

# Development of Voice Command Locking System for Security Application

**Khairunnisa Rosda<sup>1</sup>, Muhamad Amirul Azahar<sup>1</sup>,  
Nursyahirah Mustafa<sup>1</sup>, Afishah Alias<sup>1\*</sup>**

<sup>1</sup>Department of Physics and Chemistry,  
Faculty of Applied Sciences and Technology,  
Universiti Tun Hussein Onn Malaysia (Pagoh Campus),  
84600 Pagoh, Muar, Johor, MALAYSIA

\*Corresponding Author Designation

DOI: <https://doi.org/10.30880/ekst.2023.03.02.028>

Received 15 January 2023; Accepted 19 February 2023; Available online 30 November 2023

**Abstract:** A voice command locking system that can transmit and receive signals when the users give a voice command using a key phrase to the system has been built. The voice command locking system is built to improve or overcome flaws of existing locking systems, especially for the users to be more alert in protecting their houses and belongings. The voice recognition module V3 is used as a microphone and used to record and store the pre-recorded key phrase. The key phrases were trained and tested before being stored in the voice recognition module V3. Then, the pre-recorded key phrase was compared with the command given by the user before sending the signal to servo motors to open or close the locking system. The rotation of the servo motors changes based on the similarity of the key phrase from the user's command with the pre-recorded key phrase. It shows that the servo motors rotated 180 degrees if the key phrases have a similarity and vice versa. An Arduino board is the main component in this project that acts as a receiver and transmitter of data to devices that are connected to it. The time taken by the servo motor to begin rotating after receiving an instruction from the user, which is 86 milliseconds, is used to evaluate a system's functionality. It was measured starting from the command being said until the servo motors start rotating. With this upgraded system, the users will be safer with their locking system from being accessed by an unauthorized person, and it will be more convenient to use the locking system. Overall, the voice command locking system can function well.

**Keywords:** Voice Command, Locking System, Key Phrase

## 1. Introduction

The security system plays an important role in our society as it protects our houses, companies, and belongings from any crime such as robbery and access from unauthorized people. The rate of crime happening in this world is increasing hence, in this modern world, various types of security systems have already been created by people to prevent intrusion and a locking system is one of the

---

\*Corresponding author: [afishah@uthm.edu.my](mailto:afishah@uthm.edu.my)

2023 UTHM Publisher. All rights reserved.

[publisher.uthm.edu.my/periodicals/index.php/ekst](http://publisher.uthm.edu.my/periodicals/index.php/ekst)

security systems. Now, the locking system is using either the traditional way or biometric ways such as keys, password-based, facial recognition, and fingerprint [1]. The difficulty with the password-based is it can be hacked while using the traditional way, the disadvantages in opening the door are when the user's hands are full of things, incompetence to fit the key into the door lock in rushing, and biting of the key corrode in an old lock [2].

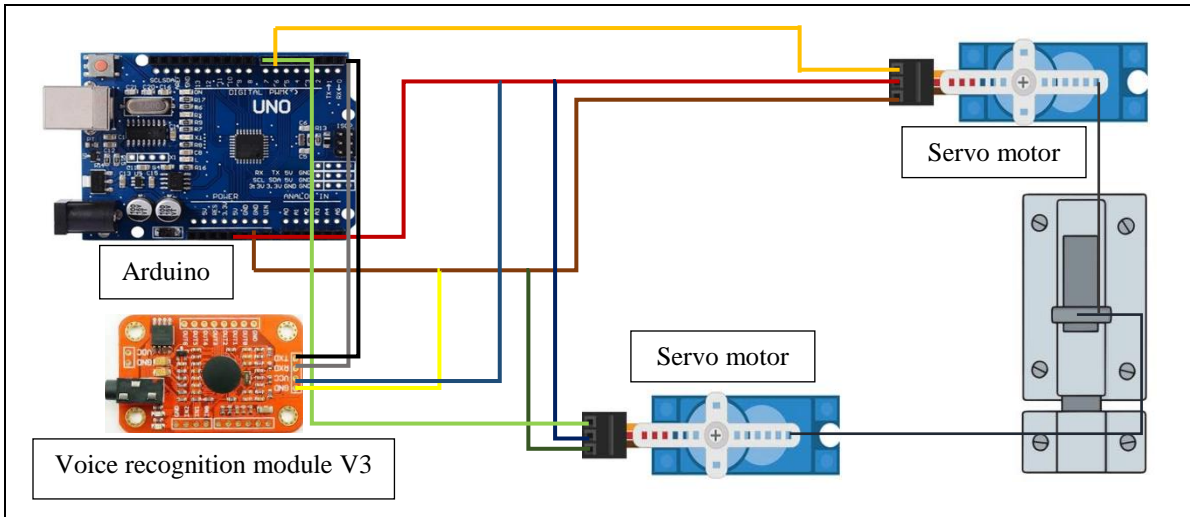
The locking system has been created over 4000 years ago and has been improved from year to year. The oldest known keys and locks were unearthed in the ruins of Nineveh, ancient Assyria's capital [3]. A lever tumbler lock was created by Robert Barron in 1778 that uses a series of levers to keep the bolt from moving within it [4]. The first electronic keycard lock developed by Tor Srnes in 1975, created a new market for programmed locks that used a variety of identification techniques including password and biometric information [5]. The biometric way accepts commands to lock and unlock the door from an approved device using a wireless protocol and an encryption key. A digital security system based on Radio Frequency Identification (RFID) technology was developed by Verma and Tripathi in 2010 [6]. A security system that includes a door locking system that uses passive RFID to activate, authenticate, and validate the user while also unlocking the door in real time for secure access. Furthermore, a door automation system using Bluetooth android for mobile phones was developed by Kamelia in 2014 [7]. It employs a command transmitted digitally via Bluetooth on Smartphones and other mobile devices rather than a key to open the door.

This voice command locking system was created to improve the flaws of the existing locking system and to make the users convenient and at the same time secure the users' belongings which helps a person to be more alert in protecting their lives, houses, and companies. Nowadays, people use keys to lock their doors but the keys can be duplicated and misplaced by the users [8]. The same goes for the fingerprint, the fingerprint can be copied from other people to access the door [9]. The facial recognition door lock also can be accessed by using the user's picture while passwords can be hacked and forgotten [10]. Therefore, in this project, we will use a voice command locking system by key phrase to improve the locking mechanism. Voice command locking system prevents unlocking the system manually to ensure the security of lives and properties. When a person says a specific key phrase, this smart system will compare it with the pre-recorded key phrase and open or close the locking system based on the command given. Compared to the existing locking system, the voice command locking system have more benefits as the voice command locking system is more secure compared to the existing locking system because only the user can open or close the system using the specific key phrase. Other than that, voice commands can make it convenient for people who cannot unlock the door physically because they can open the locking system with their voice by saying a specific key phrase.

## **2. Materials and Methods**

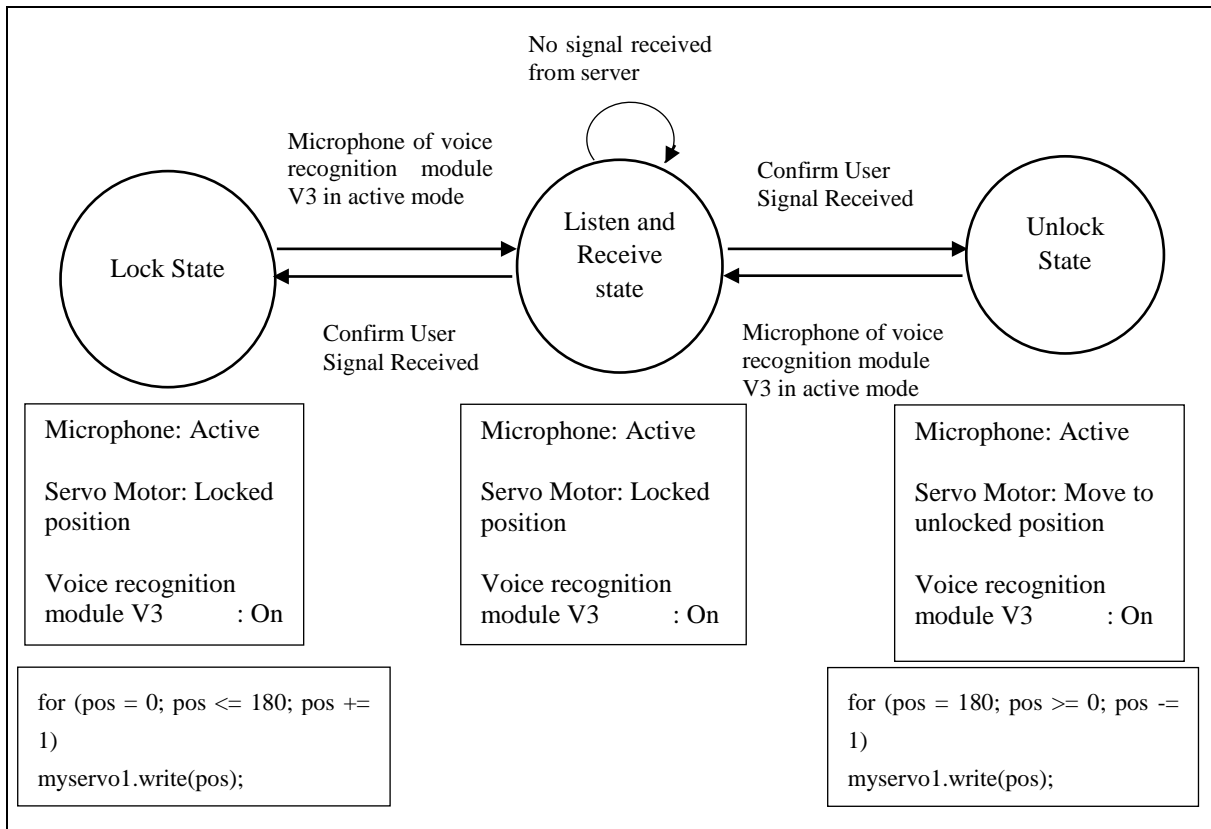
This locking system schematic circuit was built and tested by using the software which is Arduino IDE. The circuit consists of two servo motors. Figure 1 shows the schematic circuit of the voice command of the locking system. Two servo motors were connected to the microcontroller (Arduino) to receive a signal from it to rotate for opening or closing the system. The voice recognition module V3 trained and stored the key phrases in the system. Then, the voice recognition module V3 compared the command key phrase with the pre-recorded key phrases that were already stored. The microcontroller sent a signal to the servo motors.

The key phrases were trained and tested to be verified to be uploaded into the database. Besides, the servo motors were set to 180-degree rotation to open or close the system.



**Figure 1: Schematic diagram of voice command locking system**

The receiver pin from Arduino (RXD) and the transmitter pin to Arduino (TXD), were connected to pins number (3, 2) to receive a signal from the voice recognition module V3 and transmit a signal to the servo motors while the ground (GND) was connected to the ground pin to protect the circuit from damage circuit by draining out any build-up electrical charge while the power input (VCC) was connected to the 5V pin as the voltage for the circuit. The servo motors pins were connected to the ground, 5V, and pins numbers (6, 7). When the key phrase was said to the microphone, voice recognition module V3 compared it with the pre-recorded voices and sent the signal through the Arduino to the servo motors to open or close the locking system. The Arduino would not deliver the signal to the servo motors if the key phrase did not match the pre-recorded voices. Figure 2 shows the functional block diagram of the voice command locking system.



**Figure 2: Functional block diagram of voice command locking system**

Two control systems were involved in this prototype, namely the voice recognition module V3 and the servo motors. The output will be displayed on the second control system. The output displayed was based on code and command set up in the programming code that was uploaded into the UNO Arduino Board. Whilst the first control system recorded voices and stored them for comparison before sending a signal to the servo motors.

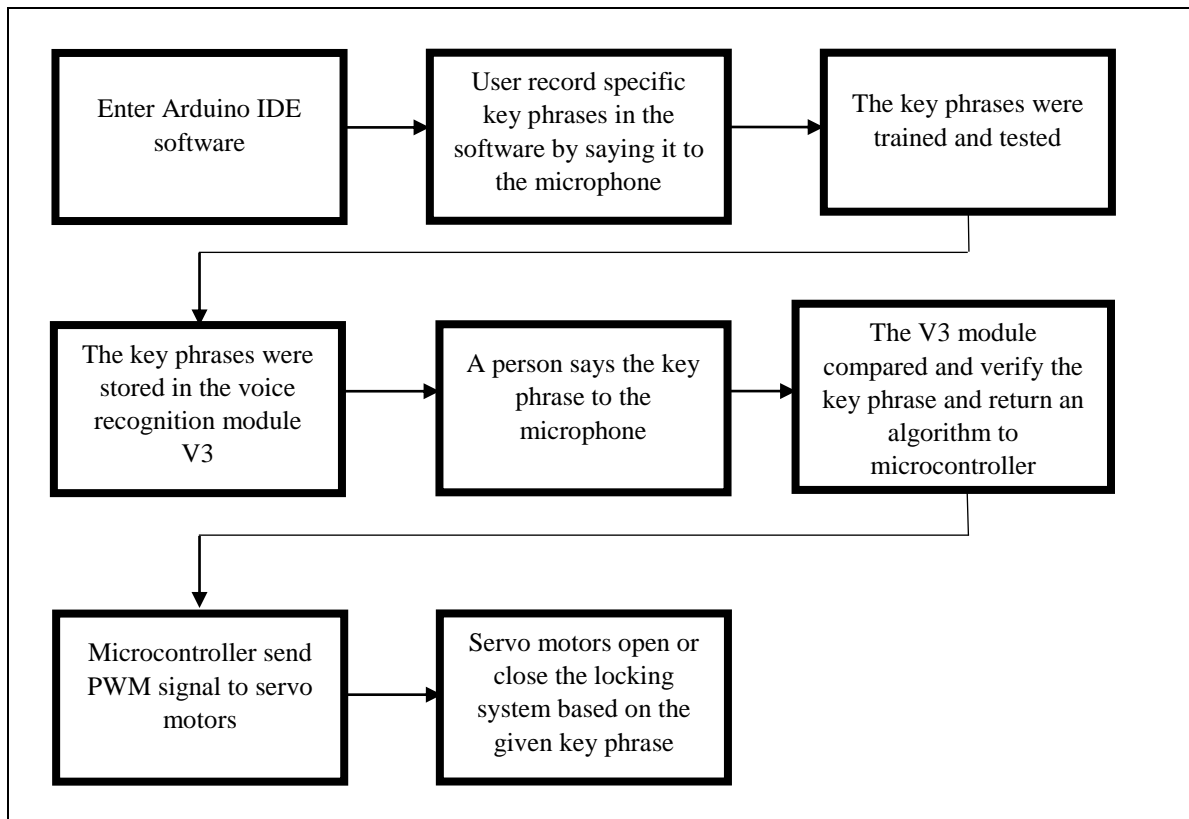
The key phrases were trained and tested in the voice recognition module V3 that connected to the Arduino before the key phrases which have been stored in the system were compared with the key phrase that will be inputted from the user before opening or closing the locking system. The user will speak the key phrase to the system, the system will analyze the key phrase and store the key phrase in a database. Systems that do not make it through the training phase are referred to as speaker-independent those, whereas systems that do are referred to as speaker-dependent systems [11]. After the key phrases were stored in the system, the key phrases will be tested by comparing the pre-recorded key phrases with the key phrase that was given. The key phrases act as the password for the locking system and the user is always able to change their password. In this project, the key phrases that were used were “ONE” to open the locking system and “OFF” to close the locking system.

### **3. Results and Discussion**

The voice command locking system is an improvement to the existing locking system by facilitating the users to be aware of safety and properties because this system has fewer drawbacks compared to the existing locking system.

The mechanism for this project is shown in Figure 3. A specific key phrase was trained and recorded by the user at the microphone of the voice recognition module V3 for each word. Then, the system was tested by saying a key phrase to the microphone. The microphone was positioned beside the locking system. The voice recognition module V3 identified and verified the key phrase before sending an algorithm to the Arduino to be processed.

The Arduino will send a PWM signal to the servo motor if the key phrase has a similarity with the pre-recorded key phrases. Servo motors opened or closed the locking system based on the command that was being said to the microphone. The time taken by the servo motor to begin rotating after receiving an instruction from the user, which is 86 milliseconds, is used to evaluate a system's functionality. It is measured starting from the command being said until the servo motors start rotating to open or close the locking system.



**Figure 3: Mechanism flow diagram**

The circuit for this system was designed and constructed to train the system to understand the specific key phrase. Then the performance of the developed device was analyzed to make sure the system works well. The developed system's performance was then examined to ensure that the system functions properly. The developed system's performance was examined several times, and if the system failed, the circuit and the programming code were revised. Although the detection accuracy of this system has been tested approximately 15 times, noise cancellation cannot be performed when the ambient influence of sound detection is in force.

#### 4. Conclusion

This simple yet intricate prototype was designed to help the community to be more alert on safety when using the locking system. From the vision of this project, it is indeed aimed to create a convenient more user-friendly with a low cost and affordable. This is due to the issues that are rarely seen but can have a great negative impact and damage such as intrusion by an unauthorized person into the user's houses or belongings. Hence, by using this prototype the cause of destruction to houses can be reduced.

The prototype of this voice command locking system was designed to facilitate the user so that the user is more convenient when using this locking system because it does not require any physical contact, allowing the user to multitask while opening or closing the locking mechanism and saving additional time. Arduino is the control unit for this system as it receives and transmits the signal to the component that is connected to it. The pre-recorded key phrases were trained and tested before being stored in the system to be compared with the command given to open or close the locking system. The key phrases also act as the password for the locking system and the user is always able to change their password. The voice recognition module V3 sent the algorithm to the Arduino before the servo motors rotated to open or close the locking system based on the signal received from the Arduino. The Arduino will not send a signal to the servo motors if the command does not match the pre-recorded

key phrases. The time taken by the servo motor to begin rotating after receiving an instruction from the user is 86 milliseconds.

### Acknowledgment

The authors would also like to thank the Faculty of Applied Sciences and Technology, Universiti Tun Hussein Onn Malaysia for its support.

### References

1. "What Are the Two Main Types of Door Locks, and Which One Is Best for Me? - Bob Vila." <https://www.bobvila.com/articles/types-of-door-locks/> (accessed Jan. 14, 2023).
2. V. R. Vinoj, C. D. Shaifee, and B. N. Mafila, "Voice Recognition Door Access Control," no. 04, 2020.
3. "A History of locks | Precision Locksmiths." <https://www.precision-locksmiths.co.uk/a-history-of-locks/> (accessed Jun. 06, 2022).
4. M. Rashid, M. W. Anwar, and A. M. Khan, "Toward the tools selection in model-based system engineering for embedded systems - A systematic literature review," *J. Syst. Softw.*, vol. 106, no. May, pp. 150–163, 2015.
5. "The History and Future of Locks and Keys." <https://gizmodo.com/the-history-and-future-of-locks-and-keys-1735694812> (accessed Jul. 01, 2022).
6. G. K. Verma and P. Tripathi, "A Digital Security System with Door Lock System Using RFID Technology," *Int. J. Comput. Appl.*, vol. 5, no. 11, pp. 6–8, 2010.
7. K. S. G. B. Lia and W. S. M. S. G. B. Sanjaya, "Door-automation system using bluetooth-based android for mobile phone Door-Automation System Using Bluetooth-Based Android For Mobile Phone," no. January 2014, 2016.
8. "Should you go for smart locks or traditional locks? - Lockout 24/7 Locksmiths - Covering Essex & North London." <https://www.lockout247.co.uk/should-you-go-for-smart-locks-or-traditional-locks/> (accessed Jan. 14, 2023).
9. K. Wazed Nafi, T. Shekha Kar, and S. Anisul Hoque, "An Advanced Door Lock Security System using Palmtop Recognition System," *Int. J. Comput. Appl.*, vol. 56, no. 17, pp. 18–26, 2012.
10. A. Mishra, S. Sharma, S. Dubey, and S. K. Dubey, "Password Based Security Lock System," *Int. J. Adv. Technol. Eng. Sci.*, no. 02, pp. 100–103, 2014, [Online]. Available: [www.ijates.com](http://www.ijates.com)
11. A. Oduroye, A. D., AkinsanyaAdeoluwa, OlufowobiAbraham, BabajideOyetunde, and S. M., "Voice Recognition Door Access Control System," *IOSR J. Comput. Eng.*, vol. 21, no. 5, pp. 1–12, 2019.