

Keyless Lock Based on Internet of Things

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Abstract

In recent years, there has been a growing interest in smart home technologies, with smart door locks being one of the focal points due to their potential to enhance security and convenience. Smart door lock systems are transforming access control by offering a keyless alternative for both residential and commercial settings. These electronic locks replace traditional keys with secure methods such as emergency alarms, privacy modes, battery backup, cameras, voice recognition, fingerprint scanners, and smartphone connectivity. This advancement not only bolsters security through features like access logs and remote locking but also streamlines daily life by eliminating the need for physical keys and enabling remote access management. The design emphasizes security measures to protect against unauthorized access. Authentication mechanisms, such as PIN (personal identification number) codes, biometric recognition, and mobile device authentication, are implemented to ensure secure user identification. In our project, we've introduced additional functionalities beyond standard smart locks, including an integrated security alarm system and voice recognition technology, pattern lock, allowing authorized users to unlock the door with a predefined passphrase or command. In case of an emergency, Alarm triggers on break-in, sending alerts with location to be authorized users. Users can contact police directly or location is sent as emergency message. Moreover, our system incorporates two-way communication, enabling remote interaction with visitors or delivery personnel through a built-in speaker and microphone system integrated into the smart lock. The paper also explores the potential for incorporating advanced features like voice-activated unlocking or integration with security cameras for real-time monitoring, further enhancing security and convenience. Furthermore, the system prioritizes user convenience by providing intuitive user interfaces and customizable settings. Users can remotely control the door lock via smartphone applications, receive instant notifications of lock status changes and grant temporary access privileges to visitors or service providers. Overall, the proposed smart door lock system represents a significant advancement in home security and automation.

Keywords: Privacy mode, voice recognition, internet of things, two-way communication, pattern lock alarm

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INTRODUCTION

In the present era, security is a major concern in everyone's life. For this reason, new modern and advanced locks were developed which are more secure [1]. These locks made a revolution in home security, by putting various new technologies in it. Those days are gone when we worried about misplaced or duplicated copies of mechanical locks. Now, with a simple touch, voice command or mobile user can unlock their door effortlessly from anywhere in the world [2].

You have probably seen a wide variety of smart door locks that use various technologies like unlocking doors with biometrics (finger or face

recognition), PIN (personal identification number) codes, radio-frequency identification (RFID) cards, and granting access with a smartphone [3]. We have made a lock in which these things were present along with added some extra technologies like security alarm system, unlocking the door with voice recognition, and privacy mode [4]. We have also added two-way communication through which you can talk to an outside person from the inside without opening the door. When anyone tries to open the door forcefully the alarm will produce a high sound. So that you will know that someone is trying to open the door forcefully. Our lock consists of four-layer locks, but we have added a fifth layer (privacy mode) [5]. When privacy mode is on from inside no one can open the door from outside. If any suspicious activity occurs or when it triggers a panic button then the door automatically locks and calls the police and sends them the actual location of the house. We put the security of users as a top priority [6].

IMPLEMENTATION

We implemented a smart door lock system with biometric (voice and face) recognition and pattern system that gives access to outside talking, police contact, and privacy mode in case of different situations [7, 8]. This program sets up a communication link for the user to have access to the house [9, 10]. A breakdown of each feature and how they can be implemented is described next.

Biometric Recognition

Implementing biometric recognition for voice and face involves several steps, including data collection, enrollment of voice and face of users.

- a. *Voice Recognition:* Unlock the door with the pre-enrolled voice of the user. If the voice used is already saved in the system the user will have access to the door.
- b. *Facial Recognition:* Unlock the door with the pre-enrolled face of the user. When a user approaches the door, the camera captures their face. The system extracts facial features again and compares them to the stored data if it matches the door unlocks.

Pattern System: Pattern can be relatively harder to guess or smudge onto the lock by someone watching you enter it. Pattern system is mostly used for higher levels of security. For a person to correctly guess the pattern he/she must remember every point where the pattern is to be connected. The pattern once enrolled by the user can only be used for further access to the door lock.

Outside Talking: Two-way communication, often called "outside talking," is a valuable feature for smart door locks. The smart lock is equipped with a built-in microphone, speaker, and camera, to establish communication with a visitor. When a visitor presses the doorbell button, a connection is established between the visitor and the homeowner through the speaker and camera. This is an easy way to allow a conversation before remotely unlocking the door.

Privacy Mode: It is an extra small lock. You can switch it on from your phone or inside. When the privacy mode is on, no one can open the door from outside. The main feature of privacy mode is when it is turned on all the other modes: pattern, face recognition, and voice recognition are disabled for some time. If someone is trying to access these features in disabled period then a notification is sent to the phone.

Emergency Event: The system may encounter an emergency such as a person trying to open the door with force etc. On detecting the emergency, the door lock sends an SMS to the user notifying about the situation with a photograph and a voice recording of the user and provides different options to the user.

On detecting the emergency, the door lock sends an SMS to the user notifying them about the situation with a photograph of the user and provides different options to the user:

- a. *Alarm:* The smart door lock includes an integrated security alarm system. When unauthorized access is detected, the alarm triggers. The alarm can be customized with different sensitivity

levels and alert methods. This alarm system is also triggered when a person enters the wrong pattern multiple times in the form of a timer in which one can't retry the pattern.

- b. *Police Contact:* In the case of an emergency the alarm gets triggered and a notification is sent to those people who have access to the door lock with an option of contacting the police. If the person decides to contact the police the location of the person is also placed with the call. Even if the call is not placed the location can be sent as a message in the form of an emergency to the police.

Backup Charging: If the battery has reached 35% the system will start its auto-charging. If, for some reason, the battery does not start charging, a notification will be sent at 30% to the user about its remaining percentage of power left. If for some reason there is no way to charge the battery, the battery can be removed and another battery can be added in its place for backup (Figure 1).

FLOWCHART

Working Process

Authentication Process

The user then has to undergo an authentication process. The flowchart shows three possible methods for user authentication:

- a. Voice recognition
- b. Face recognition
- c. Pattern lock

If the data matches in the system with the input process, the door will successfully open. If the data is unmatched in the system, the person can go under two-way communication with the owner.

If the person tries to open the door forcefully then the system can activate the emergency alarm and the user gets a notification to call the police and send the location, photo, and message.

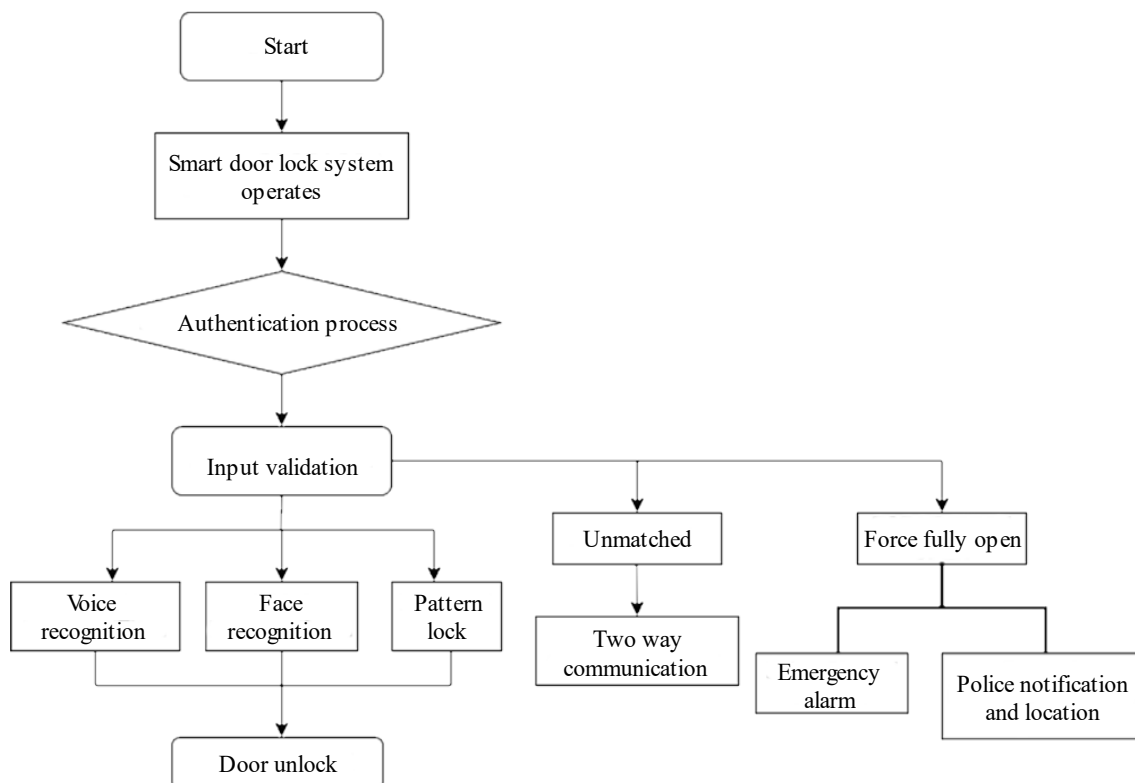


Figure 1. The system starts with the user initiating the smart door lock system.

CONCLUSIONS

In this paper, we have designed a keyless door lock system based on the internet of things. Smart door lock systems represent a significant advancement in home security and convenience. By integrating technology such as biometric authentication, remote access control, and real-time monitoring, these systems offer users enhanced control over access to their homes. This smart lock comes with panic button alerts from which police get photos and real-time location if the door opens during emergency mode.

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