

## SECURE GUARD PROXIMITY ENTRY SYSTEM: AN ARDUINO-POWERED SMART DOOR LOCK

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### ABSTRACT

These days, a strong and adaptable locking system is essential in a world where convenience and security are priority. The dual lock system described in this book is designed and implemented to offer a complete security solution for your area by utilizing the capabilities of an Arduino, a keypad, RFID technology, and fingerprint recognition. This system delivers the best protection and adaptability whether you're protecting a home, business, or any other essential space. This project presents a comprehensive solution for bolstering security measures in residential and commercial settings. This project integrates advanced RFID (Radio-Frequency Identification) and fingerprint biometric technologies into a dual-lock system, implemented and controlled through Arduino microcontrollers. By combining these two authentication methods, the system ensures robust access control, minimizing the risk of unauthorized entry while providing convenience and flexibility for users.

### I. INTRODUCTION

This article proposes a dual lock system that utilizes the most recent developments in wireless communication, biometric identification, and microcontroller technology to provide state-of-the-art security. This system provides a multi-layered approach to access control by combining an Arduino board, a keypad, an RFID reader, and a fingerprint scanner to make sure that only authorized personnel may enter the secured area. This system's main objective is to offer a smooth and intuitive locking mechanism that blends RFID-based entry and keypad simplicity with the extra security of fingerprint identification. This method not only improves the protected area's general security but also provides an adaptable and adjustable solution that can be adjusted to match the unique requirements of different applications.

The main goal of SecureGuard is to offer a smooth and user-friendly locking system that combines the ease of RFID based entry with the security of fingerprint recognition. By using a multi-tiered approach to access controls, SecureGuard provides not only increased security for the premises, but flexibility and scalability to meet different application needs. SecureGuard is a testament to how innovation and security intersect, providing a powerful solution for protecting valuable assets, sensitive data, and restricted environments in an environment where protection is everything.

### II. LITERATURE REVIEW

**X. L. Meng, et al.**, has depicted an RFID based implanted security confirmation system with novel face acknowledgment structure.

**D. L. Wu, et al.**, depicts the outline of RFID based security and access control system for the use in lodgings inside the Punjab University premises.

**L. H. Thai, H. N. Tam**, "proposes an institutionalized unique finger impression model to incorporate fingerprints which present for all finger impression layouts put away in the database while coordinating. Therefore, this two innovations i.e. RFID and fingerprints are used to outline the proposed security system.

**Yu-Chih Huang**, In RFID technology, the identification of an object automatically consists of the object, location of the object or individual with a special identifier code contained with an RFID tag, which is somehow connected to or implanted in the target.

**A. Juels**, Because of the shaky wireless channel between RFID tag and RFID reader, security dangers against RFID system have been showing up. Numerous RFID verification conventions against the security dangers have been studied.

**Lawrence O’Gorman**, a biometric security system was designed to open the door automatically using the fingerprint, data storage in SD (Secure Digital), and using the C++ programming language for developing instructions for new fingerprint registration, deletion ID (identification). Data storage in the SD (Secure Digital) will assist in keeping a record of the hours of staff entry through the RTC sensor (real-time clock

**O. Adetoyi**, a smart card system was designed to open the door automatically. This system uses two authentication techniques, namely: a smart card and a pin assigned to that card to give access to the user. If the card inserted into the reader is validated by the microcontroller, the user sees a prompt on the LCD unit to input pin code, else “INVALID CARD” is displayed.

**J. Carmona, C. O. Akanbil et al**, developed an IoT-based Smart Door System Model, which provides a double access authentication through fingerprint modules and is designed for hotels and guest houses. The proposed system architecture design specifies all the modules involved and the circuit diagram designed specifies various modules interconnectivity. The prototype implementation software is developed in the C programming language.

**Umar et al**, suggested and developed an RFID-based security control system and also installed it in hostels at the Punjab University campus this system combines RFID technology with biometrics. . In this technology, response time can be enhanced by using controller processes and real-time images

**Gyanendra and Pawan**, proposed a security system using a passive type of RFID contains a door locking system using an actuator.

**Dejan Nedelkovski, Zeydin Pala et al**, RFID is Radio Frequency Identification which is a fundamental and cheapest technology to enables wireless data transmission [12]. Radio frequency Identification i.e., RFID is a non-contact technique applied in industries for personal tracking, supply chain management, management of books in libraries and at tollgate [13].

### III. PROBLEM STATEMENT

The necessity for an all-encompassing and dependable security solution that can successfully manage access to a specific region or place is the main issue that this twin lock system attempts to address. Conventional locking systems, like keys or simple keypads, are susceptible to security breaches and unauthorized access because to their inherent constraints regarding user management and security. The suggested system integrates keypad, RFID, and fingerprint recognition among other access control techniques in an attempt to overcome these drawbacks.

These technologies work together to create a system that provides access control through a multi-layered approach, improving overall security and offering a more reliable and adaptable solution for a range of settings, including commercial, industrial, and residential ones.

Furthermore, the system's easy configuration and user-friendliness enable for The system's user-friendly and simply configurable design further contributes to its versatility and adaptability as a solution for a range of security requirements. These features enable the efficient management of authorized users, access logs, and security settings.

### IV. OBJECTIVE OF THE STUDY

- 1. Enhance Security-** The primary objective of this study is to develop a dual lock system that significantly enhances the security of access-controlled areas by incorporating multiple authentication factors.
- 2. Improve User Experience-** The system should be designed with user-friendliness in mind, providing a seamless and intuitive experience for authorized individuals to access the protected area.
- 3. Ensure Reliability-** The dual lock system should be highly reliable, with robust hardware and software components that can withstand continuous use and environmental factors.
- 4. Enable Customization-** The system should be modular and adaptable, allowing for easy customization and integration with additional security features or monitoring capabilities as needed.

## V. PROPOSED METHODOLOGY

### 5.1 Working Principles

- 1. Hardware Integration-** The core of the dual lock system is an Arduino board, which serves as the microcontroller responsible for coordinating the various hardware components. This includes the integration of a keypad for manual entry, an RFID reader for contactless access, and a fingerprint scanner for biometric authentication
- 2. Software Development-** The system's software is developed using the Arduino IDE, leveraging the platform's extensive library of functions and communication protocols to seamlessly integrate the hardware components. This software is responsible for processing user inputs, managing access permissions, and logging system events for enhanced security and monitoring
- 3. Access Control Logic-** The dual lock system employs a multi-layered access control logic, whereby users can gain entry through a combination of keypad, RFID, and fingerprint authentication. The system is designed to provide flexibility in the access control hierarchy, allowing administrators to configure the required level of security for different user groups or access points.

### 5.2 Flow Chart of Proposed System

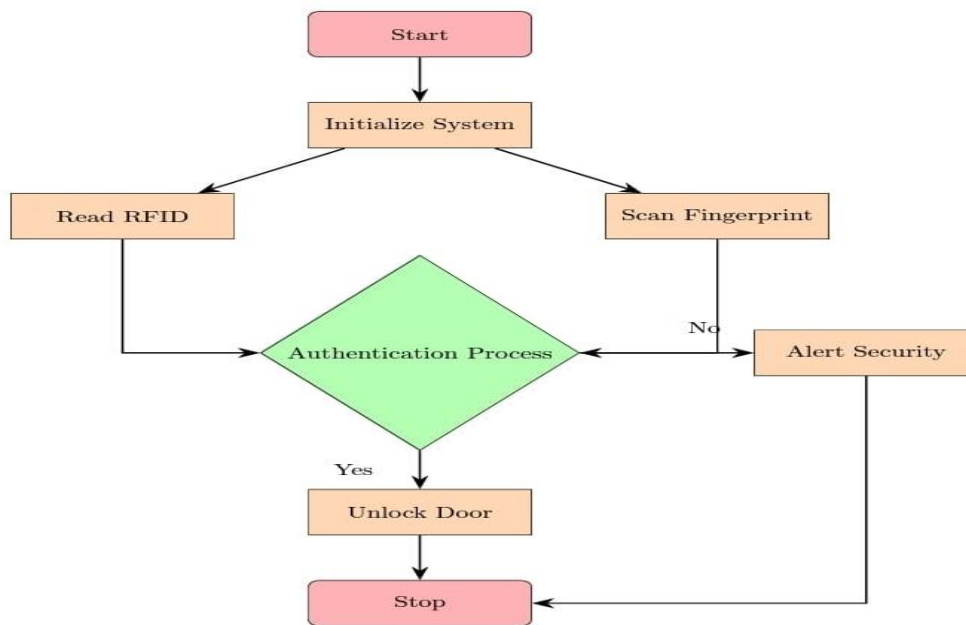


Figure 1: Flowchart of the Arduino-based door lock system using RFID and fingerprint sensor.

## VI. BENEFITS OF DUAL LOCK SYSTEM

- 1. Enhanced security** - By combining many access control techniques, such as keypad, RFID, and fingerprint recognition, a strong and multi-layered security solution is created, greatly increasing the difficulty for unauthorized people to enter the restricted area, thus bolstering overall security measures.
- 2. Flexible user management-** With the system, managing authorized users is simple and you can add, change, or remove access permissions as needed, providing a dynamic approach to user access control management.
- 2. Enhanced Accountability-** Each time an attempt is made to gain access, the dual lock system keeps a thorough access log that details the time, date, and manner of entry, ensuring comprehensive accountability and aiding in monitoring, incident investigations, and security audits, thereby enhancing overall accountability measures.
- 3. Smooth user interface-** The system's interface is simple enough for authorized users and administrators to utilize, making it an effective and user-friendly way to manage access, facilitating seamless integration into the target environment and minimizing the learning curve for users and administrators alike.

## VII. CONCLUSION

The document introduces a robust dual lock system designed to bolster access control and security across various applications. By synergizing Arduino, keypad, RFID, and fingerprint technologies, this innovative system offers a multi-tiered authentication approach, mitigating the threat of unauthorized access effectively. Looking ahead, there's ample room for expansion within the project framework. Future enhancements could encompass remote monitoring capabilities, intelligent alerts, and seamless integration with pre-existing security infrastructure. Moreover, the system's modular architecture facilitates the seamless assimilation of emerging technologies and forthcoming advancements in the realm of access control and security.

By amalgamating diverse authentication methods, the dual lock system presents a holistic solution that not only fortifies security but also streamlines access management processes. Its adaptability to evolving technological landscapes positions it as a forward-thinking solution capable of addressing the dynamic security needs of various environments. Furthermore, the system's flexibility enables customization to suit specific requirements, fostering scalability and adaptability across diverse applications. Whether deployed in residential, commercial, or industrial settings, the comprehensive approach to access control offered by this system promises heightened security without sacrificing user convenience.

In summary, the dual lock system outlined in the document represents a cutting-edge solution poised to revolutionize access control and security practices. Its integration of advanced technologies, coupled with the potential for future enhancements and customization, positions it as a versatile and future-proof choice for safeguarding assets and premises.

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