

Arduino Based Door Unlock Security System Controlled by Voice Commands

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Abstract

Privacy and security are important issues in the information system. There is a critical need to change the protective measures of the system in the present era of automation and smart gadgets. The present period is ruled by hardware apps with voice control. The majority of household equipment should be voice-activated soon. Most doors in the old system had mechanical locks with a limited number of keys. To improve security, this project suggests a Voice Recognition-based Smart Door Unlock System. The technique mentioned in this paper focused on the lock and unlock of the door using voice commands. The design included an Arduino SMD microcontroller and Bluetooth module HC-05 as it is the main hardware unit and used C++ for command controls in Arduino. The main concern of this project is to serve with android device mobile as a central console, choosing which action the unlock-lock system must do to coincide with the user's request. With a voice-activated door, you can ask the smart hub or home security to "Unlock the door" or "Lock the back door" and the request will be fulfilled. This technique will make the entire system keyless while also enhancing security. The essential prerequisites are a lock and actual door keys. A method of voice-controlling the door via automated devices is proposed to solve this problem.

Keywords—Voice Command, Smart Door Security, Arduino, Bluetooth Module.

1. Introduction

The goal of this research paper is to create a controlled door unlock system that uses voice recognition algorithms to give people a quick way to unlock their doors while also ensuring their safety and security. The Voice Controlled Unlock System is an automated locking mechanism that connects an Arduino to an Android smartphone using a Bluetooth module. A voice-activated door lock system's main objective is to give us the ability to unlock and lock the door latch while seated and using only our voice. The physical key is a well-tested and well-known technology, but it also has its deficiency. For each lock, there is only one special, individual key. We have numerous keys for various locks. A lot of keys make life more difficult and increase the chance that they will be stolen, lost, or misplaced. Those who are physically unable to walk or who have bilateral amputees can unlock and lock the door thanks to this design. The device will be easy to use, distribute keys to, and operate independently credit goes to its design. Security will increase as a result, and carrying physical keys will no longer be necessary. The majority of locks are made up of a physical key and lock system, making it difficult for someone to open the lock if they lose the key. There are various types of security and door lock devices. As a result, the need for a lock system without a physical key arose, leading to the invention of many different types of door locks, some of which are pin-type door locks that require

a pin to be entered to unlock the door. Other biometrically based door lock options include face recognition, fingerprint, and retinal scanning, which can be used for applications that require higher levels of security. The voice-activated door lock systems function by identifying the user's voice and taking the necessary action. Although there are numerous applications for voice recognition systems other applications, in this paper we're going to talk about a voice-activated door lock Using the Google voice assistant, you can operate your door lock and home appliances.

2. Literature review

In this paper, the authors designed a user-friendly system that is implemented with the help of Bluetooth technology which focuses on the home automation system using the google assistant system as the voice commands. The hardware components which they used in their papers were an Arduino ATMEGA328 microcontroller and an HC-06 Bluetooth module. They have used an app developed by an MIT App developer which can connect and access the device with the Google Assistant via Voice prompt. While testing the implementation work was done on VeroBoard from Hardware and Software implementation. They have used an OLA machine learning algorithm for adaptive home automation that can switch the device into a sleeping mode for power consumption and make the system more efficient and environment friendly also [1]. This study uses MATLAB and ARDUINO to describe the key factors affecting control robots. The authors can recognize the voice of the speaker using MATLAB and also offer a security solution for robots using string matching. In speech recognition, pitch describes whether low or high a voice is heard. FFT is the process used to identify the voice (Fast Fourier Transform). Signal representation in the frequency domain is nothing but FFT. It generates a frequency spectrum that contains all of the signal's data [2]. Natural language processing voice commands enable people to interact with technology more effectively and motivate them to adopt it more frequently. The mobile device uses Natural Language Processing to interpret the user's voice instruction. The suggested system includes a relay circuit, an Arduino Uno microcontroller, and a voice-activated module. Before use, the voice-activated unit must have been trained to recognize commands. Instead of using complex computer commands, the authors are free to communicate with the household appliances using their voice [3]. This Paper proposes a more reliable security system that makes it resistant to hacking and breaking of hard metal interlocking systems. The system was a face detection door unlock system so they used OpenCV for the image processing and Arduino UNO for storing the password. With face recognition, the additional feature proposed by the model was SMS authorization, which grants access to unlock the door. The web application to access the system was developed using HTML, CSS, and Flask API. The complete model is simple circuitry and secures from hacking [4]. Voice recognition is one of the recently implemented technologies and is widely used in many fields. One among those is the phone unlock system. The current research deals with the voice unlock function, it majorly plays a role in electronic gadgets and similar devices to lock and unlock the gadgets where the user cannot manually operate the devices. The main feature here is the Use While Driving feature which the user will activate while driving the vehicle [5]. Voice command is used in many fields, it has been actively used in the field of home automation with many applications. Security concern is also crucial hence this research implements the door lock based on voice recognition. It works on the major components including Arduino Board, Android Phone, and Bluetooth Module. As the software is concerned it uses Arduino IDE and Web-based MIT App Inventor. Data communication also plays a vital role to ensure appropriate data connectivity between devices [6]. The purpose of this paper is to build a smart lock system that can make use of

GSM modules to receive calls. To make this system they use various types of components like Arduino UNO board, GSM module, electronic Door Lock, and servo motor which act as the gear controller equipment. This system works on Arduino UNO software it needs the support of internet connectivity or Bluetooth connectivity. The use of this system is to lock or unlock the door via voice call and also it gives an alert SMS if a user utilizes the system in the wrong way [7]. In this paper, they made researched various Door Locking security systems based on RFID, gesture, Bluetooth, and GSM technology. From their research technique, people will easily choose their best technology for door locking systems. So basically, the analysis of this paper is to help people to use the best technology by using various types of technology [8]. In this paper, they work on the design of a smart lock system for doors that can be used for all kinds of people who are physically disabled. The user can activate the SLS operational mode using a mobile application. They use two special features Get Back and Fingerprint to increase the security and the comfort of the user in operating SLS. So this system is completed with Bluetooth security protocol and these two special features [9]. In this article, the authors describe a smart lock security solution that eliminates the drawbacks of both conventional and digital lock systems. This study suggests a smart door-locking system that can be fully watched and operated from a distance using an android app on a smartphone. For the hardware implementation switch, video camera, Raspberry Pi 3, and servo motor are used, and Raspbian OS, motion package, and Blynk software are the software requirements used. The system suggested in this article employs a simplified architectural design and places an emphasis on remote access to the house in addition to accessing other elements such as live streaming, voice messaging, security advancements, and an infallible system [10].

3. Methodology

The important causes of the implementation of access the unlock door control system are to help ensure safety and create easy entrance or exit doors, especially in public places. Due to the advancements in home automation, many research papers designed smart locking & unlocking systems with different technologies and appliances. Digital keys are used to control security and they propose a door-locking system based on an ARM7 controller and an Android smartphone using Bluetooth as a wireless connection protocol. This system allows the user to control the door over a short range from the door via Bluetooth, and also to check the door's status. The aim of implementing a smart door Lock login by using an Android-based smartphone is to open & close the door through commands given to the electronic devices connected to this door, via an Android phone & Bluetooth module, which turns our house into a "Smart home automation" and solves the security issues related to locking and unlocking a door. Our objectives are to present a smart door-locking system that is simple and easy to use, with high accuracy and fewer errors, and is more secure. The lock appliance consists of electronic components to lock and unlock the door remotely using the Android phone. The complete design and implementation of the structural working of the model is mentioned in Fig.1.

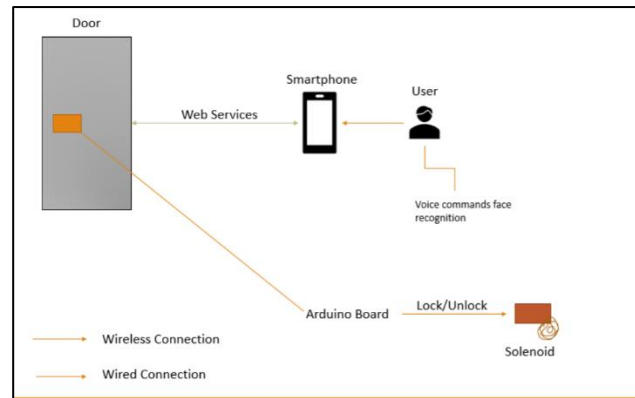


Fig.1. Functional and Operational Structure

a. Components used and Model Setup

For the implementation of the project, we used hardware and software components. The hardware requirements are Arduino Uno, Bluetooth Module (HC-05), Servo Motor, Battery connector, Breadboard, 7.4v battery, and Jumper wires are used. Also, there are some basic components like Door Lock, Metal Wire, Plastic Sheet pieces, and Sun board we have used. For the implementation of the code, Android IDE and the basic application will provide the connection between the Bluetooth module and the phone used. The whole setup of our project starts with attaching the door lock to the sun board. After that, we made the mechanism for the servo motor to move the door lock using metal wire and plastic sheet pieces. For the movement of the latch of the door lock forward and backward, fixed the servo motor near the door lock. Here a servo motor is used to operate the door lock. After fixing the Arduino and breadboard we made connections. The Bluetooth module connected to a breadboard and made the pin connections with Arduino such as TX, RX, VCC, and GND are connected to RX, TX, 5V, and GND respectively. The Servo motor connections with Arduino are like GND-GND, 5V-5V, and Signal-D9 (pin configuration shown in Fig.2 and Fig.3). Also red LED and green LED connected which are used as indicators. For the implementation of the code, we removed the Bluetooth module and uploaded the code, after that, we again connected the Bluetooth module. Now the 7.4v battery is connected to the Arduino using a battery connector. The project setup is ready to implement the voice-controlled Door unlock security system.



Fig.2. Pin Configuration of Bluetooth module front-view

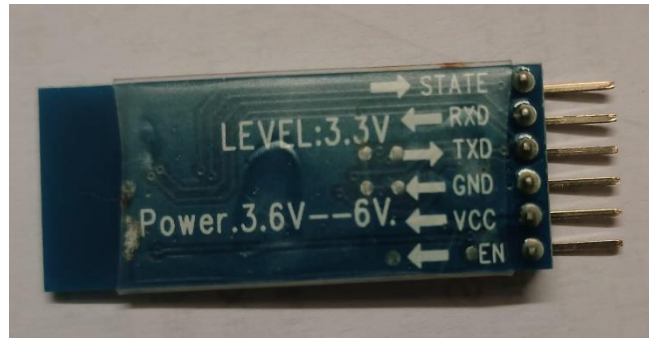


Fig.3. Pin Configuration of Bluetooth module back-view

b. Code Algorithm

For controlling the Arduino UNO with a servo motor the Arduino was programmed using C++ in Arduino IDE and connected to the laptop for data transfer through an Arduino USB cable.

- The servo motor library is included in the code to add servo motor packages and perform respective functions.
- Now the servo motor angle is defined in a way so that it can close and open the latch. The angle is defined concerning the position where it is maintained on user instructions. The pin modes are set in high and low states to execute the command.
- Here are two case scenarios to open and close, therefore the command is programmed in a while loop for open and close. If the state is open then the position set is 90 and for close, the position set is 0. Hence, the code is executed through input commands on mobile applications by Bluetooth connection which is connected to the Arduino through pin configuration according to the serial communication (Table.1).

<i>Pin Configuration</i>	<i>Description</i>
2 & 3	<i>Output</i>
<i>state</i>	<i>o(open)</i>
<i>state</i>	<i>c(close)</i>

Table.1 Serial Communication

4. Limitations and Future scope

One main limitation of our proposed model is it cannot work on every kind of door lock system. In the case of noisy environments, they take a little bit more time, and also in the case of multiple speakers they can't show the perfect results. It can lead to misunderstanding of words because speech is one kind of oral deliberation.

In the future, we will add WIFI technology, which enables controlling the lock by a person at a long distinct location. And using a public IP address to control the smart door lock system from anywhere outside the house. Also, the key pattern entered physically by some authorized persons using three buttons (A, B, C) can be replaced by three motion sensors to detect persons' step combinations. Voice recognition systems can filter some

specific voices and commands in the presence of noise and multiple people talking, in the future these systems will be able to filter out a certain voice when so many voices are present.

5. Results and Discussion

With the proposed system, voice command is used in a new way to lock and unlock the system. This system is easy to implement and requires little hardware. Mobile applications were used as its input, which has the additional advantage of luring users to use it to provide voice calls or messages to the system.

Results from the voice command test were obtained during the testing process.

- 1] The Arduino and Bluetooth module light up when the system receives a power supply (as observed from the output of Image1).
- 2] For voice commands, the Bluetooth module connects to our accessing app.
- 3] The system is ON and activated when the servo motor jerks.

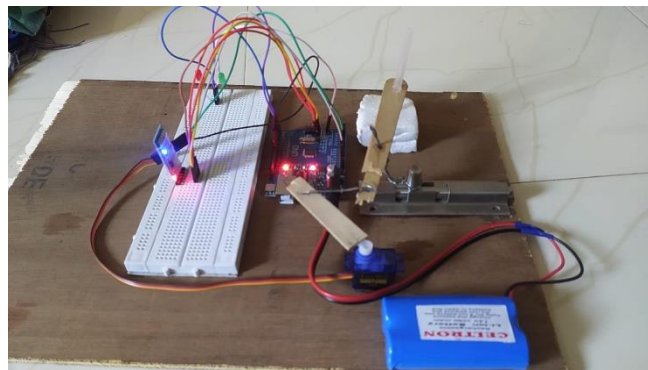


Image1: Prototype of the proposed model

After opening the application to run the actual implementation the app is connected to the Bluetooth module HC-05. When the device gets paired the buttons are as open and close to lock and unlock the door by remote control and the voice command section unlocks the voice mode. After tapping on tap to speak, if the user says unlock then the door latch gets unlocked, and the same for the lock case.

6. Conclusion

We have used voice commands to implement the smart door unlock system in this project. As a result, whether a person is at home or away, it helps them feel secure. This project utilizes Arduino and the Arduino IDE platform is used for the coding. The overall price is reasonable and accessible. Even our house will go through changes in the transition to smart homes that will engage in continuous communication with the grid in a full-scale effort to improve energy management utilizing home automation to ensure safety, comfort, and privacy. Without direct user interaction, this system allows remote access to lock or unlock the door. The system satisfies the requirements for supporting autonomous locking devices and providing electronic keys that are easier to distribute than physical ones. The system supports key customization and has minimal hardware requirements. This system's primary function is to increase security and do away with the need for carrying physical keys.

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