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IoT Based Voice Recognition in Smart Homes

¹Mayur Wajge, ²Rohit Ingole, ³Aman Chanekar, ⁴Prasanna Titarmare, ⁵Dr. Yogesh S. Bais, ⁶Ashish Polke

¹Student, ² Student, ³ Student, ^{4,5,6}Assistant Professor,

Electrical Engineering Department, Suryodaya College of Engineering & Technology, Nagpur, India

Peer Review Information	Abstract
<p><i>Submission: 02 Feb 2025</i> <i>Revision: 30 Feb 2025</i> <i>Acceptance: 04 April 2025</i></p> <p>Keywords</p> <p><i>Voice Recognition</i> <i>Smart Homes</i> <i>Home Automation</i> <i>IoT</i> <i>Arduino Uno</i> <i>MCU Node</i></p>	<p>Because it provides convenience, efficiency, and security, home automation is fast becoming an essential component of contemporary life. Automating routine home chores lowers human labor, improves security, and encourages energy economy. The difficulties and potential of smart home automation are examined in this study, with a focus on the necessity of user-friendly and efficient control systems. Using machine learning and the Internet of Things (IoT), the study suggests a voice recognition-based approach to improve the smart home experience. Voice control offers a flexible and user-friendly method of home automation that increases accessibility for all users. Additionally, this study looks at a number of control techniques, including as speech recognition, Wi-Fi-based automation, Dual-Tone Multi-Frequency (DTMF), and GSM-enabled systems. This study emphasizes the main obstacles to voice-activated smart home automation, including cost, safety, connectivity, and environmental friendliness. In order to maximize smart home interactions and provide enhanced security and user experience, the suggested architecture incorporates Automatic Speech Recognition (ASR). According to the report, intelligent, flexible, and user-responsive smart houses will be commonplace in the future.</p>

Introduction

Technology is integrated into a smart home to offer energy efficiency, convenience, and security. Through the use of Wi-Fi or GSM networks, IoT-based platforms enable remote monitoring and management of electrical and electronic items, including televisions, air conditioners, lighting systems, and kitchen appliances [1].

An internal home network, intelligent control systems, and access gateways (wired or

wireless) are the three main parts of home automation. These parts link gadgets via sensors that adapt to their surroundings to maximize efficiency and comfort. By automating repetitive chores based on user behavior analysis, advanced machine learning models improve people's quality of life [2].

A key component of smart home automation, voice recognition provides a user-friendly and effective substitute for more conventional input methods like switches and smartphone apps [3]. Voice recognition is perfect for customized home

automation because it can identify the speaker, whereas speech recognition concentrates on processing spoken text [4]. Advanced yet reasonably priced voice-controlled systems must be developed in response to the growing need for easily accessible and reasonably priced smart home solutions.

The influence of GSM and IoT-based home automation on energy management, accessibility, and home security is examined in this study. Additionally, it talks about how data analytics and machine learning improve system performance.

PROBLEM STATEMENT

The average household finds it challenging to embrace standard home automation systems because they are frequently costly and

complicated. It can be difficult to monitor and operate household appliances when away from home because many of these systems are also difficult to access from a distance. By offering a cost-effective and intuitive solution that can be accessible from any location via a smartphone application, the suggested Internet of Things-based home automation system seeks to address these problems.

The system will make it more accessible to a larger audience while streamlining the automation process and lowering system complexity.

The system will give users a cost-effective and efficient way to operate all of their household appliances from a single platform by utilizing a microcontroller and the Flutter framework.

BLOCK DAIGRAM

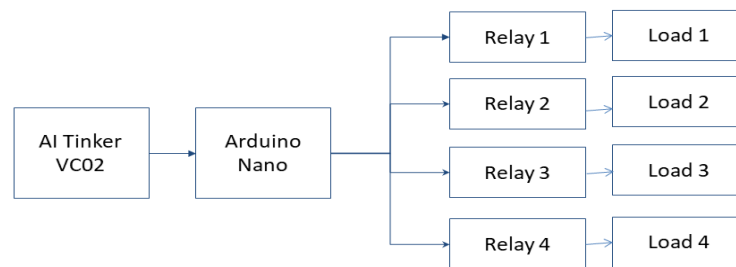


Fig. 1 :- Block Diagram

The hardware and the software are the two main parts of the suggested system. The Flutter framework is used in the software component to create a multi-platform application for appliance control, while the ESP8266 microcontroller is part of the hardware component and is used to control the appliances. The suggested system components are described in depth in the sections that follow. The ESP8266 microcontroller, which serves as the system's central processing unit (CPU), is the physical component. An inexpensive, Wi-Fi-enabled microcontroller, the ESP8266 is simple to develop with the Arduino IDE. The ESP8266 uses a number of protocols, including radio frequency (RF) and infrared (IR), to connect with the household appliances.

The relay board, which is connected to the ESP8266, controls the appliances by turning them on and off in response to user commands. The appliances are linked to the relay board, which is connected to the ESP8266 via GPIO pins. The Flutter framework, which is utilized to create a multi-platform application for managing the appliances, makes up the system's software component. With the help of the open-source Flutter framework, developers can

produce aesthetically pleasing, high-performing apps for the iOS and Android operating systems. The purpose of the application is to give consumers an intuitive interface for managing the appliances. The user has the ability to set timers, turn the appliances on or off, and make personalized schedules for them. Through Wi-Fi, the program connects to the ESP8266, which then uses user commands to turn the appliances on or off.

A structured framework for voice-controlled home automation is illustrated in the system's block diagram, showing interactions between user input, processing units, and actuators. This model integrates sensors, microcontrollers, and IoT-based cloud services.

Implimentation

Hardware Setup: The initial stage entails configuring the system's hardware, which includes the relay board and the ESP8266 microprocessor. The relay board, which is connected to the household appliances, is connected to the ESP8266. **Software Development:** Creating the system's software elements, such as the smartphone application, is the next stage. The application, which is made to

interact with the ESP8266 microcontroller over Wi-Fi, is developed using the Flutter framework. Integration: To produce a working system, the hardware and software components must be integrated after they have been designed.

The ESP8266 receives commands from the smartphone application, processes them, and turns the appliances on or off in response.

Testing: To make sure the system is operating as intended, testing is the last phase. The system is tested in a number of scenarios, such as designing custom control settings, scheduling and timers, and turning appliances on and off.

ADVANTAGES OF VOICE-CONTROLLED SMART HOMES

The proposed system provides the following benefits:

- **Enhanced Security:** Offline operation reduces cyberattack vulnerabilities.
- **Reliability:** Functions seamlessly even during network disruptions.
- **User-Friendly Interface:** Intuitive voice commands allow effortless control.
- **Customization:** Users can add and modify appliance commands as needed.
- **Cost-Effectiveness:** Affordable microcontroller-based solutions make automation accessible.
- **Low Power Consumption:** Energy-efficient design reduces household electricity use.
- **Feedback Mechanisms:** Real-time visual and audio confirmations enhance user experience.

Conclusion

For homeowners who want to automate their homes and manage their appliances via a smartphone app, the Internet of Things-based home automation system is a useful option. Users can create a smartphone application using the Flutter framework and integrate the ESP8266 microcontroller with a relay board to remotely manage their appliances and establish personalized schedules and control parameters. Easy maintenance and scalability are made possible by the system's modular design, while wireless communication between the microcontroller and smartphone applications is made possible via Wi-Fi connectivity. Enhanced

convenience, increased control over household appliances, and increased energy efficiency are just a few benefits of the suggested system.

This study proposes an IoT-based voice recognition model for smart home automation, addressing usability, security, and affordability concerns. The three key contributions of this research include:

1. Development of a voice-controlled AI assistant capable of remotely managing IoT devices.
2. Implementation of a low-cost, scalable, and privacy-focused security model for home automation.
3. Demonstration of real-world applications, proving the feasibility of user-friendly smart home systems.

Additionally, it offers a chance for upcoming improvements like energy monitoring, machine learning, and voice control. All things considered, for homeowners wishing to automate their houses and enhance their quality of life, an Internet of Things-based home automation system offers a workable and expandable solution.

References

- Ghosh, A., Subudhi, B. N., & Ghosh, S. (2020). "Object Detection from Videos Captured by Moving Camera." *IEEE Transactions on Image Processing*.
- Perera, C., Zaslavsky, A., Christen, P., & Georgakopoulos, D. (2013). "Context Aware Computing for the Internet of Things: A Survey." *IEEE Communications Surveys & Tutorials*.
- Mittal, Y., Toshniwal, P., Sharma, S., Singhal, D., Gupta, R., & Mittal, V. K. (2016). "A Voice-Controlled Multi-Functional Smart Home Automation System." *IEEE INDICON*.
- Sharma, P., Yadav, N., & Agarwal, A. (2023). "Smart Air Conditioning System Using IoT and Solar Energy." *IEEE International Conference on Computing, Communication, and Automation*.
- Obaid, H. R., Rashed, A. A., & Rehan, M. (2014). "Zigbee-Based Voice Controlled Wireless Smart Home System." *International Journal of Wireless & Mobile Networks*.