



International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Remote Door Unlock System Using Pin

Amit Tiwari^{*1}, Aditya Singh ^{*2}, Mr. Himanshu Gupta ^{*3}

^{*1,2}UG Student of Department of Bachelor of Computer Application, Shri Ramswaroop Memorial College of Management, Lucknow, Uttar Pradesh, India.

^{*3}Associate Professor, Department of Bachelor of Computer Application, Shri Ramswaroop Memorial College of Management Lucknow, Uttar Pradesh, India.

ABSTRACT

This paper presents the design and implementation of a remote door unlock system that utilizes a Personal Identification Number (PIN) to enhance security and convenience in access control. The system leverages embedded technology and secure communication protocols to allow authorized users to unlock doors remotely using a verified PIN input. By automating the access process and minimizing the need for physical keys or manual intervention, the system reduces the risk of unauthorized entry and improves operational efficiency. The paper discusses the system architecture, hardware and software components, and security measures implemented to protect user credentials. Performance evaluations demonstrate the reliability and responsiveness of the system in real-time environments. Additionally, the study highlights practical applications and potential challenges in deploying PIN-based remote access solutions across residential and commercial settings.

I. INTRODUCTION

This research paper examines how a remote door unlock system using a Personal Identification Number (PIN) can enhance modern security solutions and access control mechanisms. By utilizing embedded systems and secure authentication protocols, the proposed system enables users to unlock doors from a distance through the input of a valid PIN. This technology aims to reduce reliance on traditional keys, minimize unauthorized access, and improve overall safety in residential, commercial, and institutional settings.

The study explores the integration of microcontroller-based hardware, keypad or mobile interfaces, and wireless communication modules to facilitate seamless remote access. It also outlines the system's development and implementation process, evaluates the usability and effectiveness of user interfaces, and assesses performance in terms of access speed, reliability, and security. In addition to presenting a practical solution for remote access, the paper also discusses important technological and organizational considerations, such as data privacy, power efficiency, and resistance to tampering, that are essential for deploying the system in real-world environments.

Background of remote door unlock system using pin:

Access control is a critical component of security in both residential and commercial environments. Traditional lock-and-key systems, while widely used, have several limitations including the risk of lost or duplicated keys, lack of remote accessibility, and limited adaptability to modern smart environments. As technology evolves, there is a growing demand for automated and secure alternatives that provide both convenience and enhanced protection.

Remote door unlocking systems using a PIN offer a practical solution to these challenges. By allowing authorized users to unlock doors through a secure code, these systems eliminate the need for physical keys and enable greater flexibility in access management. When integrated with wireless technologies and embedded systems, they can support remote control features, real-time monitoring, and centralized access logging. These features are particularly valuable in scenarios where multiple users require controlled access or where quick, remote entry is necessary, such as in emergency situations.

The increasing emphasis on smart homes and IoT-based automation further underscores the relevance of such systems. PIN-based access is simple, cost-effective, and easy to implement, making it an ideal choice for enhancing traditional security frameworks without the complexity of biometric or RFID-based solutions.

Purpose of the research of Remote Door Unlock System Using PIN:

The primary purpose of this research is to design and evaluate a secure, user-friendly, and cost-effective remote door unlocking system that uses a Personal Identification Number (PIN) as the primary method of access control. With increasing demand for smart and automated security solutions, this study aims to demonstrate how PIN-based systems can offer an efficient alternative to traditional locks and more complex biometric technologies.

II. METHODOLOGY

Overview of the Remote Door Unlock System Using PIN

The remote door unlock system is designed to provide secure, user-friendly access control through the use of a Personal Identification Number (PIN). The system integrates embedded hardware and software components to facilitate remote operation, ensuring only authorized individuals can gain entry. It is intended for use in residential, commercial, and institutional settings where enhanced security and convenience are priorities. The methodology focuses on the development of the system's hardware interface, communication protocol, and authentication process, ensuring reliability, responsiveness, and user accessibility.

System Components and Functional Workflow:

1. Microcontroller Unit (MCU):

A microcontroller (e.g., Arduino or ESP32) serves as the central processing unit for the system. It receives input from the user via a keypad or mobile app and processes the PIN verification logic.

2. Keypad or Mobile Input Interface

The user enters a PIN through a keypad or a smartphone application. This input is sent to the microcontroller for validation.

3. PIN Verification Logic

The system stores a pre-defined set of authorized PINs in secure memory. Upon entry, the system compares the input against stored values. If the input matches an authorized PIN, the unlocking mechanism is activated.

4. Wireless Communication Module

A Wi-Fi or Bluetooth module is used to enable remote operation, allowing users to send PINs or unlock commands from a distance via a secure mobile interface.

5. Door Lock Control Mechanism

An actuator or relay module is connected to the door locking system. Once the correct PIN is verified, the microcontroller triggers the relay to unlock the door.

6. Security Measures

The system incorporates basic security features such as encryption for transmitted data, attempt limits to prevent brute force attacks, and alert notifications in case of repeated failed attempts.

III. FUNCTIONS AND FEATURES

The **Remote Door Unlock System Using PIN** offers several key functions and features designed to enhance security, usability, and convenience. Below is an overview of the primary functions and features of the system:

1. Secure PIN-based Access Control

The core function of the system is to allow authorized individuals to unlock doors by entering a unique PIN. This ensures that only those with the correct PIN can gain access, eliminating the need for traditional physical keys and providing enhanced security over conventional locking systems.

2. Remote Operation

The system enables remote door unlocking through a wireless connection (e.g., Wi-Fi or Bluetooth). Users can send unlock commands from a mobile app or any device with internet access, allowing entry from a distance. This is particularly useful in scenarios where users are outside the building or need to provide access to others remotely.

3. PIN Verification and Authentication

The system includes a secure mechanism for verifying the entered PIN against a stored list of authorized PINs. If the input matches an authorized PIN, the door is unlocked. The system is designed to handle multiple user profiles, each with its own unique PIN.

4. User-friendly Interface

The interface is designed to be intuitive and easy to use, allowing users to enter their PIN via a keypad or through a mobile application. The system also provides feedback to the user in the form of visual indicators or audible alerts, confirming whether access has been granted or denied.

5. Access Logs and Monitoring

The system maintains an access log, recording each unlock attempt along with the time and the status of the attempt (successful or failed). This log can be accessed by administrators for security audits, ensuring accountability and providing transparency in access control.

6. Multiple PIN Management

Administrators can add, remove, or modify authorized PINs remotely, providing flexibility in managing user access. This feature is particularly useful in commercial or multi-user environments where access needs to be updated frequently.

IV. RESULTS AND ANALYSIS

The **Remote Door Unlock System Using PIN** was tested and evaluated based on several criteria, including security, usability, response time, and system reliability. The results obtained from these tests are discussed below, followed by an analysis of the system's performance and effectiveness in real-world scenarios.

1. System Response Time

Result:

The average response time from entering the PIN to the unlocking of the door was measured under different conditions, such as Wi-Fi and Bluetooth communication modes. On average, the response time was 2.5 seconds for Wi-Fi and 1.8 seconds for Bluetooth, demonstrating that the system operates with minimal delay in both modes.

Analysis:

The system's response time is within acceptable limits for practical use. The slight variation between Wi-Fi and Bluetooth is expected due to the nature of wireless communication, but both are fast enough to ensure a smooth user experience. This quick response time makes the system suitable for both residential and commercial applications.

2. Security and Accuracy

Result:

In the security tests, the system successfully verified the correct PIN and rejected incorrect entries with a failure rate of 0%. Additionally, the system's failed attempt lockout feature was triggered after five consecutive wrong entries, preventing brute-force attacks.

Analysis:

The accuracy of the PIN verification system is flawless, with no errors in the authentication process during testing. The built-in security measures, including the failed attempt lockout and encrypted communication, provide a strong defense against unauthorized access, making the system reliable for high-security environments.

3. User Experience and Usability

Result:

User feedback was collected through surveys and direct observations during testing. 90% of participants found the PIN entry process intuitive and easy to use. The mobile app interface, used for remote unlocking, was rated positively for its simplicity and responsiveness.

Analysis:

The system's user-friendly interface and straightforward operation contribute significantly to its usability. The ability to enter the PIN through both a keypad and mobile app ensures accessibility for a wide range of users. Given the positive user feedback, the system is deemed suitable for individuals with varying levels of technical proficiency.

V. FUTURE SCOPE

As technology continues to evolve, there are several potential enhancements and future directions for the **Remote Door Unlock System Using PIN**. These developments can further improve the system's functionality, security, and user experience.

1. Integration with Biometric Authentication

Future versions of the system may incorporate biometric authentication, such as fingerprint recognition or facial recognition, in addition to the existing PIN-based access. This would provide an additional layer of security, ensuring that only authorized users can access the system, while also offering a more seamless and efficient user experience.

2. Cloud-Based Remote Access

The system could be upgraded to support cloud-based remote access management, allowing users to control and monitor access to their doors from anywhere in the world via a web portal or mobile app. Cloud integration would enable features such as remote unlocking, adding and removing users, and viewing real-time access logs, providing increased flexibility and scalability for larger installations.

3. Integration with Smart Home Systems

In the future, the system could be integrated with popular smart home ecosystems like Amazon Alexa, Google Assistant, or Apple HomeKit. Users could control their doors using voice commands or automate unlocking based on specific conditions, such as time of day, user presence, or proximity to the door.

4. Multi-Layer Security Features

To enhance the security of the system, multi-layer authentication could be implemented, combining PIN input with another factor, such as a one-time password (OTP) sent via SMS or email, or even geolocation-based access. This would prevent unauthorized users from bypassing the system, especially in high-security environments.

VI. CONCLUSION

The **Remote Door Unlock System Using PIN** represents a significant advancement in modern access control solutions, offering a secure, user-friendly, and technologically efficient alternative to traditional lock-and-key mechanisms. By leveraging PIN-based authentication and wireless communication, the system provides users with the convenience of remote access while ensuring a high level of security and reliability.

Throughout the development and testing phases, the system demonstrated strong performance in areas such as response time, PIN verification accuracy, and remote connectivity. Its ability to log access events and manage multiple users makes it highly suitable for both residential and commercial applications. Additionally, the integration of safety features like failed attempt lockout and encrypted communication enhances the overall robustness of the system.

VII. ACKNOWLEDGEMENT

We would like to express our deep appreciation to Shri Ramswaroop Memorial College of Management for all of their help with this initiative. We particularly grateful to Mr. Himanshu Gupta for his technical know-how, sage advice, and unwavering support. We also value the commitment of all lectures and college employees who have helped us flourish. We really appreciate your support and direction. We welcome your contribution to our journey.

We also like to express our gratitude to all of the colleges staff members and professors who made contributions to our personal development.

We are grateful for all of your support and inspirations.

VIII. REFERENCES

1. Muhammad Ali Mazidi, Rolin D. McKinlay, and Danny Causey, *"PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18"*, Pearson Education, 2008.
2. John Wiley & Sons, *"Internet of Things: Architecture and Applications"*, Wiley Publications, 2019.
3. Raj Kamal, *"Internet of Things: Architecture and Design Principles"*, McGraw Hill Education, 2017.
4. Bhattacharyya, D., Kim, T.-H., & Pal, S., *"A Comparative Study of Wireless Protocols: Bluetooth, UWB, ZigBee, and Wi-Fi"*, International Journal of Smart Home, Vol. 2, No. 3, 2008.
5. Tiwari, M. & Gupta, R., *"Design and Implementation of Smart Door Lock System using IoT"*, International Research Journal of Engineering and Technology (IRJET), Vol. 7, Issue 6, 2020.
6. Arduino.cc, *"Arduino UNO Rev3 — Official Documentation"*, <https://www.arduino.cc/en/Main/ArduinoBoardUno>
7. Espressif Systems, *"ESP8266EX Datasheet"*, https://www.espressif.com/sites/default/files/documentation/0a-esp8266ex_datasheet_en.pdf