

Advanced RFID Door Lock System for Secure Keyless Access in Homes and Businesses

Prof. Rohan Kokate¹, Sakshi Khutpale²

Department of MCA computer science, JD college of engineering and management, Kalmeshwar Road, Phata, Nagpur, Maharashtra 441501

Abstract

In today's world, security has become a paramount concern for individuals and organizations. The increasing incidence of intrusions has increased the need for effective door locking systems in residential, commercial, and industrial settings. This project explores a range of door lock technologies, including traditional mechanical locks, RFID systems, gesture-based mechanisms, and those that use Bluetooth and GSM technologies. Each of these systems offers unique benefits and drawbacks that are important for users to understand when choosing the appropriate solution for their specific needs. By examining the latest advances in locking technology, this research aims to provide insights that will help individuals and businesses make informed decisions about their security measures, ensuring they can effectively enhance their security.

Keywords: Advanced security solutions, including door lock systems that use RFID technology, gesture-based access methods, Bluetooth connectivity, and GSM communications. By integrating these innovative technologies, the project aims to create a robust security system that enhances convenience and security. The use of RFID allows for quick and efficient access, while gesture-based control provides a touchless experience. Additionally, Bluetooth enables seamless connectivity with mobile devices, and GSM provides remote access capabilities, making the system versatile and user-friendly.

1. Introduction

In recent years, With the growing prevalence of security concerns in both residential and workplace environments, the demand for effective door lock systems has increased. People are looking for solutions that not only provide maximum security but are also cost-effective and require minimal maintenance. For organizational settings, RFID technology is often the preferred choice due to its efficiency and reliability. In contrast, residential door lock systems typically include keypads and biometric features to meet personal security needs. Each of these systems is designed with strong authentication and authorization mechanisms, ensuring that entry is granted only to authorized individuals. Additionally, some advanced systems include intrusion detection capabilities, alerting users of any unauthorized attempts to gain entry.

A comprehensive review of the existing literature reveals the various types of door lock systems, examining their features, underlying technologies, and operational mechanisms, providing valuable insights for enhancing security measures. The purpose of this project is to help individuals choose the most appropriate door lock system for their specific needs and environment. By analyzing various door lock technologies, users will be empowered to make informed decisions about potential upgrades or changes to their existing systems. This comprehensive review of door lock systems will categorize them based on the technologies used, such as RFID, keypad, and biometrics. This categorization will help users understand the strengths and weaknesses of each option, allowing them to choose the best solution for their security needs.

2. Objective

- Providing a robust security solution that minimizes unauthorized access through innovative locking mechanisms.
- Creating an intuitive and convenient access method that meets users' needs, reducing the hassle associated with traditional locks.
- Incorporating GSM technology, allowing users to remotely control and monitor their locking systems via mobile devices.
- Using gesture-based technology for a clean and efficient entry process, minimizing physical contact.

- Building a reliable system that maintains high performance under various conditions and provides alerts in case of unauthorized attempts.

3. System Design and Requirement

I. System Design

1. System Architecture:

The system is designed with a modular architecture that integrates various components for enhanced functionality and security. The main components include:

- **User Interface Module:** This module facilitates user interaction through mobile apps and gesture recognition sensors.
 - **Locking Mechanism:** An electronic locking system controlled by an embedded microcontroller, capable of interfacing with RFID and Bluetooth modules.
 - **Communication Module:** This includes GSM for remote notifications and Bluetooth for local connectivity.
 - **Power Supply:** A reliable power source with backup options to ensure continuous operation.
2. Component Breakdown:
- **RFID Reader:** Used for scanning RFID tags/cards to grant access. It connects to the microcontroller to validate user credentials.
 - **Gesture Recognition Sensor:** A sensor that detects specific hand movements to unlock the door, providing a touchless entry experience.
 - **Microcontroller:** Acts as the central processing unit, handling inputs from the RFID reader and gesture sensor, and controlling the locking mechanism.
 - **Bluetooth Module:** Allows users to unlock the door via a smartphone app, facilitating quick access.
 - **GSM Module:** Sends alerts and notifications to users about access attempts and status changes, allowing for remote monitoring.
3. Workflow:
- User Authentication:**
- Users present their RFID tags to the reader.
 - Alternatively, they can use the mobile app to unlock via Bluetooth.
 - For touchless access, users can perform a designated gesture in front of the sensor.
- Access Validation:**
- The microcontroller checks the credentials against a stored database.
 - If valid, the system activates the locking mechanism.
 -
- Remote Monitoring:**
- The GSM module sends notifications about access attempts and system status to the user's mobile device.
 - Users can remotely lock or unlock the door via the app.

4. Security Features

- Encryption: Communication between the app, GSM, and Bluetooth modules is encrypted to prevent unauthorized access.
- Alarm System: An integrated alarm that triggers on failed access attempts.
- Backup Power: A battery backup ensures functionality during power outages.

5. User Interface:

A user-friendly mobile application designed for both Android and iOS, featuring:

- Real-time notifications
- Access history logs
- Remote control options

II. Requirements

- Functional Requirements:

- The system should read the RFID tag and identify if it is authorized.
- If authorized, the system should unlock the door.
- If not authorized, it should deny access.

User Interface:

- Optional: Include an LCD display or LEDs to indicate status (locked/unlocked, authorized/unauthorized).

Security Features:

- Implement features like logging access attempts and unauthorized access alerts.

Power Management:

- Ensure the system has a reliable power source and consider power-saving modes.

Installation Requirements:

- Consider how the components will be mounted and the wiring for the lock mechanism.

Scalability:

- Design the system to easily add more users (tags) if necessary.

Testing and Debugging:

- Include a plan for testing the system under various scenarios to ensure reliability

Mobile App Integration:

- For remote access control or notifications.

Network Connectivity:

- Use Wi-Fi or Bluetooth for remote monitoring or control.

Backup Keypad:

- A keypad for manual entry in case of RFID failure.

1.1 User Flow:

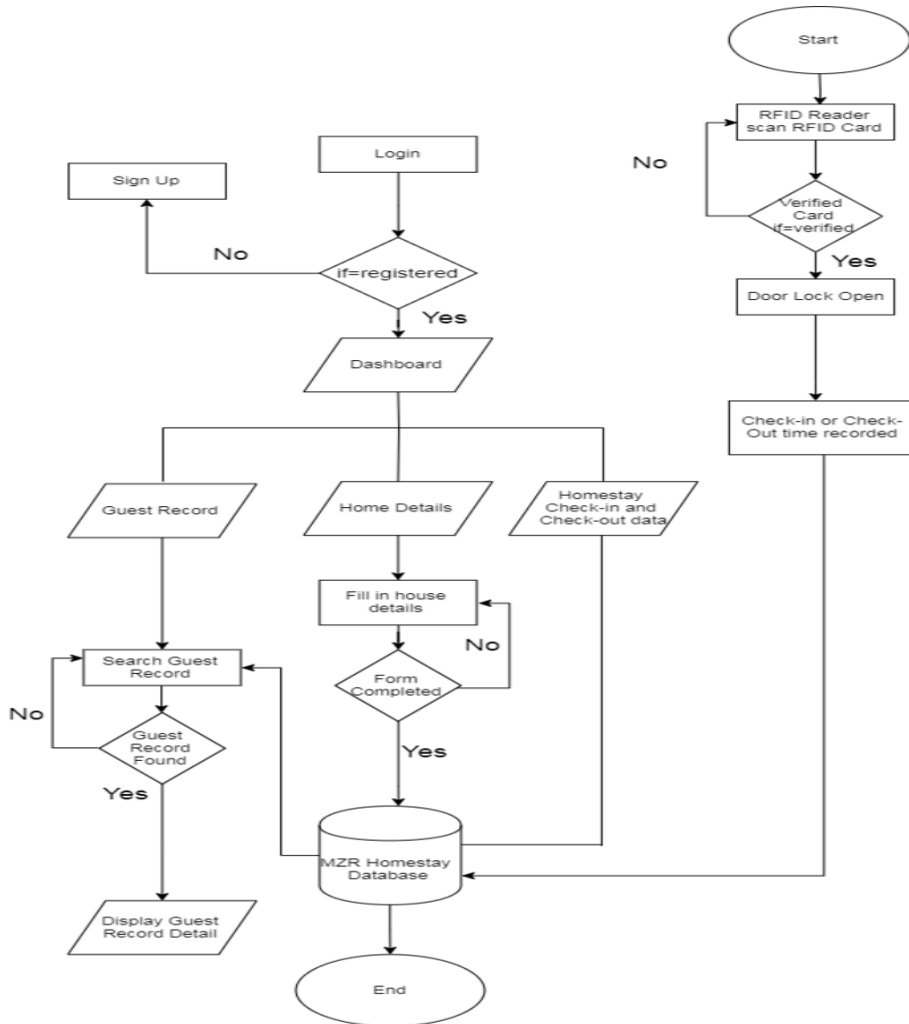


Fig. 1.4.1 Flowchart of RFID Based Door Lock System

2.1 Conclusion:

RFID based Door Lock System project presents a comprehensive review of door lock security systems, highlighting the contributions of various authors as well as their respective concepts, research findings, and theoretical frameworks. A comparative analysis of the reviewed literature is included, demonstrating the strengths and limitations of various approaches. While achieving perfect security may be unattainable, this review emphasizes the importance of identifying potential threats and risks as important steps in enhancing overall security. By systematically evaluating existing systems, the project aims to provide information on how to improve security measures in door locking mechan

2.2 References

- [1] S. Umbarkar, G. Rajput, S. Halder, P. Harname and S. Mendgudle, "Keypad/ Blue tooth/GSM Based Digital Door Lock Security System," in ICCASP/ ICMMD-2016, Vol. 137, Pp. 749-757.
- [2] M. Tseng, K. Liu, C. Hsieh, S. J. Hsu and C. Chan, "Gesture spotting algorithm for door opening using single wearable sensor," 2018 IEEE International Conference on Applied System Invention (ICASI), Chiba, 2018, pp.854-856.
- [3] Sriharsha B S, Zabiullah, Vishnu S B and Sanju V, "Password Protected Locking System Using Arduino," in BIJIT –2016, January - June, 2016, Vol. 8 No. 1, ISSN 0973 –5658.
- [4] A. Ibrahim, A. Paravath, P. K. Aswin, S. M. Iqbal and S. U. Abdulla, "GSM based digital door lock security system," 2015 International Conference on Power, Instrumentation, Control and Computing (PICC), Thrissur, 2015, pp. 1-6.
- [5] Zeiß S., Marinc A., Braun A., Große-Puppenthal T., Beck S. (2014) A Gesture-Based Door Control Using Capacitive Sensors. In: Streitz N.,Markopoulos P. (eds) Distributed, Ambient, and Pervasive Interactions. DAPI 2014. Lecture Notes in Computer Science, vol 8530. Springer,Cham.
- [6] Ilkyu Ha, "Security and Usability Improvement on a Digital Door Lock System based on Internet of Things," in Advanced Science and Technology Letters Vol.109 (Security, Reliability and Safety 2015), pp.33-38.
- [7] M. S. Hadis, E. Palantei, A. A. Ilham and A. Hendra, "Design of smart lock system for doors with special features using bluetooth technology," 2018 International Conference on Information and Communications Technology, (ICOIACT), Yogyakarta, 2018, pp. 396-400.
- [8] S. Nath, P. Banerjee, R. N. Biswas, S. K. Mitra and M. K. Naskar, "Arduino based door unlocking system with real time control," 2016 2nd International Conference on Contemporary Computing and Informatics (IC3I), Noida, 2016, pp.