

Phone-Based Smart Home System

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Abstract: This project's purpose is to create a foundation for building a phone-based smart home system. This concept proposes technology that allows customers to utilise voice commands to manage their household appliances. (R. Kankal, 2015) It demonstrates how to use voice recognition to operate home appliances. Users may forget to turn off electronic devices and let them operate for the entire day until they notice. We can overcome this problem by checking all of the devices before leaving the house, but doing so one by one takes longer. As a result, a voice control system is required to improve work efficiency by allowing users to turn off all devices with a simple spoken. The objective that is stated and trying achieve in this project is to design and develop a voice control system by developing a system with a microcontroller that controls the switching of the electrical appliances such as the light, fan, and door. The method that considered to achieve in this project is using a Bluetooth module to communicate between the hardware and the android phone. As the result, The Bluetooth communication was designed with the Android Bluetooth Control application where the interface is combined with the Arduino Uno and connected with the relay module.

Keywords: Smart Home System, Wireless Communication, Bluetooth Communication

1. Introduction

Phone-Based Smart Home System is a type of wireless communication that can be used at home to remotely control household equipment. Phone-Based Smart Home System allows us to manage electrical appliances such as lights, doors, and fans. Home automation includes not only the reduction of human effort, but also the improvement of energy efficiency and the reduction of time. Controllers and sensors are used in this project to control household appliances. It will also be locally maintainable. The fundamental concept is to create a system that will give individuals a living environment that is secure, convenient, comfortable, environmentally friendly, and intelligent. Phone-Based Smart Home System will give individuals a new living experience and a smart way of life, as it will be able to provide intelligent, personalised services based on changing environmental conditions, crises, emergencies, user status, preferences, and wishes. The introduced technology will not only save money and time but also will prove to be beneficial and effective for the economy (The European Telecom, 1995). It will also

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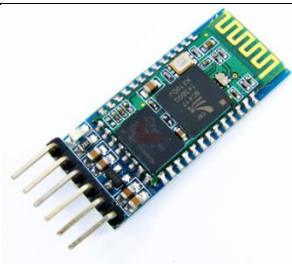

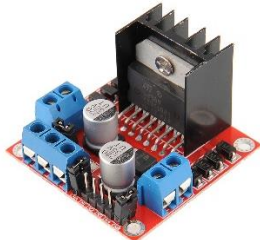

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be locally maintainable. The fundamental concept is to create a system that will give individuals a living environment that is secure, convenient, comfortable, environmentally friendly, and intelligent (Kamal, 2018).

2. Materials and Methods

The used material in this project is listed below. They were seven materials used in this project.

2.1 Materials

No	Components	Picture	Description
1	Arduino Uno		A microcontroller board called Arduino Uno is based on the ATmega328P. It has a 16 MHz ceramic resonator, 6 analogue inputs, 14 digital input/output pins, a USB port, a power jack, an ICSP header, and a reset button. (Arduino Uno REV3, 2022)
2	Bluetooth Module		A Bluetooth module called HC-05 is created for wireless communication. A well-liked module that gives projects two-way wireless functionality is the HC-05. This module allows communication between two microcontrollers, such as an Arduino, or with any Bluetooth-enabled device, such as a phone or laptop. (ElectronicWings, 2017)
3	2 Channel Relay Module		The 2 Channels Relay Module is a handy board for controlling high voltage, high current loads such as motors, solenoid valves, lamps, and AC loads. It is intended to communicate with microcontrollers such as Arduino and PIC. (MYBOTIC, 2002)
4	Motor Driver		A motor is an electronic device that assists in the conversion of electrical energy to mechanical energy. Motor drivers serve as an interface between motors and control circuits. The motor requires a high current, whereas the controller circuit operates on low current signals. (SP ROBOTIC WORKS, 2018)
5	Fan		Fan works as the electrical current reaches the motor; it enters coils of wire that are wrapped around a metal base.

6 Light bulb



An incandescent light bulb, incandescent lamp, or incandescent light globe is an electric light with a heated wire filament. To protect the filament from oxidation, it is encased in a glass bulb with a vacuum or inert gas. Terminals or wires implanted in the glass supply current to the filament. (Incandescent light bulb, 2004)

7 Magnetic door



Magnetic locks are electromagnetic door locks. A magnetic lock is made consisting of a big electromagnet that is put along the top of a door frame and a metal plate that lines up with it on the door. The lock works by delivering an electric current through the electromagnet, which generates a magnetic charge that attracts and holds the plate against the door frame. (Security, K. F, 2017)

2.2 Methods

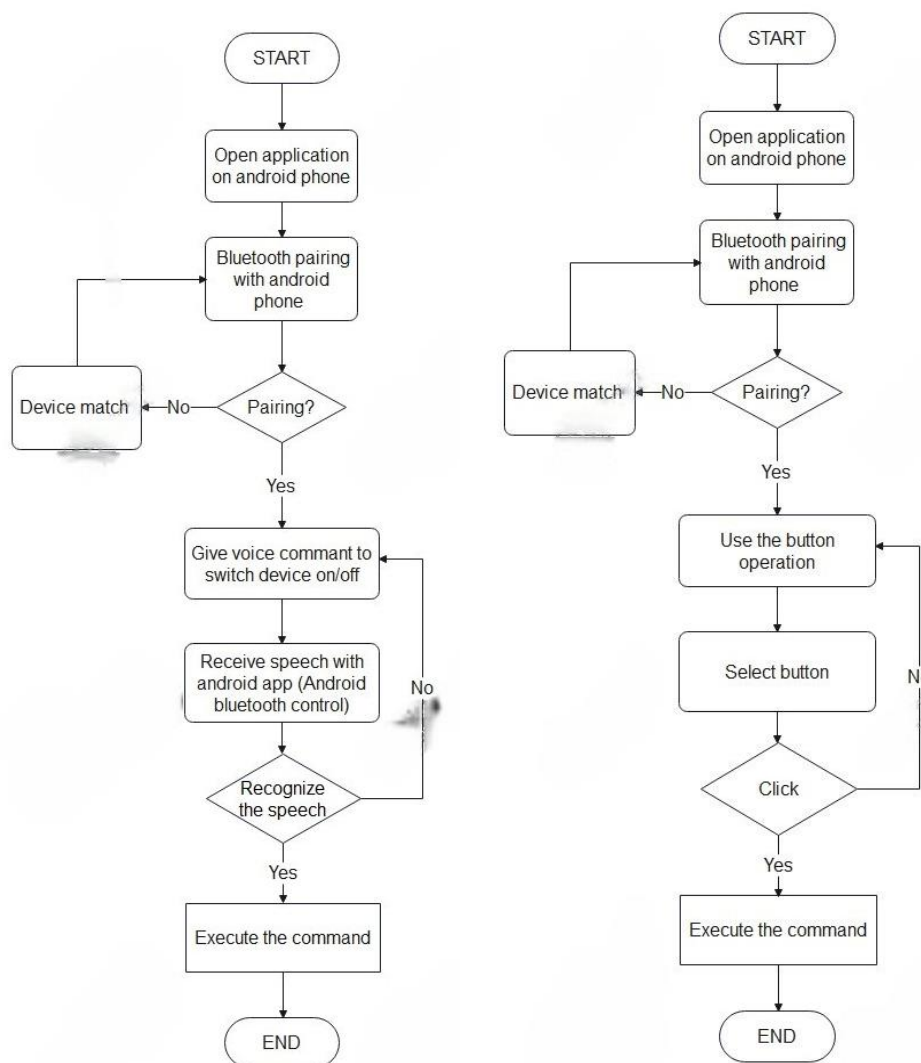


Figure 1 System Flowchart of the application using voice command and button

Figure 1 shows System Flowchart where the program will start with initializing all the sensors and connecting necessary hardware to Arduino Uno. Then the android Bluetooth control is activated using a voice command. Then a query that send by the user is detected for processing. If the user wants to turn the household appliances such as the light, fan, and wants to open the door he can give the command to the device for execution. The user can on or off the household appliance with a voice command. There is also a speed control command to control the speed of the fan. Users can also open or close the door using a voice command. In this project, there is an added control which is the users also can control the appliances using buttons and terminals which the user can control using text.

2.3 Circuit diagram

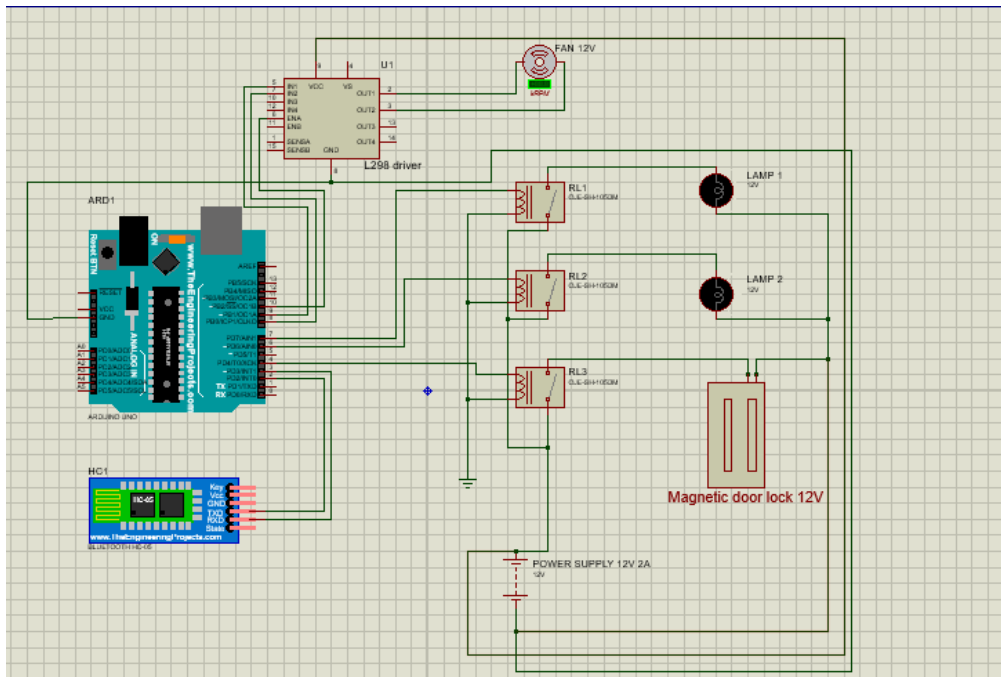


Figure 2: Circuit diagram of the proposed project

Figure 2 shows the suggested circuit diagram of this project. It is a combination of a motor driver, relay modules and Bluetooth module. All the components in the circuit diagram are connected to the Arduino Uno as it works as the ‘brain’ of the circuit. The Bluetooth module will connect to the android phone to control the appliances. The appliances we used in this project are light bulb, fan and a magnetic door. Motor driver is used to control the speed of the fan. 2 channel relays are used to permit a small amount of electrical current to control high current loads.

3. Results and Discussion

3.1 Results

The hardware testing is conducted to show that the hardware is working successfully. Three different control types are being tested: voice control, terminal control, and button control. Voice commands work well for controlling this smartphone control for blind people. There is a terminal control and button for the deaf and the mute. Figure 3 below shows the prototype and the complete hardware design of a phone-based smart home system.

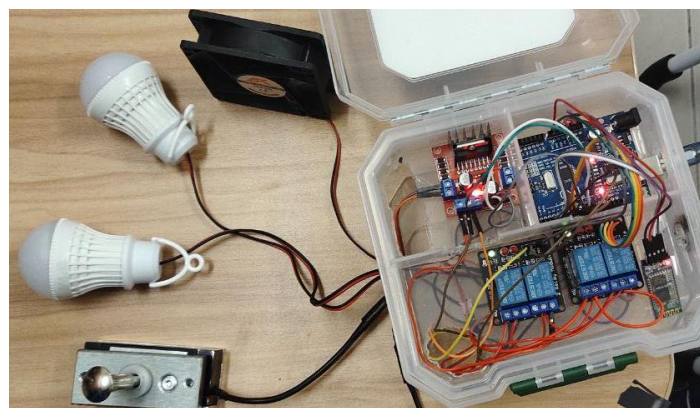


Figure 3: Complete prototype of phone-based smart home System

3.2 Discussions

Based on the obtained results, The Bluetooth connection was designed with the Android Bluetooth Control application. This module is linked through Bluetooth communication. The Android Bluetooth Control application is combined with the Arduino Uno and connected with the relay module. The voice recognition code is loaded onto the Arduino board. Ensure that the board and port are connected to the Arduino board while uploading the programming. The system will start to work after the Bluetooth module is connected to the android phone application. The main idea of this proposed project is to control the appliances using voice command. So, users can configure the commands from the android app as their desire. After the configuration users should use the exact command to control the household appliances.

Table 3.2 shows the simulation result of Android Bluetooth Control App managing voice command. There are nine commands are configured to operate the appliances. As you can see all the given operation is working when it is pressed. 1 is stated indicating the appliances are working as commanded and 0 is indicating the appliances are not working when the command is not given.

Table 1 stimulation result of Android Bluetooth Control App managing voice command

Interface	Android Bluetooth Control widgets	Status	Appliances status
Voice command	Lamp 1 on	Given	1
		Not given	0
	Lamp 1 off	Given	1
		Not given	0
	Lamp 2 on	Given	1
		Not given	0
	Lamp 2 off	Given	1
		Not given	0
	Fan on	Given	1
		Not given	0
	Speed fan on	Given	1
		Not given	0
	Lock	Given	1
		Not given	0
	Unlock	Given	1
		Not given	0
	Turn off	Given	1
		Not given	0

Android Bluetooth Control application has a mobile application that can be installed from the google play store. Figure 4 shows the main interface of phone-based home control. There are six operations that can be operated but only selected three operations were used in this project which are terminal mode, button mode and voice command mode. Figure 5 shows the graph of simulation results for Android Bluetooth Control App managing voice commands and all the commands can be seen working properly. The peaked wave shows the successful command is given and read by the application.

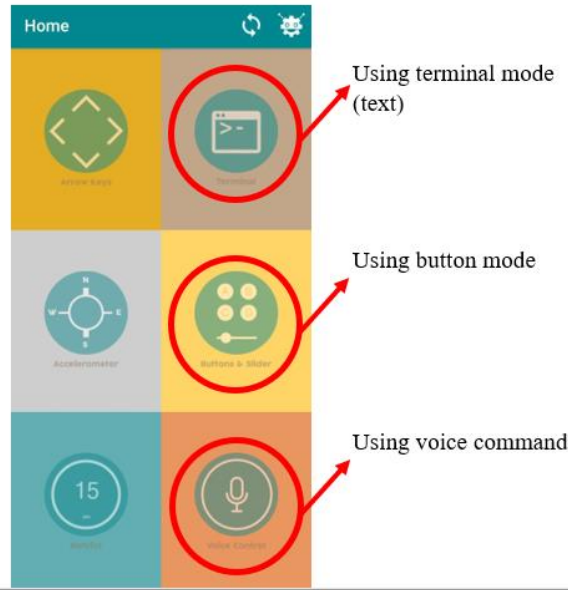


Figure 4: The main interface of phone-based home control

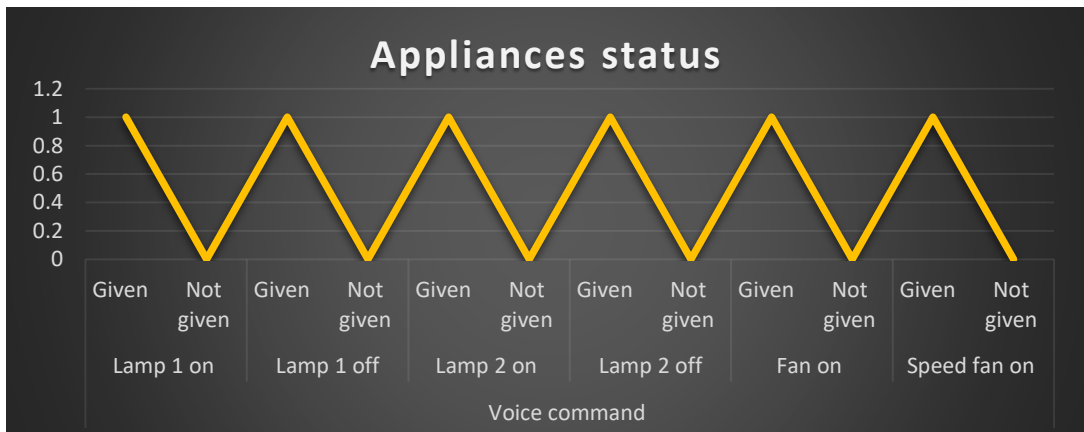


Figure 5: Graph of simulation result for Android Bluetooth Control App managing voice command

4. Conclusion

Based on the project, a voice control system for managing electronic devices with an Android phone has been designed to make life easier for the user. This system able the user to voice control the home appliances through a smartphone without further purchasing the other speech recognition product to detect the speech. These accomplishments fulfil the objectives of the project. Moreover, the android Bluetooth control app is supported by the smartphone and it is easy to interface the command. Android Bluetooth control app connected to the Arduino for controlling the home appliances. On the other hand, the user can customise the speech used to trigger the Arduino for the activation and deactivation of appliances. This capability allows users to take control of their home appliances in any place and it helps to save energy used by improving the efficiency of power consumption.

Acknowledgement

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