

EXPERIMENTAL INVESTIGATION ON VOICE CONTROLLED HOME AUTOMATION SYSTEM

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Abstract - To control electrical appliances in a typical home, latching switches with power connections are typically used. This switch is often wall-mounted. We must access the switch in this system to operate household appliances. Novel technologies are currently evolving in novel ways to regulate home appliances. Home automation is the name of this improvisation. On smart houses, there have been numerous commercial and academic initiatives. Whether it contains buttons or is entirely touch-screen, many commercially available products use remote controls. However, some movement and physical interaction are still required for monitoring and managing the appliances. Therefore, this will be a hardship for impaired people, especially for the elderly and disabled. The suggested remedy is to create a voice-activated remote control for household appliances.

Key Words: Internet of Things, Home Automation System, GUI, Relay Driver and Home Appliances

1.0 INTRODUCTION

Wireless home automation systems and voice recognition technology are becoming more and more popular in the world of smart home technology. These systems can make life easier for elderly and disabled people by allowing them to control various appliances and functions in their homes using speech commands, which can be especially helpful for those who may have limited mobility or dexterity. Additionally, wireless home automation systems can be easily installed and configured, making them a convenient and accessible option for many people. These devices are designed to integrate with various home automation systems, allowing users to control functions such as lighting, heating and cooling, security systems, and entertainment systems. Voice-activated smart home technology systems can also provide significant benefits in terms of energy management, allowing users to monitor and control their energy consumption more effectively. This can lead to significant cost savings and help reduce overall energy usage. Additionally, these devices can be used to monitor health and wellness, provide entertainment, and personalize home settings based on individual preferences.

Voice-activated smart home technology systems offer a number of advantages, such as improved convenience, better energy management, and improved quality of life. With the speed at which technology is developing, it is probable that the adoption of voice-activated smart home gadgets will increase going forward, giving homeowners even more functionality and control over their homes. The system is portable and designed to be simple to set up, operate, and maintain. The technology mentioned in the paragraph is a smart home automation system that uses voice commands to let users operate their electrical equipment.

Applications:

The Wireless Home Automation System (WHAS) was developed to give elderly and disabled people access to a voice-activated home automation system. The system is designed to be easy to install, configure, and maintain

Home Automation: With voice-controlled smart home devices, you can automate several functions such as turning on/off lights, adjusting thermostats, opening and closing blinds, locking and unlocking doors, and controlling home entertainment systems. **Energy Management:** You can use voice commands to manage your energy consumption by controlling your heating and cooling systems, turning off lights and appliances when not in use, and monitoring your energy usage.

Security and Surveillance: Voice-activated smart home devices can be used to monitor and secure your home by controlling cameras, setting alarms, and locking doors. **Personalized Home Settings:** By integrating smart home technology with voice commands, you can personalize your home settings based on your preferences. Overall, the applications of smart home technology using voice commands are numerous, and they can help to simplify your daily tasks, increase your convenience and enhance your overall quality of life.

Problem Statement:

In a typical home, electrical appliances like lighting are controlled by a simple latching switch that is connected to the power source. This switch is typically placed near a wall where the appliances it controls can be seen. Modern technology produces new home system solutions. Home automation is the name of this improvisation. On smart houses, there have been numerous commercial and academic initiatives. Whether it contains buttons or is entirely touch-screen, many commercially available products use remote controls. However, some movement and physical contact are required for monitoring and regulating the appliances. Therefore, this will be a hardship for impaired people, especially for the elderly and disabled. The suggested course of action for this project is to create a wireless remote control for household appliances that can be used.

Scope and Objective:

The fundamental goal of this method is to lessen the load on disabled individuals, particularly on elderly and disabled people. To offer those who live in places where a network cannot be accessed the smart home automation technology. voice commands can be used to control and monitor home appliances, reducing the need for physical labour. The suggested remedy is to create a voice-activated remote control for household appliances. This technology offers audio guidance along with a Graphical User Interface (GUI) to help the user. When an input is found, the speech recognition module examines it. If a known command is picked up, the voice recognition system gives the micro-controller the appropriate digital representations. Following that, the microcontroller interprets these data.

2.0 LITERATURE REVIEW

Ribil Mary Roy, Nisha [1] In this study to suggests a brand-new, low-cost home automation system that assists patients using voice instructions without requiring them to make any bodily movements. The suggested system may be operated from a great distance thanks to its integrated Wi-Fi module and is easy to use, especially for elderly and young people. Humaid AlShu'eili [2] to manage home equipment like lighting. A noise-reduction filter is used to

reduce any extraneous noise before the voice signal is recorded by a microphone. A voice recognition module is then fed with the resulting signal after it has been converted to an analogue signal. The commands that the user wants to use to manage the system are stored in SRAM memory, and these commands are used to train this module. Norhafizah bt Aripin [3] In their study to creation of an Android-based voice-command system for home automation. This technology is designed to make it easier for elderly and handicapped people to easily use their home equipment. The device processes speech input from the user's smartphone using Google's voice recognition software. The Android smartphone records the speech input and sends it to the Arduino Uno, which has a Bluetooth module. After processing the input signal, the Arduino Uno controls the light and fan. The system is simple to install and has been created to offer a user-friendly interface Humaid AlShu'eili, [4] The rising demand for home automation systems to serve the elderly and disabled, especially those who live alone, is highlighted in this study. A wireless home automation system (WHAS) that makes use of low-power RF ZigBee wireless communication modules, which are affordable, has been created to meet this demand. To ensure ease and adherence to household norms, the system is made to allow voice commands to operate all lighting and electrical equipment in a home or workplace. Mrs. Paul Jasmin Rani [5] To objective of the project is to create a fully working voice-based home automation system that makes use of the Internet of Things, AI, and Natural Language Processing (NLP) to offer a quick and affordable way to operate household appliances. Rohit Jaykar [6] to connect Google Assistant and the Raspberry Pi, the project entails creating an Adafruit account and connecting it to the IFTTT website. After that, the Google Assistant is used to interpret voice instructions and manage the household appliances by connecting the Raspberry Pi to a microphone that can hear and understand them. Mrs. S. Divya, P. Gayathri [7] to use an Android smartphone and an Arduino board to build a voice-controlled home automation system. Compared to traditional wall switches, which are frequently placed around the home and need human operation, this system is more sophisticated. Elderly or handicapped people may find it challenging to use these switches. B Shravani, Kotluru Vyshnavi [8] The home automation system has become increasingly popular as it offers a convenient and secure lifestyle. The Internet of Things (IoT), a network of physical objects implanted with electronics, software, and sensors that allow them to communicate data with other objects through the internet, is a result of technological innovation Rahabul Islam [9] Home automation is a crucial component of IoT, as it enables people to control their homes remotely, making them safer, more energy-efficient, and more convenient. LoRa (Long-Range) technology has emerged as a game-changer for IoT, providing a low-cost, low-power wireless platform that enables long-range communication. Md. Shahjalal, [10] The study proposes an AI-based data flow system for IoT server and cloud and underlines the advantages of employing LoRa for smart home networking. Since they make it possible to regulate the climate, supplies, and equipment in the home, remote smart home monitoring systems have grown in popularity.

4.0 Software Design:

Software engineering uses the Unified Modelling Language (UML), a visual language, to model complicated systems. Using a collection of diagrams that represent the many components of the system, it offers a standardised method for visualising, designing, and documenting software systems. System architecture, software designs, and business processes

are all described using UML diagrams. They make it easier for engineers to comprehend and discuss complicated software systems. It provides a common vocabulary and syntax for software engineers, allowing them to communicate and collaborate more effectively. UML can also be used to generate code, test cases, and documentation, making the software development process more efficient.

Class Diagram:

By displaying the classes, their characteristics and activities, and the relationships between them, class diagrams in UML are used to depict the static structure of a system. It is a crucial tool for developing object-oriented software that aids in planning, outlining, and articulating the architecture of the system.

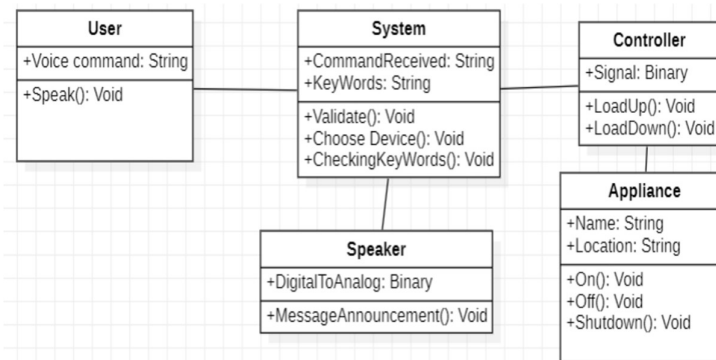


Figure: Class Diagram

Sequence Diagram:

Sequence diagrams in UML are used to represent the dynamic behavior of a system in terms of interactions between different objects over time. These diagrams help to visualize and understand the flow of messages between objects and the order in which these interactions occur.

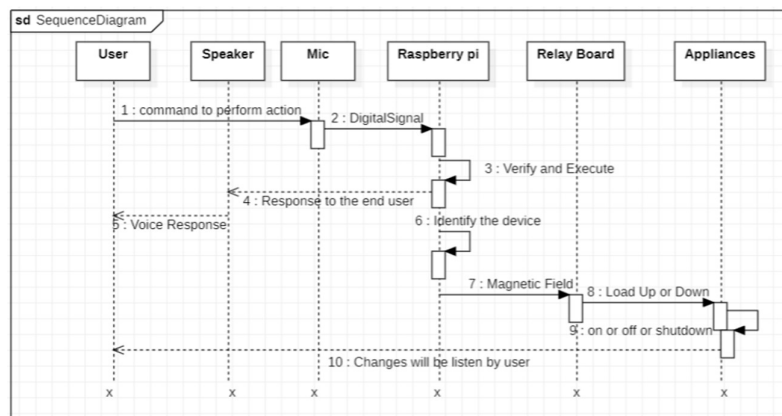


Figure 1: Sequence Diagram

Use Case Diagram: By specifying actors, use cases, and their interactions, use case diagrams in UML depict a system's functional needs. An actor is a person, system, or outside entity that communicates with the system to accomplish a certain objective. A use case is a series of operations carried out by a system to provide an actor with a certain feature.

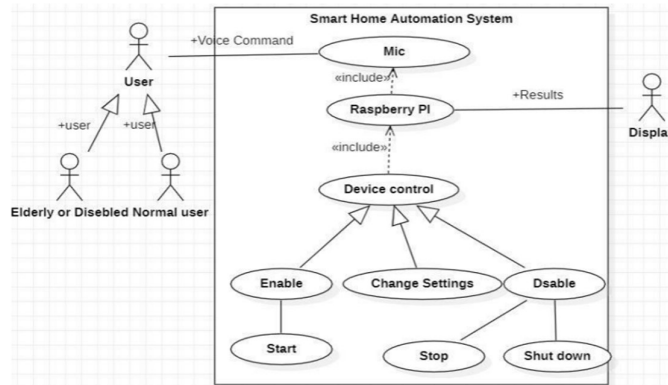


Figure 2: Use Case Diagram

Software Requirements:

Advanced IP Scanner is a free and fast network scanning tool that allows users to detect and access all devices connected to their network. It is a powerful software that can scan all IP addresses on a local network in just a few seconds, making it an essential tool for network administrators and home users alike. One of the key features of Advanced IP Scanner is its ability to detect all network devices, including Wi-Fi routers and wireless devices. It can also scan ports and find HTTP, HTTPS, FTP, RDP, and shared folders on connected devices. This makes it easy for users to access and manage the resources available on their network.

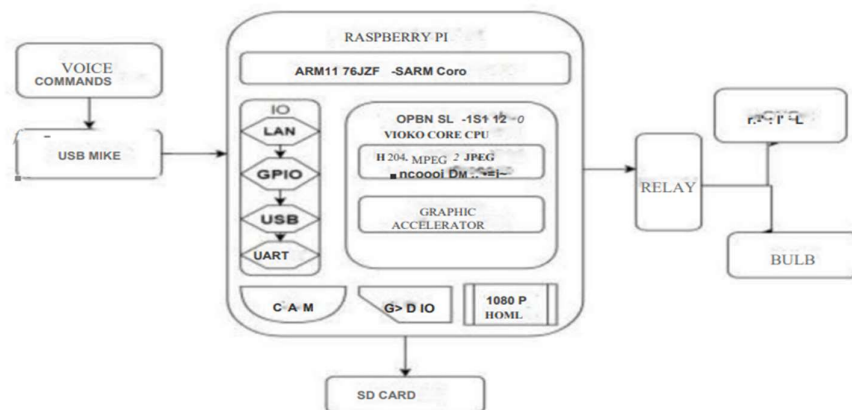


Figure 3: Architecture of the System

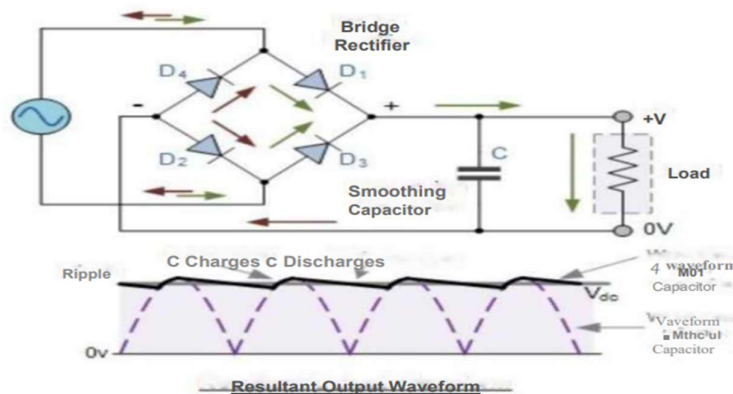


Figure 4: Waveform Output Of an audio

Implementation:

In order to run the project an operating system has to be installed. In can be installation can be done by booting the Raspberry Pi and installing the required IDE such as python 3 etc. The following steps have to be followed in order software execution First we have to install Advanced Ip scanner it is the fast and free software for networks canning.

Properties		
Network properties		
Name:	Airtel Fiber	
Password:	Fiber@1509	
Band:	2.4 GHz	
Devices connected:	1 of 8	
Device name	IP address	Physical address (MAC)
raspberrypi	192.168.137.221	b8:27:eb:89:9c:dd

Figure 5: IP Address of Raspberry pi

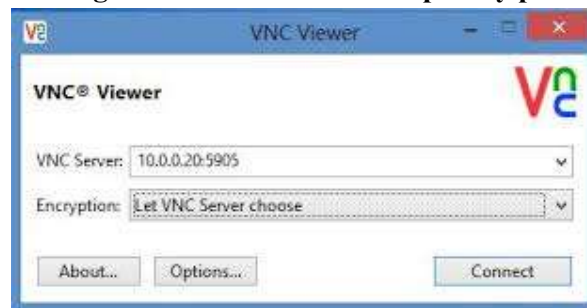


Figure 6: VNC Viewer

Hardware Setup:

In this step, we connect Raspberry Pi to the Voltage Stabilizer and the relay board at the other end. From the other end, connections are made to the home appliances and the power supply is connected to the home appliances. First, we issue a command to the microphone so that it will recognise and take into account human perception sensitivity with regard to frequencies, making it the best for speech/speaker recognition. Using Audacity, the captured voice signals are sampled and stored. 16000 samples are taken every second during the sampling process. Each voice signal has 256 samples per window, or 16 milliseconds, of time. A collection of parameters is extracted for each of these windows after it has been implemented for each of them. The first 256 samples are in the window. 128 samples from the first window and 128 samples following it make up the second window, which covers half of the first window. Thus, a 50-word sentence spoken twice will have several words variations. Therefore, it is crucial to compute the coefficients that nearly always remain the same for a speaker at various points in time. Following the command, it begins to recognise the term and respond accordingly. A green light turns on when we give a command, and it finally goes out to show that the data has been processed after the voice command.



Figure 7: Connections of Hardware

It can be used to simply establish a connection between an MCU or other embedded project and a PC for data transfer in place of a serial port. SPP-compatible Bluetooth Core V2.0 module. The module is intended to be integrated into a host system that requires the ability to change cables

Results

Command-1: The first voice command is 'LIGHT ON'. Now the processing of the data is done so that it will recognize the pre-defined word and act according to it.



Figure 8: Output for Light On command

Command-2: The first voice command is 'LIGHT OFF'. Now the processing of the data is done so that it will recognize the pre-defined word and act according to it.



Figure 9: Output for Light off command

Command-3: The first voice command is ‘MOTOR ON’. Now the processing of the data is done so that it will recognize the pre-defined word and act according to it.



Figure 10: Output for fan on command

Table 1: Testing results

Test Case ID	Test Case name	Expected Result	Actual Result	Pass/Fail
Tc-001	Turn on light	Light is turned on	Light is turned on	Pass
Tc-002	With noise data	Repeat the command	Repeat the command	Pass
Tc-003	Data with variations	Your voice is incorrect	Repeat the command	Fail
Tc-004	Turn on fan	Fan is turned on	Fan is turned on	Pass

CONCLUSION

Successful implementation of the smart home automation system has been made in real time household appliances including the fan, light, and nightlight. This project illustrated to seniors that & Handicapped People were really pleased to operate household appliances via mobile phones. Additionally, the concept enables those who are physically disabled or old to control their desired equipment without having to travel to the closest control point.

Future scope:

Home automation is becoming more and more common, making it a fundamental prerequisite for future homes that are intelligent enough to offer occupants the highest level of comfort. Here are a few of the features that this technology can do.

- Integration of Smart Home Devices
- Development of smarter home appliances
- Increasing control, customization, and efficiency

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