access”
- I2C module reduces wiring by using only two communication lines

4. Servo Motor

- Acts as the door locking mechanism
 - Rotates to unlock the door for authorized cards
 - Remains locked for unauthorized cards
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6. Hardware Requirements

- Jumper Wires
 - RC522 RFID module – 1
 - RFID tags - 1
 - Arduino UNO -1
 - I2C module
 - 16×2 LCD display
 - Servo Motor - 1
 - Door Lock - 1
 - Foam Board – 1
 - Iron stick - 1
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7. Software Requirements

Arduino IDE – Used to write, compile, and upload the program to the Arduino UNO

Embedded C / C++ – Programming language used to develop the control logic

RFID Library (MFRC522) – Used for interfacing the RFID reader with Arduino

LiquidCrystal_I2C Library – Used to control the 16×2 LCD display through the I2C module

Servo Library – Used to control the servo motor movement

8. Methodology / Working Steps

1. Each authorized user is provided with a unique RFID card or tag linked to their access permission.
 - a. An RFID reader is interfaced with a microcontroller (Arduino UNO).
2. When the user places the RFID card near the reader, the unique identification number is read.
3. The microcontroller verifies the scanned ID with the authorized card details stored in its memory.
4. If the verification is successful, the Arduino sends a control signal to the servo motor.
5. The servo motor rotates to unlock the door, allowing access to the authorized user.
6. The LCD display shows the message “Access Granted” during successful authentication.
7. After a short delay, the servo motor returns to the locked position automatically.

8. If an invalid or unauthorized card is scanned, access is denied and the LCD displays “Unauthorized Access”.

9. Estimated Project Cost

Component	Quantity	Approx Cost (₹)
Jumper Wires	1 packet	70
RFID-RC522	1	120
I2C + LCD	1	200
Arduino UNO	1	300
Servo Motor	1	100
Door Lock	1	80
Total=10	6	870

10. Expected Outcome

- The system will automatically control door access using RFID cards without manual intervention.
- Only authorized users will be allowed to unlock the door through RFID authentication.
- The servo motor will operate accurately to lock and unlock the door based on verification results.
- The LCD display will clearly show access status such as “Access Granted” or “Unauthorized Access”.
- The system will improve security and reduce the risk of unauthorized entry compared to traditional lock systems.



11. Applications

- Used in homes and apartments to provide secure access control.
 - Applied in offices and corporate organizations to restrict unauthorized entry.
 - Implemented in colleges and laboratories for controlled access to restricted areas.
 - Used in hostels and residential buildings for room security.
 - Applied in banks, data centers, and secure zones to protect sensitive areas.
 - Can be used in industries and factories to control access to authorized personnel only.
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12. Future Scope

- Integration with biometric systems such as fingerprint or face recognition for enhanced security.
 - Development of a mobile application for remote door access and monitoring.
 - Implementation of IoT connectivity to enable real-time access logs and alerts.
 - Enhancement of system security using encryption and secure authentication methods.
 - Integration with cloud storage to maintain access history records.
 - Expansion of the system to support multiple doors and users.
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13. Conclusion

The RFID-based Smart Door Lock System provides a secure, reliable, and automated solution for access control. By using RFID technology and embedded system concepts, the system reduces the dependence on traditional key-based locks and minimizes unauthorized access. The automated locking and

unlocking mechanism improves convenience while enhancing security.

Overall, this project demonstrates the effective application of RFID technology in modern security systems. The system is simple, cost-effective, and suitable for use in homes, offices, laboratories, hostels, and other restricted areas, with scope for future enhancements using IoT technologies.

14. References

Website: RoboCraze.com

Website: GitHub

Application: ChatGPT