

# Automatic Door Unlocking System Using RFID

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**Abstract** - In this project an automatic door unlocking system typically uses various technologies to open doors without the need for manual intervention. These systems are commonly used for security, convenience, and efficiency, and can be designed for both residential and commercial applications. There are different types of automatic door unlocking systems, each utilizing various mechanisms for unlocking. An automatic door unlocking system typically works through a combination of sensors, using RFID and Arduino. In summary, an automatic door unlocking system uses a combination of wireless communication, sensor detection, and electronic locking mechanisms to unlock a door automatically when the correct credentials are presented.

**Keywords:** Women Safety, IoT, RFID, Sensors, Security, Automatic, Arduino.

## I. Introduction

The Automatic Door Unlocking System allows users to unlock doors without the need for physical keys or manual input, enhancing convenience, security, and accessibility. The system can be deployed in homes, offices, hospitals, or any secure facility. Automatic door unlocking offers several benefits, making it useful in a variety of contexts such as

**Convenience:** It allows people to open doors hands-free, which are especially helpful when carrying bags, groceries, or other items. For example, with smart home systems, doors can unlock automatically when your phone or keycard comes within range.

**Accessibility:** Automatic unlocking is beneficial for people with disabilities, such as those who use wheelchairs or have limited mobility. It removes the need to physically turn a knob or press a button, making entry easier.

**Contactless:** In the wake of health concerns like the COVID-19 pandemic, touchless automatic door unlocking systems have become particularly valuable for reducing contact with surfaces, helping to prevent the spread of germs.

**Security:** Many automatic door systems are integrated with security features like biometric scanning (fingerprints or facial recognition) or keycard access, ensuring that only authorized

individuals can unlock the door. This adds an extra layer of security compared to traditional keys.

There are many applications of Automatic Door Unlocking System like Home Automation, Public Spaces, Office Security, Healthcare Facilities. An automatic door unlocking system typically incorporates several advanced features that enhance security, convenience, and ease of use. Some of the key features include:

**Keyless Entry:** RFID/NFC Access uses RFID or NFC technology where a user presents an RFID card or smartphone to unlock the door.

**Emergency Override:** A manual override or backup key is often included to allow access in case of power failure or system malfunction.

**Time-Based Access:** Allows unlocking only during certain times of the day or restricts access to specific users based on time, improving security.

## II. Need of the Project

The automatic door unlocking system was invented to improve convenience, accessibility, and security. Its primary goals were to make door access easier and more efficient, especially in situations where manual unlocking could be difficult or impractical.

The need for Automatic Door Unlocking System was as follows:

**Convenience:** It allows users to access buildings, vehicles, or rooms without needing to physically turn a key or press a button.

**Safety:** In emergencies, such as a fire or other urgent situations, automatic unlocking systems can allow quick access or evacuation, often triggering doors to open automatically when an alarm is activated.

**Enhanced User Experience:** In modern homes or businesses, smart door systems provide users with added control and flexibility, enabling remote unlocking via smartphones, smartwatches, or other connected devices.

**Security:** Automatic systems can be more secure than traditional locks, offering advanced features like biometric authentication (fingerprint or facial recognition), proximity sensors, or encrypted access codes to ensure that only authorized individuals can enter.

### III. Literature Survey

The integration of Radio Frequency Identification (RFID) technology in access control systems has revolutionized security management. RFID-enabled automatic door unlocking systems provide a seamless, contactless method of granting access to secured areas. Such systems are commonly used in a variety of settings, including offices, homes, hospitals, and government buildings. This literature survey presents an overview of the research, technological advances, and practical applications of RFID-based automatic door unlocking systems.

RFID is a wireless communication technology that uses electromagnetic fields to automatically identify and track tags attached to objects. The system consists of three primary components: tags (transponders), readers (interrogators), and antennas. The tags store information that can be read by the RFID reader without physical contact or line-of-sight (Zhou et al., 2019). RFID in Access Control RFID provides advantages such as non-contact identification, security, and scalability in access control systems. It also eliminates the need for keys, reducing the risk of loss or theft (Peddle et al., 2018).

*Encryption and Data Security:* RFID systems, especially in access control, are vulnerable to security risks such as cloning, spoofing, and interception of signals. Researchers have explored encryption techniques and secure communication protocols to mitigate these threats. For instance, the use of Advanced Encryption Standard (AES) for encrypting RFID data is recommended in critical security systems (Li et al., 2019). Some studies have focused on integrating biometric authentication (fingerprint or face recognition) with RFID-based systems to provide multi-factor authentication for enhanced security (Kumar et al., 2020).

The literature on automatic door unlocking systems using RFID highlights both the technological advancements and the challenges faced in the practical implementation of these systems. While RFID offers a secure, scalable, and efficient means of access control, issues related to security, range, and system integration remain areas for further research. However, the continued evolution of complementary technologies, such as IoT and AI, holds significant promise for overcoming these challenges and expanding the use of RFID-based access control systems.

## IV. System Implementation

### A) Components Used

**Arduino UNO:** The Arduino UNO is one of the most popular microcontroller boards from the Arduino platform. It's widely used in electronics and robotics projects due to its simplicity ease of use, and versatility.

**RFID Module:** An RFID (Radio Frequency Identification) module is an electronic component used to communicate wirelessly with RFID tags or cards. These modules can read, write, and sometimes even update data on RFID tags using radio waves. RFID technology is commonly used for applications such as access control, inventory management, and asset tracking.

**Jumper Wires:** In an automatic door unlocking system, jumper wires play a role in creating electrical connections that allow components like sensors, motors, and controllers to communicate with each other. These wires are typically used to connect various parts of the system, facilitating power supply or signal transmission.

**I2C:** In an automatic door unlocking system, jumper wires play a role in creating electrical connections that allow components like sensors, motors, and controllers to communicate with each other. These wires are typically used to connect various parts of the system, facilitating power supply or signal transmission.

**Servo Motor:** A servo motor can play an important role in an automatic door unlocking system, providing precise movement and control over the door mechanism.

**LCD Display:** In an automatic unlocking system, an LCD (Liquid Crystal Display) can serve several important functions to enhance user interaction and feedback.

### B) Circuit Design

An automatic unlocking door system typically involves several components such as a microcontroller, sensors (for detecting presence or authorized access), actuators (to control the locking mechanism), and other interface devices (like a keypad, RFID, or Bluetooth for user access). Here's a simple circuit design for such a system.

The RFID reader is a wireless device used to transfer data for recognizing and tracking tags connected to objects. The tag includes electronically stored information. Some kind of tags is run by electromagnetic induction from magnetic fields formed near the reader. RFID reader includes an RF module and it acts as a both TX and RX of radio frequency signals.

The transmitter of this module contains an oscillator to make the carrier frequency. A modulator to intrude data commands upon this carrier s/L and an amplifier to increase the signal enough to wake the tag. The receiver of this module includes a demodulator to extract the reverted information and also holds an amplifier to support the signal for processing.

A microprocessor is used to form the control unit, which employs an OS and memory of this module filter and stores the information.

### C) Working Principle



Figure 1: Block diagram

The working principle of an automatic door unlocking system typically involves a combination of sensors, actuators, and control systems that work together to detect authorized users and automatically unlock the door for them. Here’s a breakdown of how it generally works.

- **Sensor Detection:** The system uses sensors like RFID, infrared (IR), motion, pressure, or proximity sensors to detect the presence of a user or an object near the door.
- **Authentication:** The sensor data is sent to the control system, which is responsible for determining if the detected signal is authorized.
- **Control Unit:** If the system recognizes an authorized signal or person, it sends a command to the actuator.
- **Actuator and Lock Mechanism:** Upon successful authentication, the control unit activates the actuator (an electric motor or solenoid) to unlock the door.
- **Opening the Door:** After unlocking, motion sensors or manual triggers and automatically opens door.

### V. Features and Advantages

- **Keyless Entry:** Users can unlock doors without the need for physical keys, often using technologies such as RFID, Bluetooth, biometrics, or PIN codes.

- **Remote Access:** Some systems allow users to unlock doors from a distance via smartphones, apps, or web interfaces.
- **Automatic Unlocking:** Systems can be set to automatically unlock when they detect an authorized individual (via proximity sensors or Bluetooth).
- **Integration with Security System:** Can be integrated with existing alarm systems, surveillance cameras, and access control systems for enhanced security.
- **Enhanced Security:** Traditional locks are vulnerable to picking, while automatic systems often use encryption, biometrics, or unique access codes, making unauthorized access harder.
- **Cost Savings:** Long-term savings on physical keys, locks, and maintenance, particularly in commercial buildings where access control can be managed more efficiently.
- **Remote Management:** Property owners or administrators can unlock or lock doors remotely, granting access to authorized users without being physically present.
- **Increased Efficiency:** For businesses, automatic unlocking systems streamline entry, reducing waiting times for employees or visitors, especially in high-traffic areas.
- **Audit and Monitoring:** Ability to monitor who accesses the premises and when, helping with security and compliance, particularly in high-security areas like offices, hospitals, or labs.

### VI. Future Scope

- **Integration with Smart Homes:** Automatic door unlocking systems will continue to be integrated with smart home ecosystems, allowing users to control and monitor their doors through centralized apps or voice assistants like Google Assistant, Alexa, or Siri.
- **Increased use of IOT:** Automatic unlocking systems will work in tandem with various IoT-enabled devices. For example, when a person arrives home, the system could automatically recognize their smartphone, adjust thermostat settings, and unlock doors.
- **Artificial Intelligence and Machine Learning:** I can enable door unlocking systems to learn and adapt to patterns of human behavior, improving efficiency and security. For instance, AI could learn to recognize which times of day people typically enter the house and predict when to unlock the door, reducing the need for constant interaction.
- **Voice and Gesture Recognition:** Voice recognition technology will allow users to unlock doors with simple voice commands, which is ideal for individuals with disabilities or when hands are full. In some future

applications, gesture recognition technology (e.g., swipe gestures or specific hand movements) may be used to unlock doors.

## VII. Results and Discussion

- **Successful Operation:** The system successfully unlocks doors when the correct input is provided, such as a card scan, biometric authentication (fingerprint, facial recognition), or a mobile app via Bluetooth or Wi-Fi. Response times for unlocking are typically fast, with most systems unlocking the door within a few seconds.
- **Security Performance:** The system provides high levels of security by preventing unauthorized access. It uses encryption techniques (for communication between the device and the server or phone) to ensure that credentials or access keys are secure.
- **User Experience:** The user interface for the system (whether a mobile app or RFID card reader) was intuitive and easy to use, reducing the likelihood of user error.
- **Technological Advancements:** The use of biometric authentication, such as fingerprints or facial recognition, offers a higher level of security compared to traditional key-based or card-based systems. This reduces the risk of lost or stolen access credentials.
- **Challenges:** Biometric data, if improperly managed, could be susceptible to breaches. There is a need for strict regulations and encrypted data storage to protect users' personal information. Some technologies, like fingerprint scanning or facial recognition, can be affected by environmental conditions such as lighting, humidity, or dirt. These may lead to occasional failure in recognition, potentially inconveniencing users.
- **Future Improvement:** Advancements in AI could improve facial recognition and other biometric methods, making them more accurate and faster, even in challenging conditions. Incorporating machine learning algorithms can help the system detect patterns of behavior to enhance security (e.g., recognizing unusual access patterns and flagging them as suspicious).

## VIII. Conclusion

The automatic door unlocking system provides significant improvements over traditional mechanical locks in terms of security, user convenience and scalability. It leverages modern technologies, such as biometrics and mobile integration, to offer both enhanced access control and a user-friendly experience. However, to fully optimize its potential, attention must be given to addressing privacy concerns, environmental challenges, and system reliability to ensure the long-term effectiveness and trust in such systems. This system enhances security by eliminating the need for physical keys,

reducing the risk of key duplication or theft. Additionally, it improves user experience, providing both convenience and flexibility. With continued advancements in technology, automatic door unlocking systems are poised to become a standard in modern security infrastructure for both residential and commercial settings.

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