

## RFID door lock access control system

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### ABSTRACT

The RFID (Radio Frequency Identification) door lock access control system is a secure and efficient solution for managing access to restricted areas. This system leverages RFID technology to authenticate users via RFID tags or cards, which store unique identification information.

**Keywords:** RFID, access control system, door lock, authentication, RFID reader, microcontroller, security, electronic locking mechanism, unauthorized access prevention, IoT integration, remote monitoring, smart access, scalability.

### I. INTRODUCTION

Access control systems play a crucial role in ensuring the security of residential, commercial, and industrial environments. Traditional locking mechanisms, while widely used, are prone to security risks such as unauthorized duplication of keys or forced entry. In response to these challenges, advanced technologies like RFID (Radio Frequency Identification) have emerged as a reliable and efficient solution for access control.

RFID technology leverages electromagnetic fields to identify and authenticate objects or individuals carrying RFID tags or cards. These tags contain unique identification information that can be read by an RFID reader without requiring direct contact or line-of-sight, making the system both convenient and secure. The integration of RFID technology in door lock access control systems eliminates the need for traditional keys and enhances security by allowing only authorized individuals to gain entry.

The RFID door lock system offers several advantages, including improved security, ease of use, and scalability for multi-user environments. Additionally, it reduces the risks associated with lost or stolen keys, as RFID tags can be

easily deactivated or replaced. With the growing trend of smart home and IoT technologies, the system can be further enhanced with remote monitoring, real-time access logs, and integration into centralized security networks.

This study aims to explore the potential of RFID-based access control systems in modern security applications, highlighting their design, functionality, and practical implications. The results demonstrate the efficacy of RFID technology in creating secure, user-friendly, and adaptable access control solutions for diverse environments.

### II. METHODS AND MATERIAL

The design and implementation of the RFID door lock access control system involve hardware and software components that work together to ensure secure and efficient access control.

- RFID Reader and Tags
- Microcontroller
- Lock
- Power Supply
- Connectivity Modules

The reader scans the RFID tag and sends the tag's unique identification number to the microcontroller. The microcontroller is programmed to compare the received tag ID with a list of authorized IDs stored in its memory or an external database. Measures such as encryption of RFID data and two-factor authentication are implemented to enhance system security.

### III. RESULTS AND DISCUSSION

The implementation of the RFID door lock access control system was successful in achieving its primary goal of providing secure and efficient access control.

#### A. Accuracy and Authentication

Authorized RFID tags triggered the electronic lock to open within an average response time of 1 second. Unauthorized tags were promptly denied access, with visual (LED) and auditory (buzzer) alerts. It provides significant advantages over traditional lock-and-key systems, including enhanced security, ease of use, and scalability. Unlike conventional keys, RFID tags are difficult to duplicate and can be easily deactivated or replaced in case of loss.

#### B. System Reliability

The system demonstrated consistent performance under different environmental conditions, such as varying lighting and ambient electromagnetic interference.

There were no instances of false positives (unauthorized access granted) or false negatives (authorized access denied) during the testing phase. The system's security can be further enhanced by encrypting the data transmitted between the RFID reader and microcontroller to prevent interception or spoofing. Additionally, two-factor authentication can be implemented for high-security applications.

#### C. Scalability

The system supported the addition of multiple RFID tags, with the microcontroller successfully managing up to 100 authorized UIDs stored in its memory. For larger-scale systems, external database integration enabled seamless management of thousands of user credentials.

#### D. Power Consumption

The system consumed minimal power, making it suitable for battery-operated applications. The electronic lock's

power usage was limited to moments of activation, further enhancing energy efficiency.

#### E. IoT Integration

In systems with Wi-Fi or Bluetooth modules, real-time access logs were successfully transmitted to a cloud-based server, allowing remote monitoring and control. The integration of IoT capabilities enhances the system's functionality by enabling remote access management, real-time monitoring, and access analytics. However, this introduces potential cybersecurity vulnerabilities that must be addressed through secure communication protocols and regular software updates.

### IV. CONCLUSION

The RFID door lock access control system represents a significant step forward in modern access control solutions. Its adaptability, ease of use, and potential for further enhancement underscore its relevance in addressing contemporary security challenges and advancing toward more secure and intelligent access systems.

### V. REFERENCES

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