SMART DOOR LOCK SYSTEM

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Abstract: The main goal of this project is to develop a highly secure door lock system that incorporates a fingerprint scanner at an affordable price. To achieve this, we will use a range of hardware components including the Atmel Atmega328p microcontroller, a GSM module, a motor driver, a motor, and other devices. The fingerprint scanner will be strategically located on the exterior of the door panel to ensure that the control system is inaccessible from the outside. Moreover, we will install multiple latches within the door panel to enhance their strength in the event of an attempted break-in. When a user places their finger on the scanner, the fingerprint data will be sent to the microcontroller for comparison with stored records. If the data matches, the microcontroller will activate the latch’s lock or unlock feature depending on its current state. To reset the system, the user must input a known fingerprint. Overall, this project aims to leverage biometric technology to deliver a high level of security at an affordable cost, ensuring maximum peace of mind for homeowners.

Keywords: Arduino Uno, Adafruit Fingerprint Sensor, Solenoid Lock, Power Supply, Buzzer, Keyless

I. INTRODUCTION

As technology continues to advance, the security of corporate environments and offices has become a top priority. With the increasing risk of data breaches and unauthorized access, it is crucial to have an automated and dependable security system in place. Traditional methods of identification, such as passwords and ID cards, are no longer foolproof and can easily be compromised.

Manual door locks with keys can lead to frustration and inconvenience when keys are lost or misplaced, and smart cards can also be misplaced or stolen. While some may hire caretakers to manage locks and keys, this approach is not always reliable. Smart door lock systems have emerged as an innovative and popular solution to these security concerns. These systems utilize biometric identification for secure access control, allowing only authorized personnel to enter. Furthermore, smart door lock systems eliminate the need for physical keys, making managing access to multiple areas easier. Overall, smart door lock systems provide a dependable and convenient method for securing corporate environments and offices, offering peace of mind to users.

II. LITERATURE REVIEW

This article discusses the implementation of a password-protected door lock system, which can be utilized in different environments such as homes, offices, and desks. This system verifies the entered password to authenticate the user before unlocking the door, making it a cost-efficient solution compared to advanced door lock systems that utilize high-end technologies like retina scans, iris scans, or fingerprints[1].

This article showcases the development of a door lock system that utilizes a password-based mechanism and ARDUINO UNO technology. The system only allows access to users who input the correct code, providing a secure solution for protecting valuable items in various settings. As a budget-friendly option, this locking system can be easily purchased and installed by individuals seeking to enhance their security measures[2].

A study has proposed an Android-based smart door lock system as a solution to combat problems such as trespassing, unauthorized access, and unwanted instructions. By utilizing a Bluetooth module, the system establishes communication between an Android Uno and a mobile phone, which enables the system to function effectively. The Android-based smart door lock system is designed to be user-friendly, requiring minimal maintenance and simple installation, making it an ideal option for those looking to improve their home or office's security measures. The system provides users with a convenient and secure way to lock and unlock their doors using their mobile phones, resulting in a seamless and hassle-free experience[3].

This paper presents a door lock system that prioritizes security, leveraging network security measures with the use of cryptographic algorithms such as SHA-128 and SHA-512. The system is designed to enable remote access for authorized users, with user inputs being encrypted and hashed using advanced algorithms like AES-128 and SHA-512. The system also includes a sensor that can detect and notify the authorized user's smartphone application in the event of unauthorized access, providing an added layer of security. In summary, this system offers a robust and reliable security solution, guaranteeing that only authorized individuals can access protected areas[4].

The article presents an innovative door lock system that utilizes facial recognition and a camera installed on the door to grant access to users through cloud-based data storage. Although the system is advanced, it may come with a high price tag and require specialized skills for its installation and upkeep[5].
### III. DESIGN AND METHODOLOGY

To create a smart door fingerprint lock, biometric technology is utilized to identify and verify authorized users based on their fingerprints. The system comprises a fingerprint scanner that captures and analyzes a user's unique fingerprint patterns, which are then compared with data stored in its database. If the fingerprint matches, the lock is released, and the user is granted access. The lock is powered by a microcontroller and connected to a power source, providing a secure and convenient solution for home or office security.

![Block Diagram of Smart Door Lock System](image)

**Fig. 1 Block Diagram of Smart Door Lock System**

A block diagram depicting a smart door fingerprint lock system usually comprises various components that work together to provide secure access control. The core component is the fingerprint scanner which captures and sends the user's fingerprint data to the microcontroller. The microcontroller processes the data, matches it with the stored database of authorized users' fingerprints, and signals the lock to release and grant access. The system may also include a power source, display screen, and communication modules for remote monitoring and access. In essence, the block diagram offers a visual representation of how the system components interconnect to create a secure and convenient access control solution.

1. **Arduino UNO**
   Creating a smart door fingerprint lock with an Arduino is a great project for those interested in home automation. By connecting a fingerprint sensor to the Arduino and programming it to read the fingerprint data, the system can be customized to trigger the lock mechanism when a recognized fingerprint is scanned. With an Arduino, the lock mechanism can be designed to fit specific requirements and desired features, such as including a keypad for backup access. Additionally, using an Arduino can be more cost-effective compared to purchasing a pre-built smart lock system.

2. **Solenoid Lock**
   When it comes to creating a smart lock fingerprint system, a solenoid lock is a great addition to its secure and reliable locking mechanism. The solenoid lock operates using an electric current to move the locking mechanism, which makes it an excellent choice for a highly secure locking system. The combination of a solenoid lock and an Arduino-based smart lock fingerprint system is an effective way to create a custom security solution. The solenoid lock can be triggered by the Arduino when a recognized fingerprint is scanned, which sends a signal to unlock the door.

3. **Adafruit Fingerprint Sensor**
   For those interested in creating a smart lock fingerprint system using an Arduino microcontroller, the Adafruit fingerprint sensor is a well-regarded option that provides a range of benefits. Its simple integration with the Arduino board and ability to read fingerprint data make it an excellent choice for a door-locking system that is both secure and user-friendly. With the Adafruit fingerprint sensor, users can effortlessly unlock the door by scanning their fingerprints, doing away with the inconvenience of traditional keys or access codes. The sensor is renowned for its high level of accuracy and dependable, guaranteeing that only authorized individuals can enter the space. Moreover, by utilizing an Arduino board, it is possible to enhance the capabilities of the smart lock fingerprint system by incorporating additional features. A solenoid lock can be included to boost security or a backup keypad can be implemented for alternative access. The system can also be programmed to recognize multiple fingerprints, enabling numerous users to gain access without the need for individual keys or access codes.

4. **Buzzer**
   Adding a buzzer to a smart lock fingerprint system using an Arduino can enhance the security and convenience of the system. When a user scans their fingerprint and it is recognized by the Arduino, the buzzer can be triggered to emit a sound to indicate
that the door is unlocked. Conversely, if the fingerprint is not recognized, the buzzer can emit a different sound to inform the user that their access is denied.

By integrating a buzzer into the system, users can receive real-time feedback on the status of their access attempts, increasing the system's overall convenience and user-friendliness. Additionally, the buzzer can serve as an audible alarm, alerting nearby individuals of any unauthorized access attempts.

Integrating a buzzer into a smart lock fingerprint system using an Arduino is a straightforward and affordable process. Through proper programming, the buzzer can be customized to emit various sounds for different situations, such as unique tones for different users or to indicate low battery levels.

5. Working Principle

Fingerprint locks are a highly sophisticated form of access control system that uses advanced algorithms to verify an individual's identity. The user's fingerprint is scanned and converted into a digital template that is then compared with the stored data to determine if access should be granted or denied. This process is done in real-time, allowing for quick and seamless access to a secured area.

The effectiveness of fingerprint locks lies in the minutia points that are located on the user's fingers. These are unique points that are used as reference points during the matching process. During registration, the position and direction of these points are recorded and stored in memory for future use. When a user attempts to gain access, their fingerprint is compared with the stored template using the minutia points as a reference. If a match is found, the door is unlocked, and a green LED is activated to signal successful access. The process is incredibly fast, taking only a fraction of a second to complete.

Overall, fingerprint locks are a reliable and secure form of access control that provides a high level of convenience and efficiency. They are ideal for use in a range of settings, including residential, commercial, and industrial environments.

IV. Conclusion

In conclusion, the integration of an Arduino into a smart lock fingerprint system offers numerous benefits, including flexibility, durability, and affordability. By connecting a fingerprint sensor to an Arduino and programming it to control a solenoid lock, the system can be customized to meet specific security needs.

The use of an Arduino also allows for the addition of extra features, such as a keypad or remote control, to further enhance the system's functionality and accessibility. This makes it a suitable option for those looking to create a personalized security solution without having to purchase a pre-built system.

Furthermore, the solenoid lock's durability and energy efficiency make it a reliable and long-lasting locking mechanism, ensuring the system remains secure and operates smoothly over time.

Overall, a smart lock fingerprint system powered by an Arduino and solenoid lock is an effective, customizable, and affordable security solution that offers peace of mind to homeowners and business owners alike.
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