



# A SMART ASSISTANT FOR HOME USING VOICE COMMANDS

## SMART ASSISTANT USING V3 VOICE RECOGNITION

<sup>1</sup>SHREYA SHETTY, <sup>2</sup>AARATHI DINESH, <sup>3</sup>DEVANANDA K, <sup>4</sup>RISHAL K

<sup>1</sup>Assistant Professor, <sup>2</sup>B. Tech Student, <sup>3</sup>B. Tech Student, <sup>4</sup>B. Tech Student

<sup>1</sup>Computer Science and Engineering,  
<sup>1</sup>Srinivas Institute of Technology, Mangalore, India.

**Abstract:** In the fast-paced world of today convenience and efficiency can be a major driving force and improvement to home quality of life. Voice activated smart assistants have transformed home automation beyond using a physical device to control appliances. This paper discusses the design of a cost-effective and user-friendly smart assistant which controls home appliances by taking voice commands. Its quick-reacting, voice-operated circuit — comprising an Arduino microcontroller, Elechouse's Voice Recognition V3 module, and a 2-channel relay module — provides users with a convenient way to manage their lights and fans with nothing but their voice. Identifying the intention of the command, the system controls the relay that turns device on and off, with the Elechouse Voice Recognition V3. The Arduino works as the main controller to read the input from the voice module and control the relay and other devices according to the voice recognition result. This system provides a flexible, cost effective and highly capable smart home solution that is suitable for a large section of the population, suiting those who want to streamline their lives.

**Index Terms – Smart Assistant, Machine Learning, IOT, predefined commands, V3 Voice Recognition module, results analysis.**

### I. INTRODUCTION

Voice-activated gadgets have increased the accessibility and convenience of home automation as smart technology has grown in popularity, particularly for those with hectic schedules or mobility issues. Using an Arduino microcontroller, the Elechouse Voice Recognition V3 module, and a 2-channel relay module, this project presents a voice-activated smart assistant that allows control of common household appliances like lights and fans. By interpreting voice commands through the Elechouse module, the system sends signals to the Arduino, which then activates the relays to switch devices on or off. This setup provides a cost-effective, hands-free solution for home automation, combining ease of use with enhanced accessibility to improve daily living. As observed in the literature survey in today's fast-paced world, the complexity of managing multiple home technologies and daily tasks can become overwhelming. Having to use a variety of controls or apps can be complicated and annoying if you have more than one home device and task to manage. It could even be considered a sin. We all find it tough to use the computer in this day and age. So difficult, indeed, that an internet without really understanding what we're doing could mean our services. It's an unfortunate fact some with low technological skills or those who have physical disabilities find it hard. Widespread use of smart technology has seen voice-activated gadgets make home automation easier and more accessible for people in particular with a busy schedule or impediment to movement. This project presents a smart assistant that listens in on spoken commands enables the use of a 2-channel. In this case to control the smooth servos on cooler, solar panels, and even lights. Children enter the command as heard by this commander. Algorithms and voice recognition programs built in to this machine are quite sophisticated, so it's not hard to comprehend what is said to him.

### II. SCOPE OF PROJECT

With a relay module, it is possible to manage common household appliances such as lights and fans. Using the Elechouse module, our system uses voice commands, signals are sent via Arduino, which activates the relays to subsequently turn the devices on or off. This setup provides an economical solution for hands-free home automation which enhances accessibility and ease of use in everyday life. The scope of this project focuses on designing a voice-activated smart assistant for home automation includes the following major sections:

1. Device Control: Automated control of lights, fans, and other electric devices is the primary goal of the project in order to improve user convenience through voice commands.
2. Expandability: This feature enables the system to have additional appliances and more functions in later stages. Users can easily expand home automation capabilities by adding more relays and controlling multiple devices.

3. **User Interaction:** The goal of the project is to enable users to interact with their home appliances without any complicated user interfaces. The hands-free experience is made possible by voice command recognition that allows users to issue simple commands and not rely on mobile apps or other interfaces.

4. **Accessibility:** People with disabilities and the elderly find life easier thanks to voice assistant technology. They are now able to engage with and operate their residences actively through voice instructions, which further improves their quality of life.

5. **Cost-Effectiveness:** The Elechouse Voice Recognition V3 module and Arduino, two more readily available and less expensive components, are used in the system's design. The project also shows that smart home automation doesn't have to be extremely expensive or complicated.

6. **Other Technologies:** While the initial implementation concentrates on simple commands via voice, the system framework enables future developments and functionalities through integration with cloud apps, mobile services, and IoT services.

7. **Educational Value:** By educating students and electronics enthusiasts about programming and home automation technologies, this project gives them the professional skills and knowledge they need.

## I. REVIEW OF LITERATURE

Modern technologies have transformed smart home devices into an accessible tool for use within a household. The development of AI and NLP has led to the enhancement of smart home assistants over time. Earlier versions relied primarily on voice recognition to carry out simple tasks like playing music or setting an alarm. Nowadays, Alexa by Amazon and Google Assistant by Apple as well as Siri have machine learning models that integrate seamlessly. These algorithms enhance comprehension of user intent and context, therefore enabling more effortless and effective interaction with digital assistants. The benefits of these technologies include enhanced accuracy of speech to text conversion, improved extraction and interpretation of commands, and a better understanding of context. Furthermore, application of edge computing technology allows the processing of voice commands to be done in real-time, ensuring both low latency and high confidentiality. Some of the results of their efforts are: recognition of personalized wake words, multi-language support, and responsiveness to user queries enable voice assistants to understand better how people engage with them. Voice assistants in smart homes have been applied to control and operate the lights, thermostats, appliances, and other devices to facilitate interaction with the automated system in a home environment.

1. **Implementation of Home Automation using Voice Commands-** M. Karthikeyan, T. S. Subhashini and M. S. Prashanth, January 2020

This paper gives a proposal to control home appliances using voice commands. They have implemented an IOT-based system to automate light and fan operations using speech.

2. **Voice-Assistant Home Automation using Voice Commands-** Prof. Heena Patil, Prof. Mayank Mangal, Saeesh Salunke, Aatish Bhoir, Kedar Patil, April 2021

The essential aim of this project is to extend a home automation system the usage of an Arduino board with Bluetooth being remotely controlled through manner of way of Android smart telecall smartphone.

3. **A Voice Controlled Smart Home Automation System Using Artificial Intelligent and Internet of Things-** Mohamed A. Torad, Belgacem Bouallegue, Abdelmoty M. Ahmed, June 2022

This paper integrates IoT and voice recognition technology in addition to NLP-based AI to improve smart homes systems control.

4. **Design and Implementation of a Voice Assistant to be used in a IoT Home Automation Environment-** Raúl Dalí Cruz-Morales, Gonzalo Hedain López MerA, David Tinoco Varela, Erick Axel Padilla- Garcia, November 2023

This paper describes the development of a voice assistant which is used to control different electronic devices that can be found inside a home automation building

5. **Artificial Intelligence Voice Assistant and Home Automation:** Shubham Singh, Shubham Singh Panwar, Harsh Dahiya, Khushboo, May 2024

This project makes use of the Google's Texts to Speak (S) processor and a strong library. Despite this, functionality like the Internet of Things and calling the system are absent.

## IV. METHODOLOGY

This study has a systematic methodology for designing, implementing, and testing a smart home assistant system that accepts user voice commands. The overall methodology includes the following steps:

### 4.1. Requirement Analysis

- Determine key functionalities required in a home assistant (e.g., lighting control, fan control, thermostat, security alarm, media player devices).
- Investigate popular voice assistant systems (e.g., Amazon Alexa, Google Assistant) to establish baseline features.
- Choose target devices and systems for integration.

### 4.2. System Architecture Design

- Implement a modular architecture with three modules:
- Speech Recognition Module: Translates voice commands to text.

- Command Interpretation Module: Interprets the text and associates it with pre-defined actions.
- Device Control Module: Executes commands on smart devices (e.g., through Wi-Fi, Bluetooth, or Zigbee).
- Establish communication protocols between modules (e.g., HTTP requests, MQTT).

#### 4.3. Voice Recognition and Processing

- Implement using libraries like Google Speech Recognition API, CMU Sphinx, or Vosk for offline/online speech-to-text conversion.
- Preprocess speech input to eliminate noise and improve clarity.
- Apply keyword detection to invoke the assistant (e.g., "Hey Assistant").

#### 4.4. Natural Language Understanding (NLU)

- Develop a light intent recognition system.
- Implement basic NLP methods like tokenization, lemmatization, and keyword matching.
- Map recognized utterances to individual device operations (e.g., "turn on living room lights").

#### 4.5. Hardware Integration

- Interface smart devices via IoT modules (e.g., ESP32, Raspberry Pi).
- Create APIs or firmware codes to accept and run commands from the assistant.
- Provide secure communication and authentication between devices and the assistant.

#### 4.6. Prototype Development

- Create a working prototype integrating all hardware and software modules.
- Create a minimal mobile or web interface for manual control and settings adjustment (optional).

#### 4.7. Testing and Evaluation

- Perform functional testing for accuracy of command recognition.
- Test response time between voice command and device action.
- Conduct usability testing with multiple users to analyze satisfaction and improvement areas.
- Monitor and analyse rates of errors, false activations, and system breakdowns.

#### 4.8. Iterative Enhancements

- Grounded on testing outcomes, adjust the speech recognition and device management modules.
- Streamline NLP models to achieve better comprehension of a broad diversity of voice inputs.
- Incorporate feedback provisions (e.g., audio report after an activity is executed).

### V. DESIGN AND ARCHITECTURE

The architecture of the Smart Home Assistant system is modular and scalable to facilitate effective voice interaction and device control. The system has the following components in its architecture:

#### 5.1 Voice Capture and Activation

The system listens for the wake word (e.g., "Hey Assistant") continuously via a microphone array. Once the wake word has been detected, it records the full voice command of the user for processing.

#### 5.2 Speech Recognition and Text Conversion

An STT engine such as Google Speech API or CMU Sphinx processes the recorded audio input into text.

#### 5.3 Natural Language Processing (NLP) and Intent Detection

The text transcription is processed to identify the intent of the user using light-weight NLP techniques like tokenization, keyword matching, and intent classification. The system pulls out the important entities like device names, actions (e.g., turn on, switch off), and other parameters (e.g., room names, brightness levels).

#### 5.4 Command Decision and Device Control

Depending on the interpreted intent, a Decision Engine translates the command into certain device operations. Commands are sent to smart home devices via secure channels through communication protocols such as Wi-Fi, MQTT, Zigbee, or Bluetooth Low Energy (BLE).

#### 5.5 User Feedback and Status Update

Once the command is executed, the system gives immediate feedback to the user in the form of voice responses (e.g., "Light turned on") or through a mobile/web interface. This makes sure that the user knows that the command has been successfully executed or the error that happened.

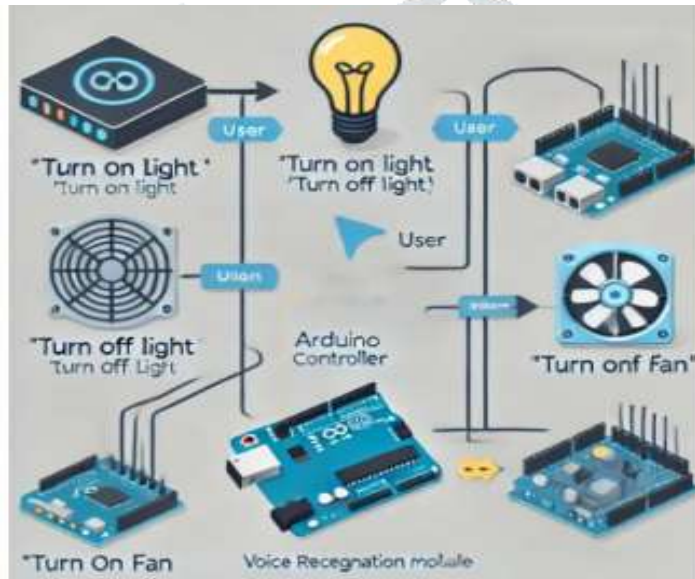
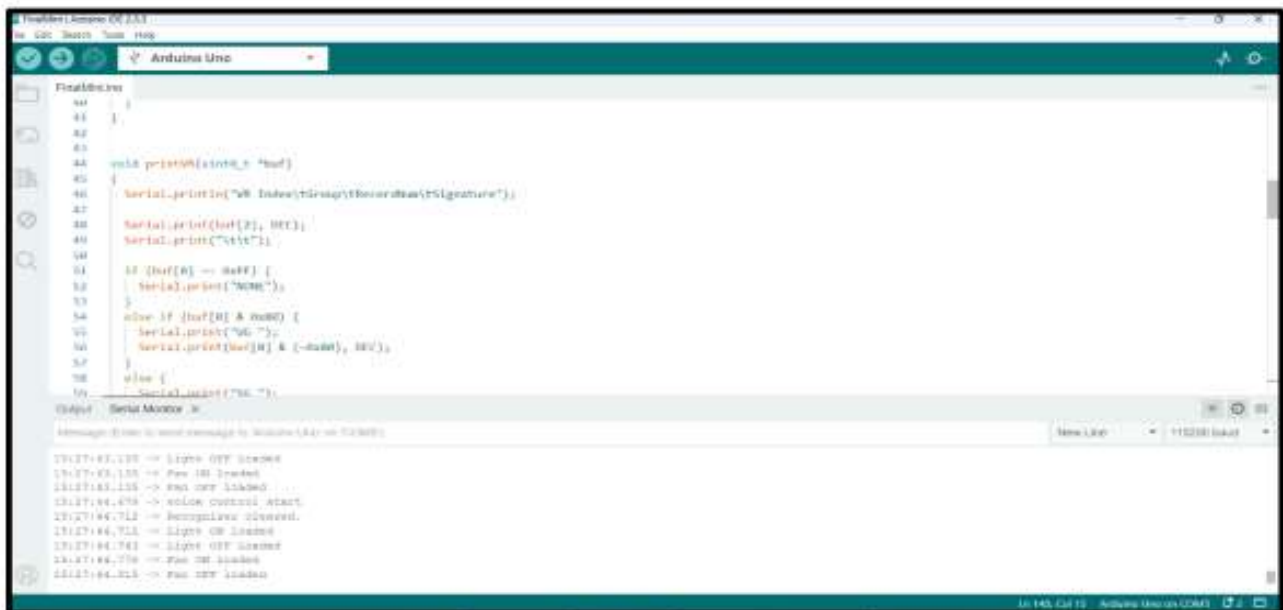
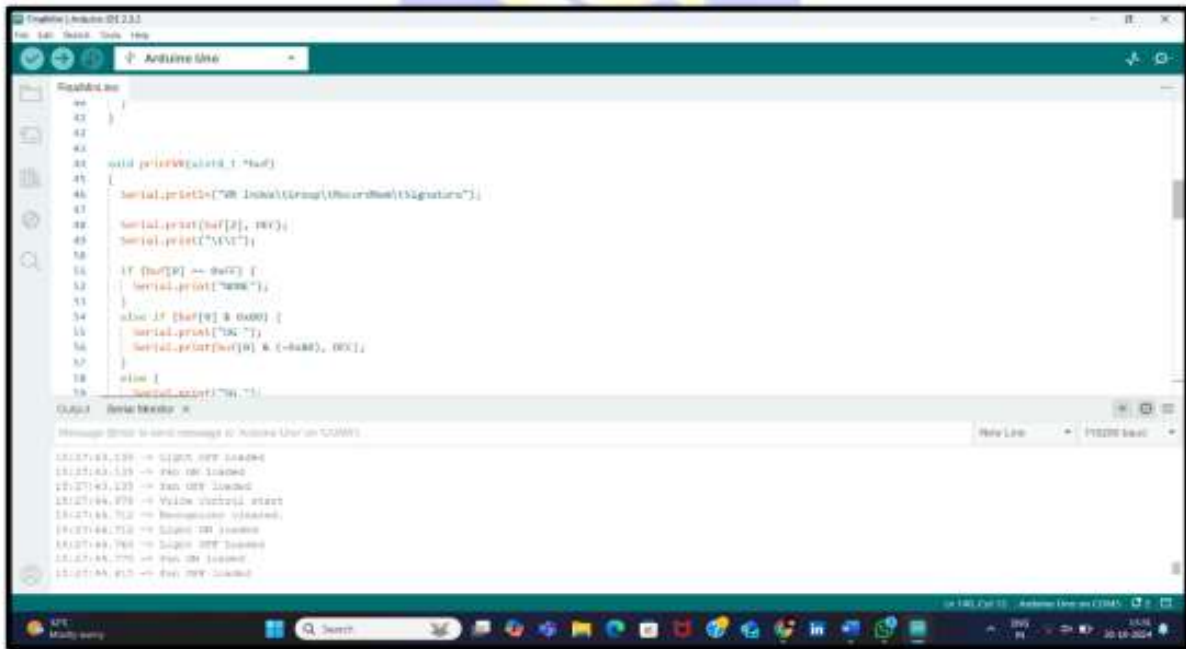


Figure: Use-Case Diagram of Smart Assistant

### VI.RESULT OF THE SYSTEM

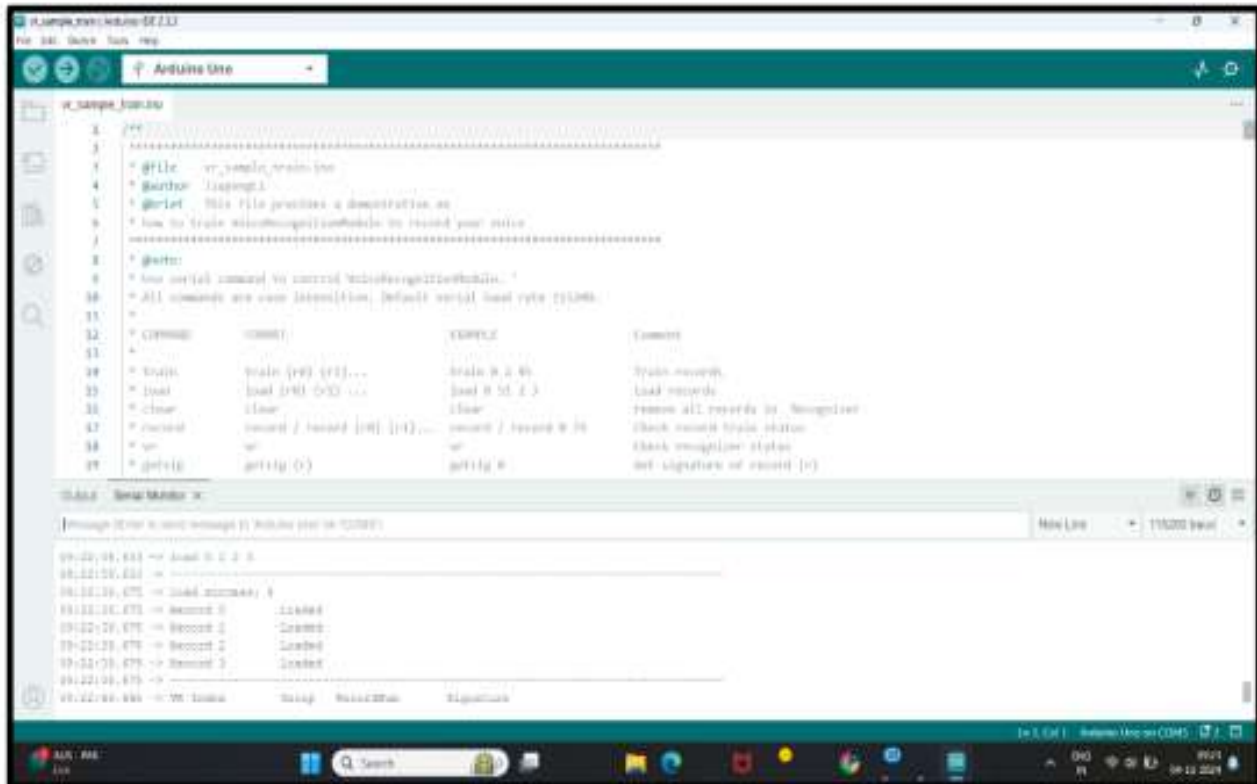


**Fig 6.1: Serial Monitor**  
*Fig 6.1: Displays the starting condition of the components when the program is stored in Arduino first*



**Fig 6.4: Voice Recognized**

*Fig 6.4: Recognizes voice commands and display the actions performed.*



**Fig 6.3: Voice Loaded**

*Fig 6.3: Loads the trained audio and recognizes the voice commands.*

## VII.FUTURE WORK OF THE SYSTEM

The voice command smart assistant reflects a practical and effective methodology for hand-free control of home devices such as fans and lights. This project proves very successful at displaying the power of combining Arduino with voice recognition, being an important step towards intelligent home automation. It makes appliances easily accessible and convenient for users, bringing increased user comfort and showing how voice-controlled devices have real-world uses and applications in normal daily life. Potential future research can extend sets of commands for the control of more devices integrating with IoT platforms for remote and synchronized control, and supporting machine learning for enhanced voice recognition accuracy. Other sensor integration, multi-language and multi-user support, and optimized power management would make the assistant more adaptable and versatile, turning it into a complete solution for smart home automation.

## VIII.CONCLUSION

In summary, the study on a Smart Assistant for Home through Voice Commands presents the capability of voice-operated systems to offer greater convenience and accessibility in home automation. The system effectively facilitates users to manage appliances and devices without using hands, enhancing user experience and power efficiency. Though it shows immense advantages, it leaves scope for future enhancements like incorporating advanced speech recognition, multiple language support, and wider smart home device integration. As a whole, this research opens up the way to more intuitive, efficient, and accessible smart home technology.

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