

# Smart Door Lock with Fingerprint

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## ABSTRACT

**The Smart Door Lock with Fingerprint system provides a secure and keyless accesses control solution using biometric technology. It uses a fingerprint sensor to authenticate users by matching their fingerprint with stored data. If the fingerprint is verified, the door unlocks automatically; otherwise, access is denied. This system improves security, reduces the risk of unauthorized entry, and eliminates the need for traditional keys. It is cost-effective, easy to use, and suitable for home and offices.**

**Keywords: Improve Security, Biometric System, Smart Door Lock, keyless Entry system.**

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## INTRODUCTION

In the modern world, security has become a major concern due to the increasing incidents of theft, burglary, and unauthorized access to private and public properties. While these systems provide basic protection, they suffer from several limitations. Keys can be lost, duplicated, or stolen, these weaknesses create security risks and inconvenience for users. Therefore, there is a growing need for an advanced, reliable, and intelligent security system that can effectively control access and ensure safety.

With rapid advancement in technology smart security systems have gained significant attention. One of the most promising technologies in this field is biometric authentication. Biometric systems identify individuals based on these unique physical or behavioral characteristics, such as fingerprint, facial recognition, iris pattern, and voice recognition. Among these methods, fingerprint recognition is widely preferred due to its high accuracy, uniqueness, performance, and cost-effectiveness. Fingerprints are unique to every individual, even among identical twins, making fingerprint-based systems extremely secure and difficult to replicate.

The smart door lock with fingerprint system is an innovative solution that replaces traditional locking mechanisms with a biometric-based access control system. This system uses a fingerprint sensor to capture and analyze the fingerprint of a user. This scanned fingerprint is converted into a digital template and compared with digital authorized fingerprint templates stored in system memory. If a valid match is found, the system grants access by unlocking the door through an electronic locking mechanism. If the fingerprint does not match any stored template, access is denied, thereby preventing unauthorized entry.

The core components of the smart door lock system include a fingerprint sensor, a microcontroller, and an electronic lock or motor-driven mechanism, a display unit, which acts as the central processing unit, coordinating communication between the fingerprint sensor, which performs image acquisition, feature extraction, and matching operations. The electronic lock ensures secure physical locking and unlocking of the door. Together, these components create a compact, efficient, and intelligent security system.

One of the key advantages of the fingerprint-based door lock system is its ease of use. Access is granted quickly by simply placing a finger on the sensor. The system can store multiple fingerprints, allowing authorized access for family members, employees, or trusted individuals. This makes it suitable for various applications, including residential buildings, offices, banks, laboratories, hospitals, and educational institutions.

## PROBLEM STATEMENT

Traditional door locking systems that use mechanical keys are vulnerable to problems such as key loss, duplication, theft, and unauthorized access. These systems do not provide reliable security, access tracking, or user authentication, making them unsuitable for modern security needs in homes, offices, and institutions.

There is a need for a secure, reliable, and user-friendly access control system that ensure only authorized individuals can enter a protected area. A smart door lock with fingerprint authentication addresses these issues by using biometric identification, which is unique to each individual and difficult to duplicate. The system aims to enhance security, eliminate the dependence on physical keys, reduce unauthorized access, and provide a convenient and efficient locking mechanism suitable for modern environments.

## LITRATURE SURWAY

- **System architecture**

### Smart Door Lock with Fingerprint



A smart door lock with fingerprint is an advanced, keyless locking system that uses biometric fingerprint recognition to unlock your door. Idea for enhancing home or office security with convenience and reduced risk of unauthorized entry.

- **Hardware Used**

#### Fingerprint sensor

1. You place your finger on the sensor.
2. The sensor captures your fingerprint pattern.
3. It compares with the stored fingerprint in memory.
4. If it match- Door unlocked.
5. If it doesn't match – Door stays locked.

- **Servo Motor**

1. Works as the door locking mechanism.
2. Works automatically without using a key.
3. Moves to a specific angle for accurate locking/unlocking.

- **Arduino UNO**

1. A fingerprint sensor module is a device that capture, stores, and matches fingerprint data.
2. Image capture: - finger placed on sensor.
3. Storage: - templates saved in modules flash memory.
4. More secure

- **Regulator(LM2596)**

1. LM2596 is a voltage regulator module that reduce high voltage to a safe lower voltage.

- **LCD**

1. An LCD is a small screen used in the smart door lock to show information to the user.
2. Show the access or not access.
3. Display on a shared fingerprint and not shared fingerprint.

- **Buzzer**

1. A buzzer is a small sound device used to give audio alert
2. Not match the finger.
3. Reaming 5-time alert audio.

- **Buttons (1,2,3)**

1. Enroll fingerprint
2. Delete fingerprint
3. Reset/admin operation

## MODULE DESCRIPTION

A smart door lock with a fingerprint module is an electronic locking system that uses biometric fingerprint. The users fingerprint is scanned and match we stored data; if it matches, the lock opens automatically.

This system provides high security, fast access, and keyless operation. It can store multiple user fingerprint

## OBJECTIVE

- To provide secure and keyless access using fingerprint authentication.
- To prevents unauthorized entry by allowing only registered fingerprint.
- To improve user convenience by eliminating the need for physical keys.
- To support multiple users with easy fingerprint enrolment and deletion.
- To enhance safety and reliability compared to traditional locking systems.
- To enable modern access control suitable homes, office, and institutions.

## APPLICATION

- **High security accesses**

Unique biometric data: - fingerprint are nearly impossible to duplicate, so only authorized users can unlock the door. No risk of key copying: - unlike physical keys or even key-cards, fingerprints can't be copied or shared easily.

- **Convenience and Speed**

Ideal for busy hands: - Especially useful when your hands are full or you're in a hurry.

- **No keys to Lose**

Forget keys forever: - you eliminate the risk of losing or forgetting physical keys.

No lockouts: - you won't be locked out because you left your keys inside.

- **User Management**

Easy enrolment: - Add or remove user fingerprint via the lock interface or connected app.

Track entry logs: - Many smart locks record who entered and when-great for families or businesses.

- **Multi-Access Options**

Backup methods: -Most fingerprint smart locks also support fingerprints

Flexile access: - useful for kids, guests, domestic helps, or service personnel.

- **Ideal for Families and Shared Spaces**

Multiple profiles: - Each family member can have their own fingerprint profile.

Temporary access: - Provide guests or helpers access for specific time.

## BENEFITS

- **Strong security:** - Harder to hack or duplicate than keys.
- **Keyless convenience:** - Just use your fingerprint – no keys to carry.

- **Fast access:** - Unlocks in seconds.
- **Multiple users:** - Store fingerprint for family, guests, help, etc.
- **Ideal for homes and offices:** - Suitable for apartment, office, and hotel

## FINAL OUTPUT

## CONCLUSION

A smart door lock with fingerprint provides a secure, modern, and convenient solution for access control. By using biometric authentication, it ensures that only authorized users can unlock the door, reducing the risk of theft, key loss, or unauthorized entry.

This system is easy to use, saves time, and improves safety compared to traditional locks. It is suitable for homes, offices, schools, hospitals, and banks. With features like fast response, high accuracy, and low maintenance, fingerprint-based smart door locks represent a reliable and efficient security system for today's smart living environment.

## FUTURE SCOPE

The future scope of a smart door lock with fingerprint is very promising due to rapid growth in smart homes, IOT, and security technologies. In the coming years, these systems can become more advanced, reliable, and user-friendly.

- **Integration with Smart Home System**

Smart fingerprint door locks can be fully integrated with smart home platforms like mobile apps, voice assistants, and home automation systems. Users will be able to lock or unlock doors remotely and monitor access in real time.

- **Multi-Biometric Authentication**

Future systems may combine fingerprint recognition with face recognition. This multi-factor security will greatly reduce unauthorized access.

- **Cloud and IOT Connectivity**

By using IOT and cloud technology, fingerprint data and access logs can be stored securely online. Users can receive instant notification and manage access permissions from anywhere in the world.

- **AI-Based Security Enhancements**

Artificial Intelligence can improve fingerprint matching accuracy and detect suspicious activities. AI can also learn user behaviour patterns and send alerts during abnormal access attempts.

- **Improved Power Management**

Future locks will use energy-efficient components, solar charging, or long-lasting batteries, reducing maintenance and power failure issues.

- **Enhanced Data Security**

Advanced encryption techniques will protect fingerprint data from hacking or misuse, ensuring user privacy and data safety.

- **Wider Application**

Smart fingerprint door locks will be widely used in homes, office, banks, hotels, hospitals, and industrial areas for secure and controlled access.

- **Cost Reduction and Easy Installation**

With mass production and technological advancement, these systems will become more affordable and easier to install, even in existing doors.

## ACKNOWLEDGEMENT

A smart door lock with fingerprint recognition replaces your traditional key with your unique fingerprint, allowing you to unlock your door in seconds by simply touching a scanner. It is a keyless system that brings convenience and higher security to your home.

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